Editor: Stephen Ruth • ruth@gmu.edu

Is There a Digital Divide? Check the Numbers

Stephen Ruth • *George Mason University*

The spectacular, and global, increase of cell phone usage and infrastructure seems to promise dramatic improvements in health and education, as well as other benefits, but there is a problem: developed nations have low-cost, dependable service, while many poorer regions and nations are unable to provide affordable, dependable wireless access to their citizens.

Broadband is everywhere; 6 billion cell phones are in use worldwide, with prices dropping in many places — it sounds like a telecom futurist's dream come true. But behind this apparently good news is a more complex reality — the persistence of serious inequities in deployment and utilization, sometimes called the "digital divide." Here, I offer insights, positive and negative, on the digital divide and demonstrate a successful wireless system deployment in an unexpected area — the high mountains of Nepal.

The digital divide has many definitions, but the one I use here is the measurable differences in capacity, utilization, or affordability of telecommunications services within or between countries or regions. Google CEO Eric Schmidt has mentioned the importance of avoiding a "digital caste system."[1] Moreover, the divide isn't present only in developing countries; the topic is as important in the US as in Africa, South America, and Asia. For example, some regions in the US lack wireless access, and the Federal Communications Commission (FCC) is trying to close the gap. Chairman Julius Genachowski has stressed the commission's significantly increasing investment in rural 3G and 4G services through a planned $500 million annual allocation to the Mobility Fund (www.fcc.gov/document/chairman-genachowskis-remarks-gsma-mobile-world-congress). The National Broadband Plan has an entire chapter about the seriousness of the "broadband availability gap," especially in rural and less densely populated areas (see www.broadband.gov/download-plan/).

Public- and private-sector telecom managers and researchers find the ITU's annual report, *Measuring the Information Society*, valuable, because it presents broad trends and significant new findings about global connectivity. The most recent version summarizes notable changes in speed, availability, and sophistication of telecommunications services for 162 countries and presents a wide variety of statistics on regions as well as individual nations.[2] However, its content is also cautionary with respect to cost and availability disparities, noting that while in developed nations, broadband costs are a small percent of household expenses, in poorer countries, the average cost can be prohibitive. As the report says, "A digital divide is unfolding between those with high speed/capacity/quality access (as is the case in many high-income countries) and those with lower speed/capacity/quality access (as is the case in many low-income countries)."[2]

Development Index and Price Basket

Two elements of the report are particularly valuable in understanding the policy challenges associated with the digital divide: the ICT Development Index (IDI) and the ICT Price Basket (IPB). IDI is an aggregate measure consisting

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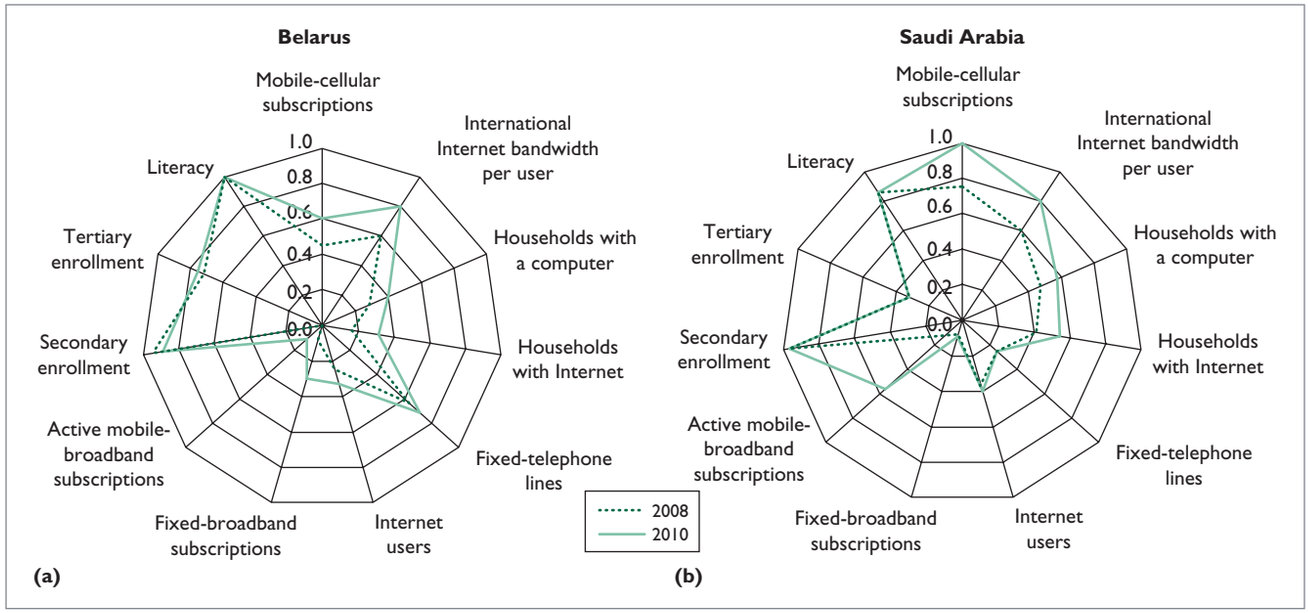

Figure 1. ICT development index component spider diagram. Shown here are access, use, and skills indicators for (a) Belarus and (b) Saudi Arabia. (Figure courtesy of the ITU, from its report Measuring the Information Society 2011;[2] *reprinted with permission.)*

of 11 indicators representing three categories:

- *access* — fixed-telephone lines per 100 inhabitants, mobile-cellular telephone subscriptions per 100 inhabitants, international Internet bandwidth per user, percentage of households with a computer, and percentage of households with Internet access;
- *use* — percentage of individuals using the Internet, fixed (wired)-broadband Internet subscriptions per 100 inhabitants, and active mobile-broadband subscriptions per 100 inhabitants; and
- *skills* — adult literacy rate, secondary gross enrollment ratio, and tertiary gross enrollment ratio.

Figures 1a and 1b show typical IDI spider diagrams for two of the nations covered in the report, Belarus and Saudi Arabia.

Not surprisingly, the IDI is highly correlated with national measures of wealth, education, and well-being. For developing nations, it's also a useful indicator of the countries that are improving in telecommunications the most and the least each year. For example, the top 10 nations in terms of improvement in IDI percentage from 2008 to 2010 are developing ones: Armenia, Saudi Arabia, Kenya, Vietnam, Belarus, Azerbaijan, Oman, Morocco, Moldova, and Qatar.[2]

The IPB is particularly valuable because it focuses directly on the fundamental question of affordability of telecommunications services — very different than the IDI's access-use-skills emphasis. The cost of rural wireless is crucial, of course, and the IPB describes worldwide financial trade-offs. Many factors are relevant, such as competition, education, and institutional structure. To describe these differences, the IPB has three constituents and their associated cost statistics: fixed telephone (monthly subscriptions, 30 peak and off-peak local calls), mobile cellular (30 monthly outgoing peak and off-peak calls plus 100 SMS messages), and fixed-broadband Internet (monthly subscription for entry-level plan with 1 Gbyte of download volume).

The IPB calculations show the expected differences between nations and regions, with user costs much lower in developed nations. For example, high-end services for smartphones have better profit margins, so poorer customers are sometimes penalized through lower service levels and increased processing costs. Figure 2 shows aggregate statistics on mobile cellular cost by world region. For Europe and the other developed countries, costs are respectively 1.6 and 2.0 percent of GDP per capita, but for developing countries and Africa, the percentages are 11.4 and 24.6 in PPP (purchasing power parity) units.

The chart emphasizes the affordability gap between large geographic regions, but the within-region statistics also disclose haves and have-nots. For example, in Africa, the percentages of people over 16 who own mobile phones are 94 (Morocco), 93 (Senegal), 77 (Nigeria), and 62 percent (South Africa) at the highest levels, and 21 (Uganda), 10 (Rwanda), and 3 percent (Ethiopia) at the lowest.[2] Similar within-region affordability differences exist in Asia and South America.

The report's overall findings indicate that we must consider several digital divides, such as gender, developed/less-developed, and urban/rural

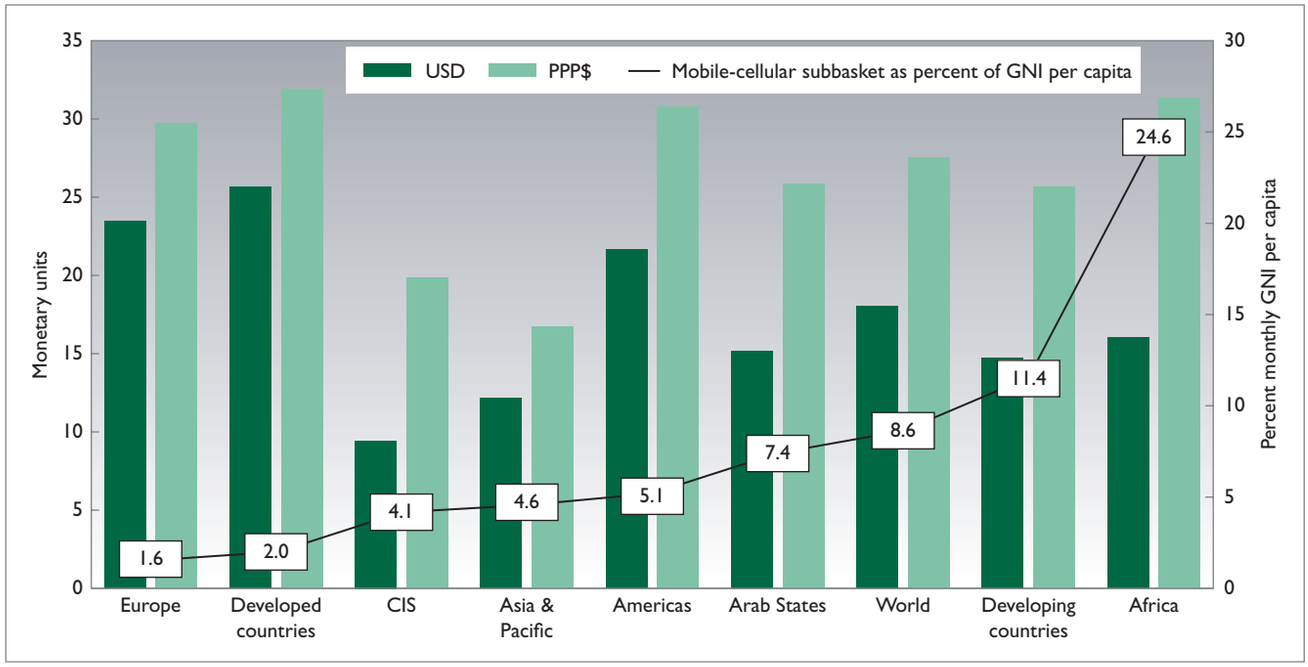

Figure 2. Mobile-cellular subbasket for ICT Price Basket. Shown here are costs by region and level of development. PPP: purchasing power parity; GNI: gross national income. (Figure courtesy of the ITU, from its report Measuring the Information Society 2011;[2] *reprinted with permission.)*

differences and affordability. With respect to gender, women still lag men in access and use — only New Zealand and Thailand have more women than men on the Internet. And this difference isn't skewed toward wealthy or poor countries. Developed nations have a significant advantage in infrastructure, variety of services offered, education, stability, democracy, and so on — but because mobile cellular is becoming both cheaper and easier to install, that difference could shrink over time. As to urban/rural differences, no matter what the level of a nation's development, cities fare better than rural areas in broadband service deployment, due to their proximity to wealth centers, technology hubs, services, and so on; yet with 6 billion cell phones in use worldwide, rural service is improving. As mentioned, affordability is the most significant challenge, but the ITU report points to some hopeful signs: increased use of low-cost Internet service for a wide variety of applications such as mail, health and education, infrastructure improvements in some regions, and increased use of cybercafés.

An Example of Success: Nepal Wireless

Despite the challenges to rural broadband deployment, many examples exist of developing nations succeeding under difficult conditions.[3] Nepal Wireless (www.nepalwireless.net), a not-for-profit ISP in the mountainous rural regions of central Nepal, is an exemplary case of surmounting challenges to broadband deployment in inhospitable conditions. Starting in the tiny Nangi village high in the area bounded by the 26-thousand-foot Annapurna range, Mahabir Pun, team leader of the Nepal Wireless Network Project (see www.globality-gmu.net/archives/2965), has spent the past decade assembling financial and government support for his vision of rural connectivity. Pun's approach is to distribute the wireless signal from larger cities such as Pokhara and Katmandu to relay stations connected through a Wi-Fi network. Wi-Fi isn't noted for facilitating long-distance connections, but the relay stations achieved sufficient signal strength at distances of more than 20 miles. Nepal Wireless managed last-mile connections from village to village using a variety of manufacturers' products depending on the situation, including smartBridges, EnGenius, Ubiquity, Deliberant, Mikrotik, and TP Link. Once the project achieved momentum, it began to grow significantly (see Table 1), so that today, it connects more than 100 villages and many schools and hospitals, delivering services as varied as telemedicine, e-teaching, local e-commerce (buying and selling of yaks and other farm animals, for example), tourist services, and many others.

The challenges weren't only technical and geographical. During the period of Nepal Wireless's growth to the status of government-approved ISP, other difficulties arose: payment demands from Maoist guerillas, equipment import restrictions, impossibly high initial government tariffs, instability due to several government coups, and many others. Yet the growth continued, and gradually Nepal

Table 1. Progress of the Nepal Wireless Networking Project from 2002 to 2011.

Entities connected	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Villages	1	2	5	13	22	35	60	82	102	122
Schools	1	2	5	8	19	24	40	58	74	80
Clinics	0	0	0	2	3	5	5	6	8	8

Wireless began to receive international notice in outlets such as *PC Magazine*, BBC News, and ABC News. One British news story described a member of the Scottish Parliament complaining that Nangi village had better connectivity than the Scottish highlands.[4] Nepal still falls at the middle or lower end of the various ITU indicators, but Nepal Wireless could be the spark that leads to long-term growth. In 2008, Pun was awarded the Magsaysay Prize for Community Development, an award dubbed the "Asian Nobel Prize" in the press, for his pioneering work on Nepal Wireless.

Tighter Internet Controls on the Horizon?

A new challenge might eventually complicate the gradual improvements in rural wireless Internet. For more than two decades, a treaty has been in force aimed at liberalizing international telecommunications. In 1988, 114 nations agreed to insulate the Internet from economic and technical regulation. Recently, though, Russia, China, and other countries have requested that the UN set up a process to reduce the scope of the 1988 agreement, specifically targeting such goals as placing cybersecurity and data privacy under international control, modifying currently liberal tariff-swapping practices, setting up "per-click" rules for some Web destinations, placing the ICANN organization under ITU (UN) control, regulating international roaming rates, and so on. Russia, China, Uzbekistan, and Tajikistan introduced a proposal for a "code of conduct" aimed at improving telecommunications-related security. Similar suggestions from India, Brazil, and other nations were aimed at internationalizing Internet governance and making it less US-centric (see http://tinyurl.com/5rnh7pj).

Several of the key Internet governance groups are headquartered in the US, including the Internet Society, ICANN, and the IETF. Even though both UN Secretary General Ban Ki Moon and ITU Secretary-General Hamadoun Touré have called for greater empowerment of the poor in Internet deployment — "building a virtuous broadband development dynamic"[5] — the current proposal appears to be considerably at variance with that expressed UN goal. These possible Internet governance changes, which will be discussed throughout the year and decided at a meeting in Dubai in December, are very controversial, particularly in the US (see www.businessagility.com/author.asp?section_id=1671&doc_id=241612). FCC commissioner Robert McDowell had this comment: "A top-down, centralized, international regulatory overlay is antithetical to the architecture of the Net, which is a global network of networks without borders."[6]

The ITU report has optimistic news, however, especially the significant reduction in average prices for wireless services in some sectors, which could eventually reduce the digital divide. But subscribers in most of the poorer nations still encounter serious affordability problems — despite the great potential of Internet-based services for education, health, agriculture, and so on — and also possibly threats to the breadth and availability of services. Perhaps the Nepal Wireless example will be part of the answer to the digital divide — simple, reliable, sustainable service using basic technology building blocks incrementally.

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Stephen Ruth is a professor of public policy at George Mason University. He manages a grant-supported IT research center, the International Center for Applied Studies in Information Technology (ICASIT), which studies contemporary technology deployment issues and, most recently, telework, e-learning, and green IT comparisons between the public and private sectors. Contact him at ruth@gmu.edu.