



## CHAPTER

## 12 Using Data for Policy Development: Designing a Universal Service Fund for Tanzania

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### Abstract

This chapter examines how data, primarily from existing sources, is being used to plan implementation of a universal service fund in Tanzania. It uses Tanzania as an example of relying primarily on existing data from multiple sources that could be used in other developing regions where time and/or resources to conduct dedicated field studies may be limited. The government of Tanzania has approved the creation of a Universal Communications Access Fund (UCAF) to extend communications services to unserved and underserved areas throughout the country, primarily in rural regions. Initial primary emphasis is to be on the extension of voice telephony to rural areas without connectivity and provision of public access to the Internet in rural communities. The chapter first provides an overview of Tanzania's telecommunications sector before explaining UCAF in more detail. It then considers the potential of information and communication technology for development in Tanzania, along with the issues that need to be addressed in implementing the country's universal service fund. It also discusses the importance of subsidies to expanding Internet access in rural areas and concludes by evaluating options for increasing access.

**Keywords:** [universal service fund](#), [Tanzania](#), [Universal Communications Access Fund](#), [voice telephony](#), [rural areas](#), [telecommunications](#), [information and communication technology](#), [subsidies](#), [Internet access](#)

**Subject:** [Museums, Libraries, and Information Sciences](#)

Many developing countries have established universal service funds to subsidize the extension of a telecommunications infrastructure to areas that are unattractive to private investment because of high costs or low revenue potential. There are many challenges in implementing these funds, particularly where there is little experience in estimating demand for new services such as Internet and broadband, and limited time and resources to collect field data.

This chapter examines how data, primarily from existing sources, is being used to implement a universal service fund for Tanzania. It is presented as an example of relying primarily on existing data from multiple sources and from local researchers that could be used in other developing regions where time or resources to conduct dedicated field studies may be limited.

The government of Tanzania (population about forty million, of which 80 percent live in rural areas) has approved the creation of a Universal Communications Access Fund (UCAF) to extend communications services to unserved and underserved areas of Tanzania, primarily in rural regions. Initial primary emphasis is to be on the extension of voice telephony to rural areas without connectivity and provision of public access to the Internet in rural communities. The author was a member of a team providing advice to the

Ministry of Communications, Science and Technology on implementation of the UCAF, including definition of services, identification of unserved and underserved areas, prioritization of access requirements, and design of procedures to allocate funds.<sup>1</sup>

p. 210 Preliminary studies of availability of telephony through mobile phones and fixed lines and projections of demand had been conducted, but there was a delay of four years between the initial studies and the final authorization of the UCAF. In that time period, mobile penetration had increased dramatically through licensing of several competitive providers, but there appear to be remaining gaps in coverage in some rural areas. Pricing is also a deterrent to use among low-income populations. The government has indicated strong interest in including support for Internet service, primarily through public access, which could include post offices, telecenters (publicly accessible locations with computers and Internet access), Internet cafes, and other entrepreneurial outlets, and possibly schools.

Key questions to be addressed included: What priorities should be used to provide total voice coverage in Tanzania, in terms of criteria such as population densities, geographic areas, or estimated demand? Could innovative technological solutions and business models to extend Internet access be fostered through financial incentives from the UCAF? Could broadband services be extended with support from the fund without waiting for the completion of 100 percent coverage for voice services? What services were likely to be provided, and what regions would gain access, through operator investment without subsidies?

Since funding and time for field research were limited, the availability and interpretation of existing data were important in understanding the extent of the gap in availability and affordability, and for identifying viable models of shared access to Internet services in most rural areas of the country. Where field research appeared necessary, involvement of local researchers from universities, development organizations, and local consulting firms was recommended to conduct the studies.

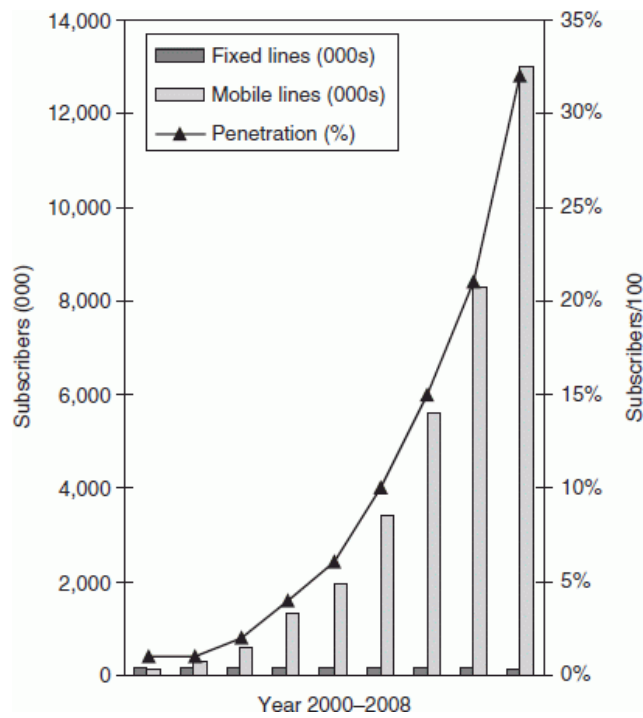
## Tanzania and its Telecommunications Sector

Located in the east part of Africa, Tanzania has a land area of about 342,000 square miles (about twice the size of California) and a population of 41 million of whom approximately 45 percent are under the age of 16.<sup>2</sup> Classified as a low income or least developed country, Tanzania has a per capita income of only about \$400,<sup>3</sup> although the amount in terms of purchasing power parity (PPP) is estimated at \$1200. About 70 percent of the population is rural. After independence in 1964 (with the merger of Tanganyika and Zanzibar), President Julius Nyerere implemented a socialist agenda, which increased access to primary school education and basic health care, but left a stagnating economy. Following liberalization of the economy in the past decade, the economy has grown more than 7 percent annually since 2002, but with an average inflation rate of 5.2 percent.<sup>4</sup> Liberalization has been accompanied by increased entrepreneurial activity in the informal sector, more foreign aid, expansion of mining and exports of raw materials, and increases in commercial (as opposed to subsistence) agriculture. Though still primarily agricultural, Tanzania's economy also benefits from recent expansion of mobile communications, as mobile and other communication services now account for about 20 percent of its economic growth.<sup>5</sup>

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Tanzania's teledensity in 2008 was estimated at 31.6 percent by the regulator, the Tanzania Communications Regulatory Authority (TCRA). The telecommunications market was approximately \$1 billion for 2008, of which more than 90 percent came from mobile services, based on a mobile average revenue per user (ARPU) of \$6 to \$7 and about 11 million subscribers.<sup>6</sup> More than 99 percent of customers use prepaid services. The number of fixed lines actually decreased from 174,000 in 2000 to 124,000 in 2008, while mobile subscribers grew more than a hundredfold (see Figure 12-1).

Figure 12-1.



Tanzania subscriber growth, fixed and mobile.

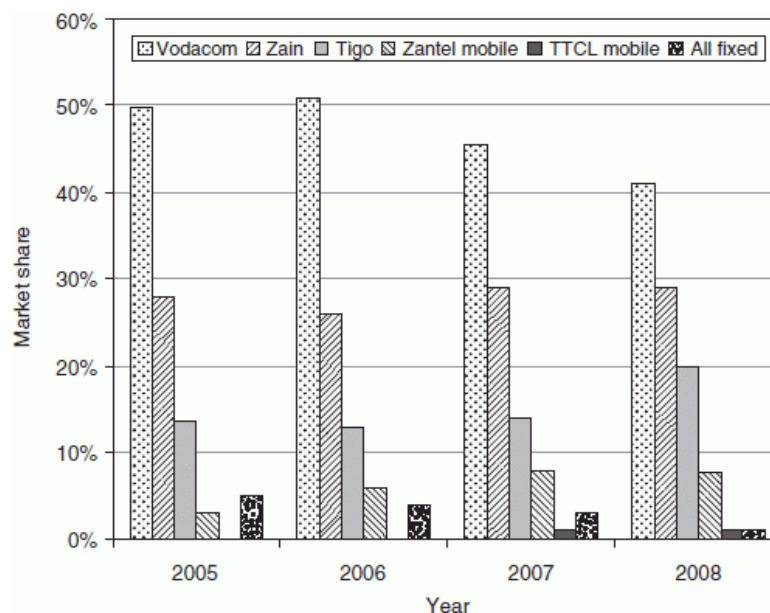
Source: TCRA data and company reports.

Mobile coverage is estimated by the operators at 70 percent of the population and 50 percent of the land area. Most of the operators use GSM technology, as is common throughout much of Africa. However, the fixed carrier TTCL operates a network using CDMA technology, and one mobile carrier offers both a limited CDMA service and a GSM service provided as a mobile virtual network operator (MVNO) using another GSM network. The GSM networks have been upgraded to the general packet radio service (GPRS) technology (also referred to as 2.5G) across the networks, while third-generation (3G) networks have been launched in urban areas by two operators. Users may simply switch SIM cards in the same handset to access operators using the same technology. To switch between operators using different technologies, they would need a second handset (see below).

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The mobile market is among the most competitive in Africa, with six major operators that compete on coverage or price (see Figure 12-2).<sup>7</sup> Competition has become especially aggressive since 2007. The three largest operators have each deployed more than one thousand base stations and cover most of the same territory. Mobile users are likely to have several SIM cards to take advantage of variations in coverage and price. For example, one carrier may provide coverage in a rural area where family members live while another may provide cheaper on-network calls. Some consumers may have multiple SIM phones that allow them to switch between operators, also allowing them to take advantage of short-term promotions.

Figure 12-2.



Telecom sector growth, 2005–2008.

Note: A new sixth operator, Benson, had a market share of 0.02% in 2008.

Source: TCRA data.

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Fixed service coverage is very limited, and the number of fixed service lines has actually decreased since 2002. The incumbent fixed line operator, TTCL, originally a government-owned postal, telegraph, and telephone (PTT) service provider, was partially privatized in 2001, with the government retaining a 65 percent share (the remaining 35 percent are now owned by Celtel, an African mobile operator purchased by Kuwait-based Zain in 2005, which, in turn, was bought by Bharti Airtel of India in 2010). TTCL retains a *de facto* monopoly on domestic fixed services, although there has been competition in domestic and fixed international services since 2005. The continuing fixed service monopoly, coupled with remaining significant government ownership and several different management structures, as well as the high investment required to build out fixed lines, appear to have stunted the fixed network. However, the government has contracted with a Chinese vendor to build a fiber backbone ring to link all district centres (comparable to county seats) around the country and to connect local fiber networks. This fiber network is to be managed by TTCL.

International connectivity was provided exclusively by satellite until late July 2009, when the Seacom submarine cable linking East African countries went into operation.<sup>8</sup> An additional submarine cable, EASSy, went into service in 2010.<sup>9</sup> As a result, international quality of service (QOS) is expected to improve, and bandwidth prices to drop. For example, the price of a 1 Mbps satellite leased line via satellite in 2009 was around \$1,500 per month, compared to about \$200 where competing undersea fiber cables were available. The introduction of competition in international gateways in Tanzania should also result in lower prices.<sup>10</sup>

Concerning Internet access, the TCRA estimated some 1.8 million Internet users in Tanzania by the end of 2008, including some fixed-line subscribers and customers of Internet cafes, as well as 600,000 mobile GPRS users and more than 1 million students who access the Internet for school-related purposes. Computers in schools remain scarce, so that most students would use telecenters and Internet cafes. Factors that contribute to very limited Internet use include the low penetration of personal computers (less than 1 percent), lack of fixed digital subscriber lines (DSL), and the high price of broadband connectivity where it does exist (only in major centers). In addition, there is very limited rural connectivity, and lower levels of education and income in rural areas. Limited Internet content in local languages also appears to discourage Internet usage.

Fixed operator TTCL offers some DSL services in Dar es Salaam (the largest city) and large towns. Competitive Internet service providers (ISP) offer dial-up and fixed broadband using CDMA-based facilities or very small aperture terminals (VSATs). In 2009 broadband connectivity cost about TZS 25,000 (about \$19) for 250 MB per month at 512 Kbps, ranging to TZS 80,000 (or about \$60) for 1 GB where available. DSL modems cost TZS 125,000 (about \$95) and service activation an additional TZ 36,000 (about \$27). Clearly such prices were beyond the reach of most Tanzanians.

At least two mobile operators were offering Internet access on upgraded HSPA networks to phones and some Internet cafes; two providers were starting to offer 3G service, initially in major cities. However, prices remained beyond reach of all but the wealthiest individuals or small businesses. In 2009 a prepaid 3G package was priced at TZS 90,000 (about \$68) per month for a 3 MB connection.

## The Universal Communication Access Fund

The Tanzania Universal Communications Service Access Act of 2006 established broad objectives for communications and authorized establishment of a Universal Communications Access Fund (UCAF). The act states that telecommunications service providers will contribute up to 1.5 percent of their gross revenues to subsidize access to “communications services” in underserved areas. Among specifications for the fund are:

- Communication services include those for “the provision of postal, electronic communications [including broadcasting] or content services.” Thus the fund may be used to subsidize broadcasting services such as local or community radio, postal services, and content.
- The fund is to increase availability of communication services in “rural and underserved urban areas.”
- The act specifically seeks to promote socio-economic development.

However, there are no specified limitations on technologies to be used or carriers/operators eligible for support and there are no specific definitions of what constitutes unserved and underserved areas.<sup>11</sup>

The broad definition of communication services reflects a unified regulatory framework adopted by the regulator, which includes telecommunications and broadcasting. In addition to telephony, communication services can include both broadcasting and Internet services, and broadband connectivity to provide such services. While universal service funds generally prioritize coverage for regions or populations without access to voice telephony (traditionally provided over fixed lines and public pay phones),<sup>12</sup> many countries are now extending definitions to include mobile telephony and Internet access through community facilities such as telecenters, libraries, Internet cafes, or other public facilities. Developing country examples in addition to Tanzania include Ghana, India, Indonesia, Mongolia, Morocco, Mozambique, Nicaragua, Nigeria, Paraguay, South Africa, Venezuela, and Vietnam.<sup>13</sup>

Organizationally, the fund falls under the jurisdiction of the Ministry of Communication, Science and Technology. It is to be managed by a board whose eight members are to be appointed by the minister to include three from industry and one from a consumer organization, one from the regulator, and the other three from the government. This structure is not typical of universal service funds in other countries, some 60 percent of which are administered through the national regulator, and an additional 19 percent through an independent agency.<sup>14</sup> Disadvantages of being under the ministry include the potential for bureaucratic delays and the possibility of political influence in selection of projects eligible for support. For example, the fixed line carrier is still 65 percent government owned, the post office is a government agency, and content providers that may be perceived as competing with the national broadcaster also appear eligible for support. Thus the UCAF differs from some other universal service funds in that it includes the postal service and broadcasting, has a specific goal of promoting socioeconomic development, and is to be administered by a board essentially controlled by the communications ministry.

## The Potential of ICTS for Development in Tanzania

In planning and setting priorities for the universal service fund, it is important to recognize the potential role of ICTs in Tanzania, particularly for its rural, social, and economic development. Information is critical to the social and economic activities that comprise the development process. If information is critical to development, then ICTs, as a means of sharing information, are not simply a connection between people, but a link in the chain of the development process itself. In general, the ability to access and share information can contribute to the development process by improving:

- *Efficiency*, or the ratio of output to cost (for example, to get price information, to coordinate delivery of agricultural products to market; to obtain information on weather and soil content to improve agricultural yields);

- *Effectiveness*, or the quality of products and services (such as improving health care through telemedicine);
- *Equity*, or the distribution of development benefits throughout society (such as to rural and remote areas, to minorities and disabled populations); and
- *Reach*, or the ability to contact new customers or clients (e.g., craftspeople reaching global markets on the Internet; educators reaching students at work or at home).<sup>15</sup>

p. 216 Ugandan farmers and fishermen can now get the daily prices of coffee and lake fish on their mobile phones for the price of a single text message (SMS). African examples of the contribution of telecommunications to *effectiveness* include the activities of Schoolnet Africa that provide ICTs and content for schools such as online “virtual labs” and reference materials that can enhance education where schools lack lab equipment and libraries.<sup>16</sup> In telehealth and telemedicine, information about the patient transmitted electronically can help distant specialists to diagnose conditions and recommend treatment. The African Medical and Relief Foundation (AMREF) has used two-way radios in Tanzania and Kenya for several decades to provide medical advice and coordinate its flying doctor service.<sup>17</sup>

Tanzania has recognized the importance of ICTs for its development through its Vision 2025 strategic plan which envisages the nation with five key attributes: high-quality livelihood; peace, stability, and unity; good governance; a well-educated and learning society; and a strong and competitive economy capable of producing sustainable growth and shared profits. Tanzania’s National ICT policy, adopted in March 2003, includes several goals, among them development of a nationwide e-education system, the teaching of ICT at all levels of education and training, and the use of ICT to improve the quality of delivery of education.<sup>18</sup>

Extending Internet access is critical to achieving these goals. Several initiatives are already underway. Many government ministries have plans to extend e-services. There are already a number of projects providing access through community telecenters and at some schools and vocational training colleges.<sup>19</sup> Some rural entrepreneurial Internet access points are being established; others have been associated with radio stations and community centers. Tanzania’s Ministry of Education and Vocational Training (MoEVT) has recognized the role of ICTs in extending basic education to all Tanzanians and providing skills that will be needed to improve productivity and competitiveness, as well as to deliver government and other services. All regional and district offices have been provided with computers and printers (although the Ministry does not state whether all locations have connectivity). A project to introduce ICTs in all government teachers’ colleges has been implemented,<sup>20</sup> and the Institute of Adult Education (IAE), which offers correspondence courses using print materials, is promoting the introduction and integration of ICT and e-learning in its regional centers across the country.

Tanzania is also committed to achieving the Millennium Development Goals (MDGs) for poverty reduction. The MDGs were enshrined in the Millennium Declaration adopted by 189 countries at the UN Millennium Summit in September 2000 to attain 8 specific goals by the year 2015:

- Eradication of extreme poverty and hunger;
- Achievement of universal primary education;
- Promotion of gender equality and empowerment of women;
- Reduction of child mortality;
- Improvement of maternal health;
- Combatting HIV/AIDS, malaria, and other diseases;
- Ensuring environmental sustainability; and
- Development of global partnerships for the attainment of a more peaceful, just, and prosperous world.

p. 217 Specific targets have been identified for each goal. The MDG goals and targets have been developed into an MDG goals/ICT indicator matrix.<sup>21</sup>

*Research questions.* Many questions need to be addressed in implementing Tanzania's universal service fund, for example:

*General questions:*

- What priorities should be adopted to extend voice services in rural areas? For example, starting with largest unserved communities or with the most remote? Extending service from existing coverage areas? Targeting certain geographic or ethnic areas?
- What kind of voice service is required in rural areas? For example, pay phones (public call offices) in addition to household or individual services typically by mobile phone?
- How important is affordability (as opposed to availability) in influencing actual usage by rural residents?
- Should projects that are integrated into rural economic and social development initiatives be given priority?
- What priority should be given to improving access in underserved (as opposed to unserved) areas (e.g., areas with poor QOS because of hills or other barriers, areas with low signal strength, areas where there is an insufficient number of available circuits, and so on)?
- What models of community or institutional access could be used to extend Internet services, such as telecenters, commercial Internet cafes, post offices, libraries? Should connectivity for schools be a priority?
- Should voice networks be required to be upgradeable to provide broadband Internet services?
- How can the UCAF provide incentives for innovative technological solutions? For example, should it subsidize satellite phones for remote areas difficult to serve with terrestrial technologies? Should existing microwave networks be used to provide backhaul for competitive Internet providers?
- How can the other services included in the Act, such as postal services, broadcasting, and content, be included in the funding process? What criteria should be used, and what priority should they get?

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*Voice services:*

- **Voice access:** How many Tanzanians now have access to voice services through owning mobile phones, through shared use of mobile phones, or through access to pay phones?
- **Access demographics:** What demographic characteristics distinguish people with voice access from those without (e.g., location, income, education level)?
- **Mobile coverage:** What parts of the country have no mobile coverage, and how many people live there?
- **Affordability:** To what extent is price, or affordability, restricting access (as opposed to availability or signal coverage)?
- **Cultural factors:** What cultural factors may influence access and use (e.g., large and extended families, sharing within families, communities of interest—tribal, ethnic, work location)?
- **Mobile investment:** What factors influence the investment decisions of mobile operators to continue to extend coverage (e.g., cost of financing, estimated demand, topography, lack of electricity, and so on)?

*Internet and broadband:*

- **Demographics of Internet users:** What are the characteristics of current Internet users (e.g., age, location, education, income)?
- **Internet access:** How and where are people accessing the Internet? For example, where are community access facilities located, and what is their usage? How many small and medium enterprises (SMEs) and

nongovernmental organizations (NGOs) have Internet connections? How many people are accessing Internet applications on mobile phones?

- Computer access: Why is the number of personal computers so limited? If price is the major barrier, how could prices be reduced?
- Internet use: What factors influence Internet use (e.g., availability, price, skills required, language required, and so on)?

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- ↳ • Mobile Internet: To what extent are subscribers living where 2.5G or 3G service is available using it for e-services or for Internet access?
- Current models of Internet access: What is the experience with community access to date (telecenters, radio stations, schools, Internet cafes, and so on)?
- Broadband demand: Will cheaper broadband prices significantly increase demand?
- Broadband investment: Would increased demand result in more broadband investment by operators?

*Sources of data.* Some demographic and technical data was available from government and industry. However, there was neither time nor budget to carry out extensive field studies to get an understanding of how mobile phones are used and shared, and what factors inhibit Internet usage. Preliminary field research included interviews carried out in Dar es Salaam with operators, ISPs, government officials, and Tanzanian researchers. Most of the information had to be gleaned from secondary sources, including data collected by the Tanzanian regulator and census, and several studies of rural telecommunications access and demand in African countries including Tanzania, as well as ICT case studies in Tanzania. These sources include:

- Household budget expenditure data including money spent on ICTs collected by the National Bureau of Statistics, but disaggregated only to urban versus rural level;
- Other recent national and rural government surveys that contain rural socio-economic data (census data, although detailed, dated from 2002 before mobile competitive mobile services were introduced);
- Data on coverage and number of subscribers submitted by operators to the regulator regularly as a requirement of their licenses, but not disaggregated by location or combined into a single data base or mapping system;
- Field studies recently conducted or in process on rural use or impact of ICTs that could provide some insights into rural demand and use, although not carried out in the projected highest-priority regions; and
- Pilot projects to establish community access through telecenters and entrepreneurial access points and Internet cafes that could provide anecdotal or possibly case study evidence of usage, costs, and sustainability.

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There are several potential problems with relying on these studies to gain a better understanding of rural communications access and usage. Because of ↳ the difficulties in reaching rural populations (poor roads or no roads, scattered villages, and so on) researchers tend to concentrate more on urban and periurban areas, or to overgeneralize from small rural samples or case studies. Where significant resources have been put into rural data collection, such as for the national census and HIV/AIDS and malaria monitoring, available data may not be sufficiently disaggregated to be very useful.

## Insights from Available Data

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What is known about access? The following section discusses findings from existing research and field case studies that could help to understand rural access and demand, and to assess the likelihood of the mobile industry extending rural coverage without subsidies.

*Most users are urban.* Most mobile phone owners live in urban areas. The National Bureau of Statistics (NBS) survey in 2007 found that almost two-thirds of households in Dar es Salaam had mobile phones and 42.5 percent had phones in other urban areas, but only 13.9 percent of the households surveyed in rural areas



owned mobile phones.<sup>22</sup> Yet many more rural households have phones than electricity, which is available in only about 2 percent of rural households, compared to 40 percent in urban areas.<sup>23</sup> (Rural entrepreneurs offer charging services for phone owners using diesel generators, vehicle batteries, and solar panels.)

*Sharing mobile phones and minutes is common.* On a per capita basis, the NBS statistic of only 13.9 percent of households with a mobile phone would indicate a rural teledensity of less than three, assuming at least six members per household. But there is convincing evidence that family members share their mobile phones. ICT Africa's survey of Tanzanian mobile phone owners found that 46.2 percent indicated they did not share their phones, while 44.6 percent said they shared with family members, 25.4 percent with friends, and 15.8 percent with neighbors (multiple responses permitted).<sup>24</sup> Using these estimates, access to a phone where there is coverage could be widespread among family members and fairly extensive for friends and neighbors of a mobile phone owner. This conclusion was collaborated by a study on ICTs and poverty in Tanzania that found that mobile phones were widely shared among poor populations.<sup>25</sup> Airtime is also apparently widely shared, through transfer of minutes from one phone account to another. The ICT Africa survey found that of all Tanzanians surveyed (20.5 percent of whom were estimated to have mobile phones), 61.7 percent said they had received minutes as a favor or for cash or barter.<sup>26</sup>

p. 221 *Rural mobile phone owners are older.* While Tanzania has a very young population with about half under the age of sixteen, many mobile phone owners tend to be from older cohorts. A survey of four hundred mobile phone owners in twenty-two villages in Iringa province found that 49 percent were aged thirty-six or older (of course, this means that half were under thirty-six years).<sup>27</sup> This finding is not surprising in that it is likely that only adults with disposable income from rural jobs, cash crops, or remittances from relatives working in cities could afford mobile phones.

*Demand for mobile phone service is high.* ICT Africa's survey indicates that on average, mobile phone users spend 28.9 percent of their disposable income on mobile phone use, while the poorest 75 percent of the population with phones spend about 41 percent of their disposable incomes on phone use.<sup>28</sup> Clearly, Tanzanians view access to communications as extremely important, likely displacing other discretionary purchases, particularly in rural areas where incomes are generally very low. These findings may also help explain the fact noted earlier that communication services now account for about 20 percent of Tanzania's economic growth.<sup>29</sup>

*Cost is a significant barrier to mobile phone ownership and usage.* While demand for communication is high, cost is a constraint in usage among those with mobile phones, and a barrier to those without. In the ICT Africa survey, when asked what prevented them from making more calls, 72.3 percent cited the cost of calls, and 46.7 percent cited the cost of calls "very high." Among those without phones, demand for mobile phones and mobile phone use is high, with about 20 percent of the population interested in purchasing a phone or SIM card. However, the average amount they were willing to pay to use a phone was very low, only \$2.61. Next to Ethiopia, this was the lowest amount among the seventeen sub-Saharan African countries covered in the survey. To purchase a phone, respondents on average were willing to pay \$10.89, and among rural users \$9.74, although they realized that phones would cost the equivalent of about \$17. The study concluded that availability of \$10 handsets could result in 2.26 million additional subscribers.<sup>30</sup>

*Subscriber overcounting.* It is likely that there are fewer individual subscribers than most estimates indicate because of the prevalence of users having multiple SIM cards to deal with variations in coverage areas (e.g., to make sure they can reach family members in rural areas), to use cheaper on-network calling rates among contacts on the same network, and to take advantage of short-term promotions. Research ICT Africa estimated 1.16 SIMs per mobile user in Tanzania in 2008 based on their survey of mobile phone owners and non-owners in seventeen countries.<sup>31</sup> Yet operators and SIM resellers interviewed in Dar es Salaam estimated most mobile subscribers had two to four SIM cards. Indeed, one mobile executive interviewed in April 2009 stated: "People walk around Dar with their pockets loaded with SIMs."<sup>32</sup> However, multiple SIM use is likely to be less common in rural areas because of more limited network coverage and fewer convenient local SIM resellers.

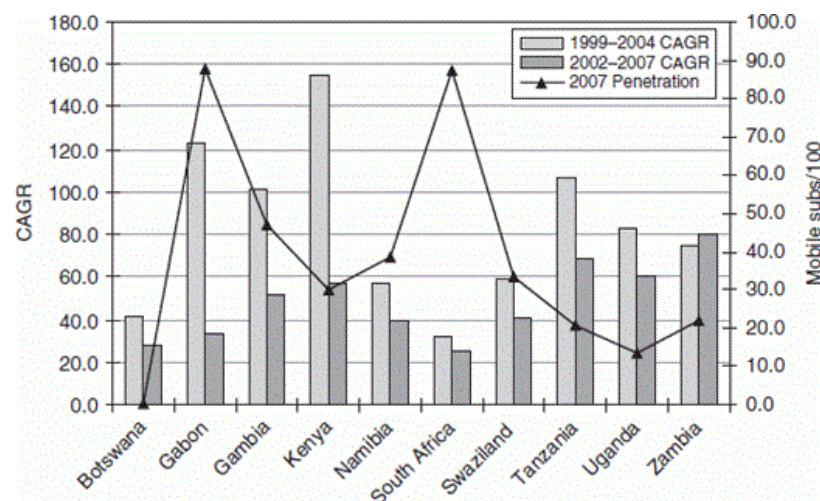
p. 222 Also, operators may have incentives to inflate their subscriber figures in order to attract others to their network—using the rationale articulated in Metcalfe's Law (as popularized by Internet pioneer Robert Metcalfe) that being able to connect to more people offers significantly greater value.<sup>33</sup> Further, data are not available on the amount of churn in subscribership (i.e., changing carriers as opposed to simply using different SIM cards). Thus, aggregating numbers of SIM cards from all operators is likely to significantly overestimate the number of individual subscribers.

These findings provide both a “good news” and “bad news” view of rural access. Clearly, telephony is highly valued by the rural population, but most find they cannot afford to purchase phones or to use phones much. However, those with phones tend to share their phones and their minutes within families, and may also be willing to sell or barter minutes with others in the community, so that where there is coverage, actual access may be much higher than reflected in numbers of handsets or SIM cards. It is not clear whether sharing of phones and selling and bartering of minutes have effectively replaced the function of a community public payphone. While it would be useful to have more data from rural areas of Tanzania with and without mobile voice coverage, it seems clear that if coverage were provided in currently unserved areas, residents would benefit from individual and shared use of mobile phones.

## The Importance of Subsidies to Expanding Rural Access

In 2008 Tanzania’s mobile growth was 56.4 percent, while the mobile cumulative annual growth rate (CAGR) from 2002 to 2007 was 68.8 percent.<sup>34</sup> Extrapolating the 2008 growth rate to the existing estimated mobile density of 31.6 percent would result in more than 100 percent mobile density by the end of 2011, a highly unlikely scenario. In fact growth rates have generally declined in sub-Saharan Africa including Tanzania in the past few years. Figure 12-3 shows growth rates from 2002 to 2007 declining compared to growth rates in 1999 to 2004 in several sub-Saharan countries (the exception being Zambia).

**Figure 12-3.**



Mobile growth and penetration in Sub-Saharan Africa.

Source: Based on ITU data, [www.itu.int/ITU-D/ict/ey/](http://www.itu.int/ITU-D/ict/ey/).

Although growth rates may decline, given heavy urban penetration, we might expect that most network expansion will be in rural areas, since about ten million people or 25 percent of the population live in rural areas without mobile coverage or fixed line access. Yet Tanzanian mobile operators at the time of planning implementation of the fund were apparently much more concerned with capturing additional urban customers than extending into unserved areas. Interviews with several mobile operators in April 2009 indicated that they were not likely to be extending networks much beyond their current coverage, but rather upgrading their existing networks to attract more business and high income users, and increasing urban capacity to compete with new entrants.

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Competition among operators should be expected to drive continued expansion. As noted above, there are six mobile competitors (plus two new licensees), of which three have significant rural coverage. Developing countries with mobile competition (even a duopoly) have experienced mobile growth rates significantly higher than those that remain monopolies.<sup>35</sup> The three largest operators in Tanzania do compete on coverage; ICT Africa’s survey found that for 62 percent of Tanzanians with mobile phones, coverage was the primary reason for selecting a carrier. Yet the operators appear to prefer to compete on services and features, which were cited as important factors in about 28 percent of survey responses.

Of course, anticipated average revenue per user (ARPU) is likely to be much higher in urban areas, as many rural residents live at subsistence levels, although they may also generate significant revenue from

incoming calls paid for by urban relatives. The global recession also apparently squeezed mobile operators as well as contributing to a revenue shortfall in the Tanzanian economy. One mobile executive stated that his company had effectively stopped extending rural coverage; another executive stated that the two largest mobile operators had halted network expansion.<sup>36</sup>

p. 224 Thus, it would appear that subsidies are required to extend coverage to unserved rural areas. Yet the available research on access indicates that there is significant pent-up demand among those without mobile phones, that those with phones are willing to spend a very high percentage of their disposable income on mobile use, and that reducing the price of handsets could result in more than one million new subscribers, who in turn might provide access to many million more relatives and neighbors. Simply reducing the price of handsets, therefore, where wireless coverage exists, could significantly increase rural access. Could operators be persuaded to lower handset prices, given the potential increase in usage revenues? Or would a handset discount subsidized by the fund (similar to the Linkup model in the United States) be more appropriate?

## Options for Increasing Internet Access

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*Access models.* As discussed earlier, the Tanzania Universal Communication Service Access Act of 2006 and its specifications for the UCAF, use the term *communication services* (rather than telecommunications or telephony), which can be interpreted to include Internet services. The Ministry of Communications, Science and Technology and the manager of the UCAF believe that extending Internet access should be a major means for the fund to contribute to Tanzania's development.<sup>37</sup> Tanzania is also committed to using ICTs to help achieve the Millennium Development Goals, and several ministries and government organizations have plans to provide services electronically in rural areas. Thus, while voice communications remains the first priority, the UCAF is expected to fund Internet projects also as a high priority, without waiting until all unserved areas receive voice coverage.

There are a variety of alternatives in terms of access models and technologies that could be adopted to extend Internet access. The access models include:

- A single nationwide model of public access (e.g., at post offices);
- A variety of public access models (telecenters, cybercafes, other shops, NGOs, etc.);
- Schools and libraries;
- Other institutions, such as government offices, community centers, and banks; and
- Personal Internet access using wireless phones, PDAs, laptops, or netbooks.

p. 225 Also, there are a variety of technologies that could be used to reach these access locations including 3G or next-generation mobile networks; fixed wireless (e.g., via WiFi, WiMax) from existing backbone—fixed or mobile; DSL in towns where TTCL has fixed lines; and very small aperture terminals (VSATs).

It should be noted that these models are not mutually exclusive. Different access models may accommodate users with varying needs (e.g., literacy levels, ability to pay, and familiarity with technology). Further, there is considerable experience in sub-Saharan Africa (and other developing regions) in implementing Internet projects, in terms of organization, training, content, and models for sustainability.<sup>38</sup>

Additionally, there are already a number of private and public sector plans or initiatives for Internet expansion or adoption. The UCAF could coordinate its Internet/broadband initiatives with other government priorities, such as Internet connectivity for all schools (or middle and secondary schools), for postsecondary education (including universities, teachers' colleges, technical schools, and nursing schools), or for the achievement of targets adopted for the Millennium Development Goals (MDGs) program.

*A pilot project approach.* The UCAF will not have sufficient funds to address all Internet needs, and is likely to address completing voice service coverage as its first priority. Therefore, in the first phase (i.e., the first three years), several pilot projects could be supported that would take a variety of approaches to providing Internet access in different regions of the country. Also, by the end of the three-year period, more of the

domestic fiber backbones should be in place, and impact of the availability of international submarine cables on demand should be better understood. Advances in wireless technologies may also indicate which middle-mile or last-mile technologies are likely to dominate.

Bidders for pilot project support in rural areas could include operators (mobile or fixed) that have announced plans for extensive national broadband coverage. They could use the pilot project support to demonstrate how their networks would be deployed in rural areas, and the projects would provide an opportunity to assess the suitability and sustainability of their strategies in rural areas. The pilot project approach would also provide an opportunity for smaller operators and ISPs to obtain seed money to demonstrate their approaches, also subject to the evaluation criteria. The following are three examples of projects that could yield valuable experience for planning national Internet and broadband access.

A key component of this pilot phase would be an independent evaluation to collect utilization data, to document lessons learned from the projects' implementation and operation, identify individual and collective benefits, and assess potential sustainability. Tanzanian researchers could be contracted to carry out these evaluation studies, which would be used in determining future strategies for investment in Internet access.

p. 226 *Other forms of support.* The following are examples of possible pilot projects that could be funded during the start-up phase of the UCAF. Since the UCAF mandate is broad, other strategies could be tried to increase user access, provide more affordable equipment, and develop relevant content. For example:

*Individual user-based subsidies.* The UCAF could experiment with providing some subsidies for individuals who would otherwise be unable or unlikely to use the Internet. For example, vouchers for a certain amount of time online could be subsidized for distribution to target populations, such as low-income users, first-time users, rural users, or students. This approach was used successfully in a United States Agency for International Development (USAID) telecenter project in Bulgaria.<sup>39</sup>

*Discounts on equipment.* The UCAF could also reduce the cost of computers, cited by several people interviewed as a hindrance to computer and Internet use in Tanzania. Netbooks, and other basic personal computers are now available for a few hundred dollars in industrialized countries, but typically cost much more in the developing world. The UCAF might be able to provide funds to schools, telecenters, and libraries, among other entities, to arrange bulk purchases or offset taxes and duties. Other government procurement initiatives with vendors or donors for schools and community access should be coordinated with the UCAF so that participating communities and institutions receive high priority for connectivity projects.

*Support for training.* The UCAF could experiment with supporting training in computer and Internet skills because ability to use computers or other devices and to find and use online materials are critical for Internet use. Training could be done at telecenters, or by NGOs, community groups, or professional trainers or volunteers.

*Support for content or applications.* Another aspect of UCAF's Internet access program could involve the issuing of grants for the development of online content and/or applications that could increase the utilization and effectiveness of online resources. While such content support is unusual for universal service funds, the UCAF mandate is broad enough to include content. The experience of Uganda, one of the few countries to support content creation and training, could be used as a model.

While available data are limited, several conclusions can be drawn from the above analysis that can inform UCAF implementation. Concerning voice services, the number of mobile subscribers is likely to be considerably lower than most estimates because of the common use of multiple SIM cards. However, the actual number of Tanzanians with access to voice communications is

significantly greater than the number of mobile subscribers because of the common practice of sharing phones and airtime. Factors affecting rural access to voice services include not only signal coverage but also the price of mobile handsets and calls. Without subsidies, mobile carriers are not likely to extend rural coverage, but to upgrade their urban networks and services to attract more urban customers and generate higher ARPU.

Concerning the Internet, usage is extremely low, and occurs largely through Internet cafes and telecenters, primarily in urban areas. Few rural schools, government offices, or businesses have computers. Prices for Internet devices, whether computers or 3G phones and personal digital assistants (PDAs), are likely to remain beyond the reach of the vast majority of Tanzanians. Pilot projects to increase Internet access in rural and under-served areas could be designed to encourage innovation in terms of technologies and implementation strategies, and participation by small and new operators and ISPs. Evaluation of the projects could provide valuable data on demand and barriers to usage, and contribute to a better understanding of the role of ICTs in Tanzanian development.

Several of the strategies recommended for implementation of Tanzania's UCAF could be relevant for other developing regions. For example, data from the national census and other surveys can be a useful source, particularly if data can be disaggregated according to relevant demographic and geographic criteria. Studies and experience from neighboring countries and others with comparable conditions (in this case, Uganda, and more generally sub-Saharan Africa) can be useful to estimate demand and to understand potential barriers to adoption. A pilot project approach with support for evaluation can provide valuable experience at minimum cost before national rollout plans are implemented. Finally, involving local researchers can be advantageous in identifying relevant existing studies, planning and carrying out field research, and building local capacity in ICT planning and evaluation.

## Notes

1. Research for this paper was carried out in the process of gathering information to advise the government of Tanzania under a contract to Kalba International funded by the World Bank. Konrad (Kas) Kalba and Heather Hudson collaborated in conducting field interviews, reviewing secondary data, and drafting initial reports. No confidential information is included in this chapter. The views expressed are those of the author.
2. A recent study estimates that 44 percent of the population is under fifteen; see Population Reference Bureau, "2008 World Population Data Sheet," <http://www.prb.org/Publications/Datasheets/2008/2008wpds.aspx>.
3. The World Bank estimates the average Tanzanian per capita GDP at \$400 (without PPP adjustment). See World Bank, "Tanzania at a glance," September 24, 2008.
4. Robert J. Utz, ed., *Sustaining and Sharing Economic Growth in Tanzania* (Washington, DC: World Bank, 2008).
5. Interview with director of the National Bureau of Statistics, April 2009.
6. Estimates by Konrad Kalba, May 2009.
7. The major mobile operators are Vodacom (subsidiary of Vodafone), Zain owned by MTC of Kuwait which purchased Celtel International (sold in 2010 to Bharti Airtel), Zantel (also the fixed carrier in Zanzibar), owned by Etisalat, TTCL Mobile, and Tigo (owned by Milicom).
8. See <http://www.seacom.mu>.
9. The Eastern Africa Submarine Cable System, <http://www.eassy.org>.
10. Three carriers were operating international gateways in competition with TTCL in August 2009, according to the UCAF manager. Personal communication, August 2009.
11. United Republic of Tanzania, the Universal Communication Service Access Act, 2006.
12. InfoDev, "Universal Access and Service." Module 4 of ICT Regulation Toolkit, December 2008, <http://www.ictregulationtoolkit.org>.
13. Heather E. Hudson, "Defining Universal Service Funds: Are They Accelerators or Anachronisms?" *Intermedia* 38 (2010).
14. Ibid.
15. Heather E. Hudson, *From Rural Village to Global Village: Telecommunications for Development in the Information Age* (New York: Routledge, 2006).

16. See <http://www.schoolnetafrika.org>.
17. See <http://www.amref.org>.
18. Tanzania ICT Policy, 2003, quoted in “Information and Communication Technology (ICT) for Basic Education,” <http://www.moe.go.tz>.<sup>↗</sup>
19. Information and Communication Technology (ICT) Policy for Basic Education, “ICT for Improved Education,” August, 2007, <http://www.moe.go.tz>.<sup>↗</sup>
20. Project “ICT Implementation in Teachers’ Colleges,” <http://www.teachers.or.tz>.<sup>↗</sup>
21. See <http://www.un.org/millenniumgoals/>.
22. National Bureau of Statistics (Tanzania) and Macro International, *Tanzania 2007–08 HIV/AIDS and Malaria Indicator Survey Key Findings* (Calverton, MD: NBS and Macro International, 2009).
23. Smaller households in emerging markets are statistically correlated with higher mobile penetration levels. See Kas Kalba, “The Adoption of Mobile Phones in Emerging Markets,” *International Journal of Communication*, January 2009.
24. Alison Gillwald, “Towards Evidence Based ICT Policy: Access & Usage in 17 African Countries,” Research ICT Africa, presented at the Telecommunications Policy Research Conference, Arlington, VA, September 2008.
25. Interview with Ophelia Mascarenhas, researcher for a study of ICTs and poverty in Tanzania funded by the International Development Research Centre (ICRC), April 2009.
26. Christoph Stork, “Mobile Access & Use in East Africa” (n.d.), <http://researchICTafrica.net>.<sup>↗</sup>
27. Hosea Mpogole, Hidaya Usanga, and Matti Tedre, “Mobile Phones and Poverty Alleviation: A Survey Study in Rural Tanzania” (Iringa, Tanzania: Tumaini University, n.d.).
28. Stork.
29. Utz.
30. Gillwald.
31. Ibid.
32. Personal interview, April 2009.
33. Metcalfe’s Law states that the value of the network is  $n(n-1)$ , or almost the square of the number of users.
34. ITU data at <http://www.itu.int/ITU-D/icteye/>.
35. Hudson, 2006.
36. Personal interviews, Dar es Salaam, April 2009.
37. Ibid.
38. See for example, Florence E. Etta, and Sheila Parvyn-Wamahiu, eds. *Information and Bibliography Communication Technologies for Development in Africa*, vol. 2; and Tina James, ed. *Information and Communication Technologies for Development in Africa*, vol. 3 (Networking Institutions of Learning—SchoolNet) (Ottawa: International Development Research Centre, 2004).
39. “Bulgaria Projects: LearnLink,” <http://www.learnlink.aed.org/Projects/bulgaria.htm>.<sup>↗</sup>