

The social and economic implications of mobile telephony in Rwanda: An ownership/access typology

JONATHAN DONNER

Introduction

This chapter will explore the social and economic implications of the rapid adoption of mobile telephony in Sub-Saharan Africa, drawing particularly on examples from Rwanda. It will contrast the experiences of three groups of people: those who own a telephone, those who rely on public telephones, and those without access to any telephone at all. While some universal patterns of mobile use are evident, the exercise will also highlight ways in which mobile adoption has different implications in an environment of limited landline availability.

One overarching theme of telecommunications in Africa is the persistent scarcity of telephones of any kind. The International Telecommunication Union (ITU 2004a) estimates that in 2003 across Europe there were 96.3 telephone subscribers—fixed and mobile combined—per 100 people. In the Americas, there were 66.6 subscribers per 100. In Africa, there were 8.7 per 100. Africa's telephone subscribers are concentrated in cities, and in the relatively more prosperous nations on the continent, particularly South Africa and Botswana.

Despite this scarcity, a second theme is the rapid increase of mobile telephone users in the region. Africa is the world's fastest growing mobile market (ITU 2004b). By 2003, 67 percent of the total telephone subscriptions in Africa were mobile lines, compared to 50 percent in the Americas and 58 percent in Europe (ITU 2004b). Landline penetration in the region continues to grow, but slowly. Meanwhile, from Senegal to Somalia, mobile providers are adding base stations and customers as quickly as possible.

These dual themes of overall telephone scarcity and increasing mobile use provide the rationale for this chapter's typology. 'Private phone owners', 'public phone users' and 'telephone non-users' are cat-

egories that will remain salient in Africa for years to come. However, rapid mobile adoption is changing the composition of the groups: new *mobile-only* owners are joining the ranks of the phone-owners, once the domain of only the most prosperous households. Meanwhile, mobile-based payphones are extending the reach of shared connectivity, allowing more frequent use of phones among those who cannot afford or access a telephone subscription of their own.

Rwanda suffered through a devastating civil war and genocide in 1994. Relative stability has returned to the country, but poverty remains the everyday reality for many. Though Kigali is a vibrant small city, most of Rwanda's eight million inhabitants live in rural areas and rely on agriculture for their livelihoods (CIA 2004). Thus, Rwanda's experiences with both urban and rural telecommunications challenges make it illustrative for the region. Rwanda's mobile provider, MTN Rwanda Cell, began offering GSM service in 1998. By 2003, Rwanda had 1.6 mobile subscriptions per 100 people compared with 0.28 landlines (ITU 2004b). Coverage now extends to all of Rwanda's major cities and commercial centers, though parts of the countryside remain without a signal.

This brief review will draw on the results of a series of studies conducted in Rwanda, as well as on references to recent studies and initiatives from elsewhere in Sub-Saharan Africa. The participants in the Rwanda studies are micro-entrepreneurs—owners of small businesses, generally with fewer than 5 employees, which are critical to urban economies in the developing world (Mead & Leidholm 1998; Santos 1979). The initial study was a Q-sort (prioritization) exercise, in which 31 micro-entrepreneurs articulated their perspectives on mobile use (Donner 2003). A broader survey in Kigali focused on the list of recent calls stored on user's phones to assess "whom micro-entrepreneurs call, and why" (Donner 2004a; 2005a). Most recently, we conducted open-ended interviews on topics ranging from business-specific uses to social coordination (Donner 2005b).

Private phone owners

We start with what remains the smallest of the three groups in the typology: those individuals (or households) who own their own telephone. In the days before the widespread use of mobiles, membership of this group was easy to discern; only the most prosperous Rwandan households had the income, bank accounts, credit, status, proximity, and/or political clout to get a landline installed (Panos 2004). Now, there are two paths to private phone ownership: landline purchase (still reserved for the most prosperous) and mobile handset purchase (open to a wider range of Rwandan society).

Mobile and landline owners

Many fortunate households with landlines were among the first to purchase mobiles. Landline-owning households still represent a disproportionately large share of Rwanda's mobile users, since nearly every wealthy Rwandan now owns a mobile. In many ways, the trajectory of mobile adoption resembles that found in Europe and the United States, as the technology was adopted first by business, professional, and government elites before making its way into broader domestic/personal use (Katz 1999). These prosperous households welcomed the mobile in the same way their counterparts in Europe did—as an additional *mobile* telephone line which could complement and extend the reach of landlines at home and at work. As elsewhere, purchasing decisions for this group mix instrumental and intrinsic dimensions. Though certainly convenient, mobiles are also symbol of affluence and a source of comfort and security (Donner 2003).

The mobile is not simply a complement to the landline for those who possess both. It is a competitor for the same calls (Hamilton 2003). Since MTN Rwanda Cell's international rates have consistently been lower than those of the landline provider, RwandaTel, some households purchase mobiles to save on international calls. This rate competition will benefit all telecommunications consumers in the country in the long run by putting downward pressure on prices. Some users are 'cutting the cord' altogether. We interviewed a few former landline owners; some had cancelled their lines, others decided not to renew a line when they moved.

New mobile-only owners

There is now a second, larger group of telephone owners in Rwanda—those who for the first time in their lives find they can afford and purchase a telephone subscription of their own (Gamos 2003). Members of this group never had a 'cord to cut'; they are the mobile-only users. Driving a mobile boom in the developing world that is moving beyond the most prosperous homes, this group represents a growing cadre of users worldwide. For these users, the mobiles provide benefits of basic connectivity offered by the telephone (Pool 1977), plus the mobility, security, and status/display benefits more unique to the mobile.

Complementary attributes of mobile telephony fuel this increased adoption. At the network/infrastructure level, the addition of a mobile base station in an urban neighborhood or rural village can change the availability of telecommunications services literally overnight, at a lower cost per potential household. At the pricing/service level, inexpensive and used handsets are becoming plentiful. Most im-

portantly, the introduction of pre-pay plans has been critical for expanding mobile use in Africa (Minges 1999; Oestmann 2003), since many would-be owners lack bank accounts, access to credit, and even mail service to support contract accounts. By contrast, pre-pay cards allow users to recharge their phones whenever they have a little bit of money on hand, and to carefully meter their own expenditures. The vast majority of Rwanda's mobile users rely on pre-pay cards. The economic and social benefits of telephone ownership for this group of new users are discussed below.

ECONOMIC BENEFITS

Many of the micro-entrepreneurs we interviewed described significant changes in the productivity of their businesses. Here are three examples.

- Innocent is a baker. His operation is small; most days, he and his employee cook samosas over an open flame in his home. Two years ago, he purchased his mobile, which has allowed him to coordinate more easily with his regular customers. He no longer spends a good part of his day traveling to customer's shops to see what their order might be. Instead, he calls ahead and arranges to bring the proper amount of baked goods. In addition, Innocent estimates that 30 percent of his customers are now from outside Kigali—every one of which is able to contact Innocent only because he has his mobile.
- Afsa, a hair braider, moved to Kigali as an orphan after losing her family in the 1994 genocide. She learned braiding from a woman who provided lodging in exchange for her work, but she did not receive much money from this arrangement. At the recommendation of her customers, and having seen how much success others were having with their mobiles, Afsa saved for months and purchased a mobile of her own. Now, Afsa's customers can give her number to people who like their braids, and her business is growing by word of mouth. Thanks to referrals, and the ease with which she can schedule braiding sessions with regular customers, her business has tripled—from four clients a week to twelve. Now, she lives on her own, is saving money, and is planning to open her own salon. As she puts it, "When I got the mobile, I began to see braiding as a business—as work—and could see a future."
- Annette runs a small restaurant near the airport, which serves Ugandan food. (She is Ugandan). Lately, since she purchased her mobile, her lunchtime customers have gotten in the habit of calling her each day, to order in advance. She explains: "It's always on time and easier for them. Not like first reaching here and ordering and so forth. No sooner do they park than we put food on the dining table,

since we are aware of what they'll have." Others, later in the lunch hour, will call ahead to make sure she hasn't yet run out of food.

These stories of increased productivity are not limited to the urban areas. One owner of a dairy store in Kigali explained that many of his suppliers "up-county" had purchased mobiles and would contact him when milk was available for purchase. Rural farmers, ranchers, and fishermen are using mobiles, particularly text messages, to stay in touch with markets, cut travel costs, gain price knowledge, and reduce the bargaining power of middlemen (King 2004).

Most of these productivity gains come from the ability to rapidly exchange information between people who are beyond convenient travel distance, even if the distance is just a matter of a kilometer or two. In many cases, a landline could provide the same benefit (Aronson 1971), but other benefits are unique to mobiles, particularly to the fact that the mobile travels with the person instead of being tied to a location. For a self-employed tailor like Speciose, having a mobile means she can finally take lunch away from her sewing machine without risking the loss of a client. As has been the case in other regions mobiles give the self-employed greater flexibility and reachability (Aspden & Katz 1994).

SOCIAL BENEFITS

While the economic benefits are important to this group, they are not the only story. Roughly 70 percent of calls made and received by the micro-entrepreneurs we interviewed were with family or friends, rather than with business contacts (Donner 2005a). When a married couple uses the mobile to arrange to share a taxi ride home after work, or a woman uses the mobile to talk to a family member about a sick relative, or when Annette's customers call her restaurant to see if lunch is still being served, the mobile is allowing new users the same power to coordinate everyday life from a distance that people in high-teledensity countries may take for granted, whether via conventional telephones (Cherry 1977) or via mobiles (Ling & Haddon 2003).

One way to understand the social impacts of the mobile is to consider how mobile use may change a user's network of communication partners. The Kigali surveys looked at micro-entrepreneurs' call logs; asking users "who did you talk to?" and "what did you talk about?" We also asked respondents when they met each call partner, and to estimate whether the amount of overall contact with each of these call partners had increased, decreased, or stayed the same since getting the mobile. Thus, we could identify which kinds of contacts were new to the user's social network. We found little evidence that users are meeting new family members or friends because they have the mobile—they

are, instead, talking more frequently with the family and friends they already have. New customers, on the other hand, are very much a feature of the networks sampled on the call logs. Indeed, the highest concentration of new customers was found among those who had only a mobile line, versus those who had a mobile line and a fixed line (Donner 2004a). As sociologists have observed with the landline in other settings (Ball 1968; Thorngren 1977), mobiles are increasing the frequency of contact with existing friends and family, both locally and among geographically distant partners.

As the convenience of the mobile in everyday life has become apparent, some families with the wherewithal to do so have begun purchasing multiple handsets. For example, one interview respondent described frequent conversations between him and his wife—both on mobiles—about what time he would be coming home from work that day. Another respondent spoke of his four year old son, who would borrow his mother’s mobile to tell his dad he missed him. These stories seem familiar to us—as they should. The preceding paragraphs have presented examples of how mobiles are being used in familiar ways, for familiar purposes. However, at least three other factors illustrate ways in which the use of mobiles in resource-poor (and connection-poor) settings is different than that in more prosperous settings.

Firstly, the mobile helps maintain family relationships at a distance, in the form of the diaspora (Paragas 2004). International or long-distance internal relocation in search of economic opportunities has become central to the economies of many nations. In Rwanda, we met Ugandans like Annette, the restaurant owner, who were in Rwanda for economic opportunities and met Rwandans with family in Uganda, Burundi, and South Africa. In each case the mobiles helped people feel closer, even when hundreds of miles apart. Annette, for example, can regularly call her mother, check on the money she has sent back, and check on her daughter, who is still in school in Uganda. Each individual call Annette makes to her mother and daughter may be about family matters, but the overall effect may also be economic. Without an affordable and reliable way to be in touch, Annette might not feel comfortable staying in Kigali with the thriving restaurant.

Secondly, a powerful technique to maximize the mobile’s benefits while minimizing costs is ‘beeping’ (Donner 2005b; Oestmann 2003). Beeping occurs when an individual places a call to a mobile subscriber, and then hangs up before the call is complete. The resulting “missed call” message on the mobile’s call log is *usually* a signal requesting the mobile owner to call back. However, as the practice has spread it has diversified. If the beeper and the beepee have arranged the beep in advance, it can mean “pick me up now” or “I’ve arrived safely” or anything else that they can think of. For Fred the dairy vendor, a beep from his supplier meant “there’s milk now—send the truck”.

Meanwhile, the lucky few Rwandan youths with mobiles have taken to beeping each other as a virtually free way to say “I’m thinking of you” (it is even cheaper than texting). There is no instrumental content to these messages; instead, the beeps represent a form of “phatic” communication (Malinowski 1923) where messages are used to signal the existence of a relationship or open communication channel (Haddon 2000; Ling 2004; Thurlow & Brown 2003).

Since beeping allows many more users to maintain a mobile subscription than would otherwise be able to do so, Kigali, Nairobi, Kampala, and other African cities are awash with beeps (Borzello 2001; Mutahi 2002). Thanks to prepaid cards and the calling-party-pays structure, a mobile owner must pay only the basic monthly access charge of a few dollars a month to keep his phone able to receive incoming calls. If he or she can “beep” other phone owners and convince them to pay for the call, the user’s monthly expenditures can be quite low. Of course, this leads to a complex battle of wills as to who will pay, though generally the wealthier person is expected to pay (Donner 2005b). Beeping also provides a vehicle for one interaction between users of public telephones and mobile owners. Non-mobile owners can use public payphones to ‘beep’ their friends, families, and business partners who do own mobiles, transferring the cost of the call to city dwellers (Oestmann 2003).

Finally, there is the issue of mobile theft. Theft is a worldwide problem (Katz 2004), but can be especially damaging in settings like Rwanda, when the mobile might be the most expensive object a user owns, representing months of savings. Petty thieves will snatch the unattended mobile, or slash a handbag to free the mobile likely to be inside. Many of our interview subjects said they had been the victim of mobile theft. One jeweler we spoke with has had three mobiles stolen—one by a customer, right out of his store! Options to recover the mobiles are few; Angel, the arts and crafts saleswoman, had to rent a new mobile immediately (while saving to get a new one) after her mobile was stolen. Afsa the hair braider has an ‘emergency fund’ set aside specifically in case hers is stolen. Such emergency funds and immediate rentals indicate how, for individuals who had lived without their own telephones for years, the mobile has become an essential part of everyday life. Rangeria, an auto mechanic, explained “I always get frustrated when I don’t have my phone because I am used to it. And it disappoints those that do usually talk to me on my mobile”. Reminiscent of Wurtzel and Turner’s (1977) findings about “missing the telephone” another respondent compared a household without a mobile to a “home without water”.

Public phone users

Though it is tempting to focus the chapter on the excitement surrounding the new mobile owners, the great majority of households in Rwanda and elsewhere in Sub-Saharan Africa do not own a mobile or a landline. There are two interrelated barriers to mobile ownership. The first, quite simply, is money; even with prepay cards, inexpensive handsets, and the beeping strategies to reduce the cost of call, many Rwandans cannot afford mobiles or the airtime to support them. The second is access to a mobile signal; MTN is moving to cover as much of the nation as possible, and Rwanda's small size and dense population mean it will eventually end up with a higher proportion of its landscape covered than Chad or Mali or the Congo, but currently the nation is not 100 percent covered. The twin barriers to mobile ownership—cost and signal availability—clearly interact to privilege the urban areas over the rural ones. Indeed, mobiles may not be much better than fixed lines as a solution to connect many rural households (Panos 2004).

That said, recent data from London's Gamos Group (2003) suggests that though phone ownership in Sub-Saharan Africa is rare, phone utilization is not. Based on surveys in Botswana, Uganda, and Ghana, Gamos reports that roughly 75 percent of respondents living in rural areas with low levels of phone availability nevertheless reported using a phone at least once in the last three months, often traveling a significant distance to do so. The proportion of regular telephone users was even higher in the urban areas.

The recent introduction of mobile-based public phones and telecenters is good news for these regular users. In many areas, both rural and urban, public fixed-wireless payphones are springing up. These payphones provide GSM-based access in places where a conventional landline might not be practical or profitable to install (Oestmann 2003), and add additional lines in neighborhoods with long queues for existing public phones. Indeed, South Africa's three mobile providers are required as part of their license agreement to provide equipment for thousands of fixed-wireless shops, which entrepreneurs run as franchised, individual businesses (Reck & Wood 2003). Sometimes, the public phone is simply a mobile handset; Bangladesh's Grameen Village Phone is famous for developing a financial and technological model to empower thousands of women entrepreneurs to act as "phone ladies" for a village (Richardson, Ramirez & Haq 2000); Grameen Phone is replicating the model in Uganda, in collaboration with MTN (USAID 2004).

Users of public payphones don't enjoy the same flexibility to receive calls as mobile owners, but the shared-phone model will be an important aspect of telephone service for the years to come. Indeed, even a single phone or shared mobile line in a village can increase the

linkages between rural residents and their mobile-owning families in urban areas (Gamos 2003), and can improve the ability of farmers in villages to receive the best prices for their goods (Eggleston, Jensen & Zeckhauser 2002; Saunders, Warford & Wellenieux 1994).

Telephone non-users

What of the rest? If Gamos's (2003) estimates are correct, roughly 25 percent of citizens in Ghana, Botswana, and Uganda (and possibly Rwanda) do not regularly use telephones at all, either because they live out of easy travel distance to a phone, or because they choose not to make any calls. One could argue that these households benefit indirectly from recent improvements to connectivity among non-governmental and governmental service organizations that serve them, particularly in rural areas. For example, the software firm Voxiva and Columbia University are working with the US Centers for Disease Control and the Rwandan Government to develop a system that uses mobile telephones and internet connections to connect rural health clinics with central hospitals and government offices. The resulting nationwide information system will support Rwanda's efforts to dramatically scale-up the treatment of HIV/AIDS with antiretroviral drugs (Casas & LaJoie 2003; Donner 2004b; Nyaruhirira et al. 2004). Similar efforts are underway in South Africa—using text messages to coordinate patient care (Lindow 2004)—and in Uganda, where wireless-enabled PDAs put up-to-date information in the hands of rural caregivers (Phipps, Sanguidi & Woolway 2003).

For the most part, however, the encouraging developments in mobile ownership and the expansion of public phone availability must be presented with a caveat: that the split between rural and urban levels of mobile use is the latest wrinkle in an ongoing challenge for rural connectivity in resource-poor settings (Andrew & Petkov 2003; Hudson 1984; Panos 2004; Saunders et al. 1994). Mobiles are extending connectivity to populations on the urban periphery and even to some rural areas where landlines were unprofitable, but for the foreseeable future, GSM signals are unlikely to cover every village on the continent. The digital divide (Norris 2001) remains an important policy issue for Africa, even at the level of basic voice connectivity. Like a village without electricity or a paved road, a village without a mobile signal may be ill-equipped to participate in the interconnected formal economy.

Where market forces encourage neither the landline provider nor a mobile provider to provide connectivity at a reasonable cost, a number of other approaches are available to increase coverage and reduce the costs of use. Though a full review of these approaches is beyond the scope of this chapter, these include regulatory levers, such as

South Africa's phone shop requirement, flexible franchise models for rural GSM service (Engvall & Hesselmark 2004), and the pursuit of alternative satellite or WiFi/WiMAX technologies to support rural/remote connectivity (O'Neill 2003). These solutions require skillful collaboration between and integration with existing services so as to best balance the needs of all stakeholders. But by looking beyond where mobiles are working to where they are not, we can underscore that mobiles are but one part of an evolving telecommunications landscape that is the result of complex interactions between technologies, regulatory frameworks, geography, and user demand.

Conclusion

Despite challenges in serving remote areas, mobile ownership clearly provides significant economic and social opportunities to millions of individual users throughout Sub-Saharan Africa. Much of this value comes from the fact that many residents in cities like Kigali now have significantly greater access to basic voice telephony. Annette's restaurant thrives because her customers have mobiles; Celestine, the plumber, has the numbers of his three main contractors programmed on his mobile; Yousef the taxi driver is happy because both he and his wife can stay in touch during the day. Each story is a reflection of Metcalfe's law (Gilder 2000), illustrating how a network's value grows as a function of the square of the number of terminals; as more Rwandans become mobile owners, existing mobile and landline users benefit as well.

When the proportion of telephone users in a city triples in five years, there are significant changes to both the social and economic networks permeating the city. Townsend (2000) argues that mobiles are "rewriting the spatial and temporal constraints of all manner of human communications—whether for work, family, or recreation and entertainment [...] speed[ing] up the metabolism of urban systems, increasing capacity and efficiency." The acceleration Townsend observed is certainly evident in Kigali. Indeed, it is possible that the effect he describes is even more pronounced in this city, where mobiles are often their owner's only telephones. The productivity gains are palpable. Rangeria, a self-employed auto mechanic, told us: "Before, when I wanted a spare part, I was supposed to go to pick it up. But now I just call from where I am, and they bring it to me. Before, I would waste a lot of time." Indeed, Rangeria often now engages in *four* telephone conversations to fix a car: one for the appointment, one to tell the customer what the cost will be, one to the supplier to get the parts, and one to tell the customer the car is ready. Every call eliminates or streamlines a trip.

As with the economic benefits, the usefulness of the mobile in social relations may be even stronger among this population of new mobile users. People who before could arrange a talk once a month with far-flung relatives can do so more frequently. Families can coordinate their daily lives more effectively than previously possible. But we must be careful about whether we attribute this power to the mobile handset/network in particular. When we ask Kigali's residents what they perceive to be the benefits of their mobiles, they might mention increased social status, or security, or constant contact and increased mobility (Donner 2003), but, particularly if they are new mobile-only users, they may also mention the simple value of their new capacity to make and receive calls when they desire—as we have seen with land-line users (Dimmick, Sikand & Patterson 1994; Pool 1977).

At one level, the similarities in observed patterns of mobile use generally support Katz and Aakhus's (2002) theory of a universal '*Apparatgeist*' (common patterns) of mobile use. The micro-coordination of the lunchtime call to the restaurant, the long-distance call to the loved one, and even the teenager's sending of an "I'm thinking of you" beep each represent similar kinds of behaviors to what we would see in parts of the world with higher teledensities. But by looking at the mobile's implications for three kinds of individuals (those who now own a phone, those who access a public phone, and those who can not access any phone), we can focus on the critical distinction between the few who now have their own telephone and the many who do not. That distinction used to represent a clear line between the elite and the rest of the nation, but no longer.

There are two distinct transitions underway between the three groups: as new public phones are installed, some people who previously could *not make calls at all* are now able to *place calls, from time to time*. Meanwhile, new mobile owners, who previously had to rely on public phones, now can *make and receive calls, whenever they want*. It remains a rich area for future research to further explore the magnitude and meaning of these two transitions, particularly the one between public phone use and private phone ownership. The interviews with micro-entrepreneurs suggest that the difference is fundamental—a critical change rather than a mild difference in degree of reachability or convenience. There are 1.5 billion mobile subscribers on the planet, already more than there are landlines (ITU 2004b). Thus, many of the next billion mobile owners in China, India, Africa, and throughout the developing world may have experiences more like the new mobile owners in Rwanda—their first and only phone will be the mobile.

It is probably too early to determine what the long-term impacts of mobile telephone use on the region will be. Are mobile owners and payphone users in Rwanda happier? Wealthier? Healthier? Most evidence is still anecdotal. Though we are likely to see increased urban

economic activity, and increased urban-rural contacts from the mobile, it remains an open question whether the productivity gains we observed at the firm level will translate into increased levels of national prosperity. For now the key observable implication of mobile use seems to be social and economic amplification, as Townsend's metaphor of a 'speeding up' urban metabolism suggests. A reframing of the role of mobiles around amplification rather than transformation would have special significance for analysis in Africa, since doing so might highlight the ways in which mobile use is interrelated with the continent's distinct social, political, and economic structures.

Nevertheless, Rwandans are quite optimistic about the potential of mobiles to improve their lives, and express this optimism by voting with their pocketbooks, buying and using mobiles almost whenever possible. By focusing on the distinct experiences of three phone-user categories, this chapter has helped illustrate both the benefits and the challenges associated with the spread of mobile telephony in Rwanda and beyond. Even as we are pleased to see how so many Rwandans are benefiting from mobiles, it is worth paying attention to the other, still larger categories of public phone users and non-users in the country, and, to continue to work on the issues of connectivity, access, inclusion, and broad-based development that are important to them.

References

- Andrew, T. N. & Petkov, D. (2003)**, 'The need for a systems thinking approach to the planning of rural telecommunications infrastructure', *Telecommunications Policy*, 27 (1-2), 75-93.
- Aronson, S. H. (1971)**, 'The sociology of the telephone', *International Journal of Comparative Sociology*, 12 (3), 153-167.
- Aspden, P. & Katz, J. (1994)**, *Mobility and communications: Analytical trends and conceptual models* (No. OTA N3-16040.0), Washington, DC: US Congress, Office of Technology Assessment.
- Ball, D. W. (1968)**, 'Toward a sociology of telephones and telephoners', In: M. Truzzi (Ed.), *Sociology and everyday life*, Englewood Cliffs, NJ: Prentice-Hall.
- Borzello, A. (2001)**, 'Uganda's "beeping" nuisance', Retrieved 29 October, 2004, from <http://news.bbc.co.uk/1/hi/world/africa/1132926.stm>.
- Casas, C. & LaJoie, W. (2003)**, 'Voxiva: Peru', Retrieved September 30, 2004, from <http://www.bus.umich.edu/BottomOfThePyramid/Voxiva.pdf>.
- Cherry, C. (1977)**, 'The telephone system: Creator of mobility and social change', In: I. de Sola Pool (Ed.), *The social impact of the telephone*, Cambridge, MA: MIT Press, 112-126.

- CIA (2004)**, 'World factbook—Rwanda', Retrieved 20 Dec, 2004, from <http://www.cia.gov/cia/publications/factbook/geos/rw.html>.
- Dimmick, J., Sikand, J. & Patterson, S. J. (1994)**, 'The gratifications of the household telephone: Sociability, instrumentality and reassurance', *Communication Research*, 21 (5), 643-663.
- Donner, J. (2003)**, 'What mobile phones mean to Rwandan entrepreneurs', In: K. Nyiri (Ed.), *Mobile democracy: Essays on society, self and politics*, Vienna: Passagen Verlag, 393-410.
- Donner, J. (2004a)**, 'How mobiles change microentrepreneurs' social networks: Enabling and amplifying network contacts in Kigali, Rwanda', Paper presented at the 'Mobile Communication and Social Change: 2004 International Conference on Mobile Communication', October 17-18, Seoul, Korea.
- Donner, J. (2004b)**, 'Innovative approaches to public health information systems in developing countries: An example from Rwanda', Paper presented at the conference 'Mobile Technology and Health: Benefits and Risks', June 7-8, Department of Economics, Society, and Geography, University of Udine, Italy.
- Donner, J. (2005a)**, 'The mobile behaviors of Kigali's microentrepreneurs: Whom they call ... And why', In: K. Nyiri (Ed.), *A sense of place*, Vienna: Passagen Verlag.
- Donner, J. (2005b)**, 'What can be said with a missed call? Beeping via mobile phones in sub-Saharan Africa', Paper presented at the Conference on Communications in the 21st Century: Seeing, Understanding, Learning in the Mobile Age, April 28-30, Budapest.
- Eggleston, K., Jensen, R. & Zeckhauser, R. (2002)**, 'Information and telecommunication technologies, markets, and economic development', In: G. Kirkman, P. Cornelius, J. Sachs & K. Schwab (Eds.), *The global information technology report 2001-2002: Readiness for the networked world*, New York: Oxford University Press.
- Engvall, A. & Hesselmark, O. (2004)**, 'Profitable universal service providers', October, Retrieved January 27, 2005, from <http://www.eldis.org/fulltext/profitable.pdf>.
- Gamos (2003)**, 'Innovative demand models for telecommunications services', Retrieved December 23, 2004, from <http://www.telafrica.org/pdfs/FinalReport.pdf>.
- Gilder, G. (2000)**, *Telecosm: How infinite bandwidth will revolutionize our world*, New York: Free Press.
- Haddon, L. (2000)**, 'The social consequences of mobile technology: Framing questions', Paper presented at the 'Sosiale Konsekvenser av Mobiltelefoni Seminar', Oslo.
- Hamilton, J. (2003)**, 'Are main lines and mobile phones substitutes or complements? Evidence from Africa', *Telecommunications Policy*, 27, 109-133.

- Hudson, H. E. (1984)**, *When telephones reach the village: The role of telecommunications in rural development*, Norwood, NJ: Ablex.
- ITU (2004a)**, *African telecommunication indicators 2004*, Geneva: International Telecommunication Union.
- ITU (2004b)**, 'Online statistics', Retrieved December 20, 2004, from <http://www.itu.int/ITU-D/ict/statistics/>.
- Katz, J. E. (1999)**, *Connections: Social and cultural studies of the telephone in American life*, New Brunswick, NJ: Transaction Publishers.
- Katz, J. E. (2004)**, 'Mobile phones in educational settings', Paper presented at the conference 'The Global and the Local in Mobile Communication', Budapest, Hungary.
- Katz, J. E. & Aakhus, M. (2002)**, 'Conclusion: Making meaning of mobiles—a theory of *Apparatgeist*', In: J. E. Katz & M. Aakhus (Eds.), *Perpetual contact: Mobile communication, private talk, public performance*, Cambridge, UK: Cambridge University Press, 301-318.
- King, B. M. (2004)**, 'Text messaging empowers Kenyan farmers', Retrieved 2 December, 2004, from http://www.interaction.org/ict/success_text_Kenya.html.
- Lindow, M. (2004)**, 'How SMS could save your life', Retrieved November 23, 2004, from <http://www.wired.com/news/medtech/0,1286,65585,00.html>.
- Ling, R. (2004)**, *The mobile connection: The cell phone's impact on society*, San Francisco: Morgan Kaufmann.
- Ling, R. & Haddon, L. (2003)**, 'Mobile telephony, mobility, and the coordination of everyday life', In: J. E. Katz (Ed.), *Machines that become us: The social context of personal communication technology*, New Brunswick, NJ: Transaction Publishers, 245-265.
- Malinowski, B. (1923)**, 'The problem of meaning in primitive languages', In: C. K. Ogden & I. A. Richards (Eds.), *In the meaning of meaning: A study of the influence of language upon thought and of the science of symbolism*, London: K. Paul, Trench, Trubner & Co., 296-336.
- Mead, D. C. & Leidholm, C. (1998)**, 'The dynamics of micro and small enterprises in developing countries', *World Development*, 26 (1), 61-74.
- Minges, M. (1999)**, 'Mobile cellular communications in the southern African region', *Telecommunications Policy*, 23 (7-8), 585-593.
- Mutahi, W. (2002)**, *How to be a Kenyan*, Nairobi, Kenya: Kenway Publications.
- Norris, P. (2001)**, *Digital divide: Civic engagement, information poverty, and the internet worldwide*, New York: Cambridge University Press.
- Nyaruhirira, I., Munyakazi, L., Donner, J., Ruxin, J., Schocken, C., Ellis, D. et al. (2004)**, 'Technology supports rapid scale-up of Rwanda's HIV/AIDS care and treatment programs', Paper presented at the AIDS 2004: XV International Conference, Bangkok, Thailand.

- Oestmann, S. (2003)**, 'Mobile operators: Their contribution to universal service and public access', Retrieved 29 October, 2004, from http://rru.worldbank.org/Documents/PapersLinks/Mobile_operators.pdf.
- O'Neill, P. D. (2003)**, 'The "poor man's mobile telephone": Access versus possession to control the information gap in India', *Contemporary South Asia*, 12 (1), 85-102.
- Panos (2004)**, *Completing the revolution: The challenge of rural telephony in Africa* (No. 48), London: The Panos Institute.
- Paragas, F. (2004)**, 'Migrant mobiles: Cellular telephony, transnational spaces, and the Filipino diaspora', Paper presented at the conference 'The Global and the Local in Mobile Communication', Budapest, Hungary.
- Phipps, K., Sanguidi, G. & Woolway, S. (2003)**, 'What works: HealthNet Uganda's evolution from NGO to sustainable enterprise: Portable healthcare service delivery to Uganda's rural areas', Retrieved September 29, 2004, from <http://www.digitaldividend.org/pdf/healthnet.pdf>.
- Pool, I. d. S. (Ed.) (1977)**, *The social impact of the telephone*, Cambridge, MA: MIT Press.
- Reck, J. & Wood, B. (2003)**, *What works: Vodacom's community services phone shops*, Seattle: World Resources Institute.
- Richardson, D., Ramirez, R. & Haq, M. (2000)**, 'Grameen telecom's village phone programme in rural Bangladesh: A multi-media case study', Retrieved July 6, 2004, from <http://www.telecommons.com/villagephone/contents.html>.
- Santos, M. (1979)**, *The shared space: The two circuits of the urban economy in underdeveloped countries*, New York: Methuen.
- Saunders, R. J., Warford, J. J. & Wellenieux, B. (1994)**, *Telecommunications and economic development*, 2 ed., Baltimore, MD: Johns Hopkins University Press.
- Thorngren, B. (1977)**, 'Silent actors: Communication networks for development', In: I. de Sola Pool (Ed.), *The social impact of the telephone*, Cambridge, MA: MIT Press, 374-385.
- Thurlow, C. & Brown, A. (2003)**, 'Generation txt? The sociolinguistics of young people's text-messaging', *Discourse Analysis Online*, 1 (1).
- Townsend, A. M. (2000)**, 'Life in the real-time city: Mobile telephones and urban metabolism', *Journal of Urban Technology*, 7 (2), 85-104.
- USAID (2004)**, 'Using cellular phones in Uganda for rural income generation and more', Spring/Summer, Retrieved November 23, 2004, from http://www.dot-com-alliance.org/newsletter/print_article.php?article_id=36.
- Wurtzel, A. H. & Turner, C. (1977)**, 'What missing the telephone means', *Journal of Communication*, 27 (2), 48-57.

