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Investing in Infrastructure in Developing Regions: Innovative Strategies and Policies

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Investing in Infrastructure . in Developing Regions: Innovative Strategies and Policies

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"L'information est la clé de toutes les portes." (Information is the key to all doors.)
-- woman using a telecentre in Timbuktu

Abstract

Recent innovations in technology and policy are significantly increasing access to basic telecommunications services in the developing world. For example, in most African countires, there are now more wireless lines than fixed lines; for many new subscribers, their mobile phone is their first and only phone. This dramatic growth in connectivity is due partly to the advantages of wireless technologies in fast deployment of new networks, but perhaps more to the innovations in regulation and policy that have fostered innovation. Where countries have introduced competition in wireless/mobile services, rates have come down, and innovative wireless carriers have introduced features such as "pay as you go" using rechargeable cards, and inexpensive text messaging. The result has been dramatic growth in access to basic communications.

However, access to broadband that would allow use of the Internet's Worldwide Web and other advanced services, is still very limited and/or expensive in most of Africa. This paper examines how technological and regulatory innovations might bridge this broadband divide. The paper also explores how targeted subsidies may be used to increase broadband access.

1. Access to the Internet

In developing regions, the need for services besides basic voice is now spreading beyond urban areas, businesses and organizations, to small entrepreneurs, NGOs (nongovernmental organizations) and students, driven by demand for access to e-mail and the Internet. E-mail is growing in popularity because it is much faster than the postal service and cheaper than facsimile transmission or telephone calls. Such services can be valuable even for illiterates. A Member of Parliament from Uganda stated that his father sent many telegrams during his lifetime, but could neither read nor write. Local scribes wrote down his messages and read them to him. Similarly, "information brokers" ranging from librarians to staff of telecentres can help people with limited education to send and access electronic information. Telecentres equipped with personal computers linked to the Internet enable artisans, farmers and other small entrepreneurs to set up shop in the global marketplace.

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The good news is that access to voice services has improved dramatically, thanks largely to newly available and more affordable wireless (mobile) services in many developing countries. The bad news is that Internet access is still very limited, and that broadband, a key requirement for productive use of many Internet resources, is still unavailable and/or unaffordable in most of the developing world.

Table 1 shows the gap between the industrialized and developing worlds in three indicators that together suggest the limited access to the Internet. The first is estimated Internet users: more than 85 percent of the world's Internet users are in developed countries, which account for only about 22 percent of the world's population. The other two indicators selected are personal computers and telephone lines because Internet access requires both communications links and information technologies, typically personal computers or networked computer terminals. While there is still much less access to telecommunications in developing countries than in industrialized countries, at present, the gap in access to computers is much greater than the gap in access to telephone lines or telephones. High income countries had 22 times as many telephone lines per 100 population as low income countries, but 96 times as many computers.

Table 1: Internet Access Indicators

Region	**Main Tel Lines /100 Pop**	**PCs/100**	**Internet Users /100**
Africa	2.7	1.3	0.03
Americas	34.8	29.0	14.5
Asia	11.7	4.6	0.4
Europe	36.6	21.4	2.3
Oceania	39.1	42.4	9.7
World	17.1	10.2	9.9

Derived from ITU, December 2003.

It should be noted that broadband access is not included in the above table. Recent data from the ITU indicates that some broadband services were commercially available in 82 economies (out of 200) worldwide, but that penetration rates are quite closely correlated with gross national income per capita, so that in developing countries that do have broadband, access is generally very limited.

Internet access in Africa is particularly limited and expensive. Broadband is virtually nonexistent even for business and institutional customers in most African nations. This lack of

local and domestic high speed connectivity prevents Africans from connecting to the SAT-3 undersea cable that now lands at most African countries bordering the Atlantic and Indian Oceans. This $650 million 120 Gb/s cable is estimated to be operating at only 3 percent of its capacity.[1] And despite the fact that the price of international bandwidth has dropped with the increase in capacity, the price of Internet access was higher in Africa than anywhere else in the world, and completely out of reach of most Africans. See Table 2.

Table 2: Internet Access Pricing

Country Classification	Internet Access (20 hours per month)	Internet Price as % of GNI/capita
Africa	$60.09	241.3%
Americas	$31.39	27.5
Asia	27.02	48.7
Europe	21.50	6.8
Oceania	39.84	39.9

Derived from ITU, *World Telecommunications Development Report,* December 2003.

2. The Explosive Growth of Wireless

In developing countries without sufficient wireline infrastructure, wireless personal networks can be used for primary service. In many developing regions, wireless growth has been explosive, with mobile phones becoming the first and only telephones for many new subscribers. In Africa, and in many developing countries of Asia, now more than half of all subscribers are wireless subscribers. See Table 3.

It should be noted that wireless can also be used for public access. For example, cellular operators in South Africa were required to install 30,000 wireless payphones within five years as a condition of their license.[2] This policy, plus rollout requirements placed on Telkom, the monopoly fixed operator, contributed to a significant improvement in access to telephone service. By 1998, 85 percent of South Africans, including 75 percent of those living in rural areas, said that they had access to a telephone. In townships and rural areas, access typically meant an available payphone within a short walk.

Yet these wireless services provide very limited bandwidth, typically a maximum of 9600 bits per second, and often as little as 2400 bits per second. They can be used for text messaging and simple e-mail, but are not really suitable for Internet access (although cellular service has been used for Internet connectivity at a Uganda telecenter where no fixed line service was available). They may, however, provide lessons about how to extend broadband services in developing regions.

Table 3: Wireless Access Indicators

Region	Wireless subscribers /100 population	Wireless subscribers /all subscribers
Africa	4.6	62.4%
Asia	12.4	50.9
Americas	29.9	46.3
Europe	51.3	55.1
Oceania	48.9	54.7
World	19.1	51.5

Derived from ITU, *World Telecommunications Development Report*, December 2003.

3. Lessons from the Wireless Explosion

3.1. The Impact of Competition

Several lessons can be learned from the dramatic expansion of wireless and growth of wireless users in the developing world. Wireless technology has the advantage of being faster and cheaper to deploy in many instances than wireline technologies. However, cellular services have been around for two decades, and growth did not take off until prices were lowered. *Competition* is the key driver of the wireless explosion. Wireless competition has resulted in innovative pricing and service offerings. Rechargeable smart cards make phone service accessible to people without bank accounts or credit histories. Cheap messaging can substitute for many e-mail functions. For example, the Philippines is now the world's largest user of SMS (short message service). And demand in developing regions has been shown to be much greater than many operators assumed.

Note that pricing for SMS in developing regions is typically lower than in industrialized countries, perhaps in response to perceived demand and ability to pay for text messaging. See Table 4.

Where competition in wireless has been introduced, in general, the growth rates are much higher than where there is one monopoly wireless operator. Conversely, the *lack* of competition appears to be a significant barrier to providing wireless service. Could lack of competition, either through wireline technologies or through competing terrestrial wireless or satellite technologies, be a major barrier to extending broadband access in the developing world?

Table 4: Prepaid Cellular and SMS Pricing

Region	Prepaid local call per peak minute	Local SMS Message
Africa	$.21	$.07
Americas	.29	.07
Asia	.22	.09
Europe	.24	.10
Oceania	.35	.16

Derived from ITU, *Telecommunications Indicators,* December 2003.

3.2. Demand Greater than Assumed

In designing networks and projecting revenues, planners often assume that there is little demand for telecommunications in developing regions, particularly in rural areas. Similarly, telecommunications service providers may be reluctant to extend services to poorer populations who are assumed to have insufficient demand to cover the cost of providing the facilities and services. Their forecasts are typically based solely on the lower population densities than are found in urban areas, coupled with a "one size fits all" fallacy that assumes all rural residents are likely to have lower incomes and therefore lower demand for telecommunications than urban residents. However, A study for the World Bank estimates that rural users in developing countries are able collectively to pay 1 to 1.5 percent of their gross *community* income for telecommunications services.[3] The ITU uses an estimate of 5 percent of *household* income as an affordability threshold.[4]

The take-up of wireless services in many developing countries has also demonstrated that there is significant pent-up demand for telecommunications services, even among relatively low income users. While demand for broadband is likely to be more limited, it is certainly not negligible. For example, entrepreneurs may want Internet access to order parts and supplies, check on international prices, and arrange transport of their produce to foreign markets. There may also be significant demand from government agencies and NGOs operating in rural areas to administer health care services, schools, other social services, and development projects.

3.3. Old Distinctions No Longer Relevant

Classifications and distinctions that once were useful may no longer be relevant. Regulators typically issue separate licenses and approve separate tariff structures for fixed and mobile services, yet these distinctions have become blurred. Mobile telephone service was designed for communication while in vehicles; however, modern cellular and PCS systems are used for personal communications, and can often be considered a substitute for fixed network connections. As noted above, in many developing countries, wireless has become the first and

only service for many customers who never before had access to a telephone. Eliminating these licensing distinctions may accelerate access.

The distinction between voice and data no longer makes sense; bits are bits, and can be used to transmit anything. Yet in many developing countries, voice communication is still considered a monopoly service. Since broadband wireline services such as DSL and ISDN use existing wireline networks, a voice monopoly may actually preclude other operators from adopting these technologies. However, some countries are encouraging the growth of voice over IP, which could also be offered over broadband networks. For example, China's operators are building parallel IP networks that users can access with a prepaid phone card.

4. Overcoming Incumbent Bottlenecks

4.1. Limiting Periods of Exclusivity

In a liberalized environment, the length and terms of operator licenses can impact the pace of growth of networks and services. Regulators typically face choices concerning how long to protect incumbents to enable them to prepare for competition, and how long to grant periods of exclusivity or other concessions to new operators to minimize investment risk. Yet exclusivity and long time periods may be the wrong variables to focus on if the goal is to increase availability and affordability of telecommunications services. Instead, investors cite a transparent regulatory environment with a "level playing field" for all competitors and enforcement of the rules as key to their assessment of risk.

A few countries have granted fixed licenses with as much as 25 years of exclusivity, although 10 years or less seems more common. Even 5 to 10 years seems like a lifetime given the rapid pace of technological change, with Internet time measured in dog years (seven to a calendar year). It is highly unlikely that fixed line providers will have an incentive to roll out broadband services beyond large businesses and some upscale residential areas if they see no near term threat to their monopoly. Some jurisdictions[5] have negotiated terminations of exclusivity periods with monopoly operators in order to enable their economies to benefit from competition in the telecommunications sector.

4.2. Extending Access through Resale

Authorization of resale of local as well as long distance and other services can create incentives to meet pent-up demand even if network competition has not yet been introduced. Franchised payphones can be introduced in developing countries in order to involve entrepreneurs where the operator has not yet been privatized and/or liberalized. . Franchised telephone booths operate in several African countries; in Senegal, private phone shops average four times the revenue of those operated by the national carrier.[6] Indonesia's franchised call offices known as Wartels (Warung Telekomunikasi), operated by small entrepreneurs, generate more than $9,000 per line, about 10 times more than Telkom's average revenue per line.[7] . In Bangladesh, Grameen Phone has rented cellphones to rural women who provide portable payphone service on foot or bicycle to their communities. Commercial cyber cafes in many African cities resell Internet access and many often sell phone cards as resellers of telephone services.

Resale of network services can also reduce prices to customers. Most interexchange carriers in industrialized countries are actually resellers that lease capacity in bulk from facilities-based providers and repackage for individual and business customers, offering discounts based on calling volume, communities of interest, time of day and other calling variables. Similar strategies can be used to resell broadband when networks that are upgradeable (such as for DSL) or that have excess capacity (such as optical fiber or satellites) are available.

4.3. Legalizing Bypass

Strategies to extend broadband often focus too much on technology. For example, a VSAT may be an ideal solution to bring high speed Internet access to a rural school or telecenter, but is it legal in the country in question to install the VSAT, which bypasses the public switched network? Wi-Fi (IEEE 802.11 standards using commonly unlicensed bands) can provide broadband access for villages and neighborhoods. Yet in many African countries it is necessary to have a license or to register to use these bands, even if they are not being used for other purposes. Such restrictions inhibit investments to extend Internet access.

Many monopoly operators claim that bypassing their networks effectively siphons off revenues that they need to expand their networks, which would also probably create more jobs. However, the relationship is not so simple. As noted above, without competition, there is likely to be little incentive to roll out broadband, to choose the most cost-effective technologies where broadband is deployed, and to price broadband services reasonably. Thus, policy makers will not further the goal of extending access to affordable broadband by preserving wireline monopolies.

Protecting dominant carriers may also hinder economic growth. For example, a West African Internet service provider pointed out that he needed relatively inexpensive international connection to the Internet in order to provide affordable Internet access for his customers. By using bypass, he is creating new jobs in value-added services as an Internet provider, as well as providing an important information resource for economic development of the country.[8]

5. Toward Universal Access

5.1. Community Access

The concept of universal access continues to evolve, both in terms of services that should be universally included and in our understanding of access, which includes *availability*, *affordability* and *reliability*. Universal access should therefore be considered a dynamic concept with a set of moving targets. Thus, for example a multi-tiered definition of access could be proposed, identifying requirements within households, within communities and for education and social service providers.

Community access was a benchmark commonly applied for voice services in developing countries: publicly available payphones were to be available in each village or neighborhood of towns and cities. This approach is now being extended to the Internet, as many countries are extending public access to the Internet through telecenters, libraries, post offices, and kiosks.[9]

As demand grows, entrepreneurs, small businesses, NGOs, and some residents may want direct Internet access. One solution is for the community access point, such as a telecenter, to become an ISP. The telecenter in Timbuktu, Mali, became an ISP to serve NGOs, entrepreneurs, and local government agencies that could afford a computer and access charges. In Alaska, the FCC has issued a waiver to allow the E-rate subsidized Internet service for schools to be accessible to the community. To qualify, the community must have no local ISP and no local access to an ISP (i.e. access without long distance toll charges).[10] This approach could be a model for other rural and developing regions where commercial ISP services are not available.

5.2. Targeted Subsidies

The strategies above should serve to extend broadband services by removing barriers and creating incentives to enable facilities and services providers to reach potential customers. However, there may still be locations where projected revenues would not alone justify the costs. The traditional means of ensuring provision of service to unprofitable areas or customers has been through cross subsidies, such as from international or interexchange to local services. However, in a competitive environment, new entrants cannot survive if their competitors are subsidized. Therefore, if subsidies are required, they must be made explicit and targeted at specific classes of customers or locations such as:

- **High Cost Areas:** Carriers may be subsidized to serve locations that are isolated and/or have very low population density so that they are significantly more expensive to serve than other locations. This approach is used in the U.S. and has recently been mandated in Canada.

- **Specific User Groups:** Subsidies may target important development sectors such as education and health through access to schools and health centers, and/or to publicly accessible facilities such as libraries and post offices. For example, South Africa is providing Internet access to government information and electronic commerce services through post offices. The U.S. provides discounted Internet access to schools, libraries, and rural health centers (see below).

5.3. Incentive-based Subsidies

A policy of providing discounts or other funding to end users may be more effective as an incentive to provide broadband services rather than the more traditional policy of subsidizing the carrier of last resort. One approach may be to provide “broadband vouchers” for use in low income and/or sparsely populated areas.[11] A variation of this model has been successfully used in the U.S., where schools, libraries and rural health centers are empowered through the E-rate subsidy established by the Telecommunications Act of 1996 to solicit bids for services from operators. The Telecommunications Act mandated policies designed to foster access to Aadvanced services@ for schools, libraries, and rural health care facilities through a Universal Service Fund (USF). The USF was originally established to make local telephone service available to all Americans at reasonable rates; the definition of universal service was expanded by the Act, so that subsidies of up to 90 percent are available for school and library access, while

rural health care centers may obtain subsidies to reduce their telecommunications charges to comparable urban rates.

An important features of the E-rate program is that the subsidy goes to the school (or library or rural health center) and not the phone company. The school is then able to post its requirements on a website and take bids for services. This encourages incumbent and new service providers to extend their services, and provides “anchor tenants” in rural or disadvantaged communities. And it empowers the schools, rather than leaving them begging for service.

6. Conclusion: Universal Access to the Internet

Demand for Internet access in Africa is bound to grow, as the Internet becomes an indispensable resource for information, commerce, and entertainment, and with the introduction of online multimedia content. Thus there will be requirements for broadband access to the Internet for schools, government agencies, businesses and organizations, and through community access points for individual residents. The above lessons from the wireless explosion and incentive-based investment strategies and subsidies should help to extend Internet access in African communities.

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[1] Goldstein, Harry. "Surf Africa." *IEEE Spectrum Online,* January 30, 2004.

[2] ITU, *World Telecommunication Development Report,* Geneva, 1998, p. 50.

[3] Kayani, Rogati and Andrew Dymond. *Options for Rural Telecommunications Development.* Washington, DC: World Bank, 1999, p. xviii.

[4] ITU, *World Telecommunication Development Report,* 1998, p. 35.

[5] For example, Hong Kong and Singapore.

[6] ITU, *World Telecommunication Development Report,* 1998, pp. 77-78.

[7] ITU, *World Telecommunication Development Report,* 1998, p. 77.

[8] Personal communication, July 1997.

[9] Petzinger, Jr., Thomas. "Monique Maddy uses Wireless Pay Phones to Battle Poverty." *Wall Street Journal,* September 25, 1998, p. B1.

[10] See http://www.library.state.ak.us/usf/waiver.cfm

[11] Karen Kornbluh, "Fill Potholes on America's Info Highway", *Los Angeles Times*, June 13, 2002