Policy

Decentralizing the Mobile Phone: A Second ICT4D Revolution?

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Development researchers are starting to back compelling anecdotes of the mobile phones' impact on development with estimates of the economic impact of widespread voice and data communication. Jensen (2007) was able to document a small, but significant, increase in fishermen's incomes after mobile phone service came to communities in Kerala, India, as well as positive health and educational impacts and less waste of resources. Waverman (2005) of the London Business School sees a strong correlation between mobile phone penetration and economic growth, suggesting that a developing nation with 20% teledensity would see an annual GDP per capita growth rate 0.6% higher than a comparable nation with 10% teledensity.

The rise of the mobile phone has challenged the predictions that many information and communication technology for development (ICT4D) specialists offered about information in the developing world. Instead of embracing community solutions that offered shared access to information, many poor people have been willing to pay large sums (as Song [2009] and others have documented, sometimes more than 50% of their disposable income) for personal access to communication tools. Presented with a model that extends connectivity into many poor communities without government subsidy, often turning a profit (and thus being sustainable), the development community is rightly looking for ways to build tools that leverage these platforms to promote economic and community development.

The rise of mobile telephony in the developing world is the most believable sort of revolution: one that pays for itself. Previous attempts to put communication tools in the hands of the poor, through community radio stations and subsidized telecenters, required large, ongoing investments by government or aid agencies simply to maintain operation.

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Microfinance—perhaps the most celebrated innovation in profit-oriented development—has not been widely adopted by commercial actors, as profit margins are disappointingly slim, even with the high interest rates charged to borrowers. A USAID study of a leading commercial microfinance institution in Bangladesh sees profit margins on microloans that barely exceed operating costs (Curran et al., 2005), and AusAID-supported research suggests that tight margins and high operating expenses mean that commercial banks expand into microfinance primarily when required to do so by government regulators (Goodwin-Groen, 1998).

By contrast, Kenyan mobile operator Safaricom reported 40% EBITDA (earnings before interest, taxes, depreciation, and amortization) profits in 2008 on nearly US\$1 billion in revenue. The attractive profit margins mean that mobile phone networks in developing nations are being built by multinational corporations seeking revenue, allowing aid and development agencies to focus on tools and services for the poor built atop these networks. This synergy leads thinkers like Rohit Singh (2009) to declare the spread of mobile phones for both development and profit goals to be a win-win proposition.

While we are wise to embrace the successes of the mobile phone platform, we need to think carefully about the implications of a substantially mobile-based communications future in the developing world. While the economic benefits of mobile phones and their accessibility for large segments of a developing world population are extremely encouraging, the mobile phone may have weaknesses as a platform for activism and political speech, as well as for future technical innovation.

Much of the thinking about ICT4D has focused on the benefits of the Internet—an open, decentralized platform that differs from mobile phone networks in key ways. The Internet is a largely decentralized network, while mobile phone networks tend to have central points of control. Mobile networks tend to be less competitive, less generative, and less protective of privacy than the Internet. As a result, it's unclear that some of the most promising emergent behaviors we've celebrated on the Internet can be easily replicated in a centrally controlled, mobile-dominated communications world.

Limited Competition

When mobile phone companies began operating in the developing world, they generally brought muchneeded competition to monopoly telephony markets. In many cases, monopoly providers were government owned, and they provided low-quality service at high rates, focusing more on providing patronage jobs than customer service. Frew Amare Gebreab (2002), writing for the World Bank, found that government monopoly providers who introduced mobile services did not see major growth in teledensity, while privatized monopoly providers and competitive markets saw explosive teledensity growth.

The most competitive markets have seen three or more mobile operators jockeying for position. This competition, combined with innovative payment systems introduced by wireless operators, made telephony accessible to more users, rapidly outpacing landline teledensity. But many markets have not experienced the continual, downward price pressure that one might expect from competition. Prices have stabilized at rates that are affordable for middleclass consumers, but they remain exorbitant for poorer users. Alison Gillwald and Christoph Stork (2008) find that spending on mobile telephony exceeds 35% of disposable income in several nations, and exceeds 50% in some fast-growing markets (Kenya, Nigeria, Rwanda, Zambia). At the same time, profit margins are high for many operators.

Most countries have chosen to issue only a limited number of GSM spectrum licenses, an essential precondition for new market entrants to compete with established entities. There are technical reasons to limit deployment, but governments have also discovered that scarcity increases the price of these licenses, the revenue of which supports government operations. By contrast, many developing nations use a less restrictive system to license Internet service providers; those less restrictive markets tend to be significantly more competitive (Wallsten, 2005), and there is evidence that prices decrease as costs of Internet bandwidth decrease.

The open, innovative environment of the Internet has produced numerous businesses that provide useful content and services to users at low or zero price points. The competitive online environment

provides strong negative price pressure, as a provider is always subject to a competitor who will offer a similar service for free, supported by advertising. It's unlikely that this dynamic will prevail in a mobile phone market, as competition is limited by licensing, and operators need to cover substantial operating and licensing costs. Instead, mobile phone markets likely require regulatory intervention to prevent price-fixing and collusion among a small number of competitive providers.

Less Generative

Jonathan Zittrain (2008) argues that much of the success of the Internet comes from its "generative" capacity. It's possible for a software developer to create a novel application, distribute it online, and create functionality that's never existed before. Zittrain offers Skype as an example, an application that's become increasingly popular in developing nations for very low-cost voice communications. Internet-linked personal computers are generative because a developer does not need to ask permission from a network owner before creating a new service, and users can decide whether or not to try the application.

It's much harder to create novel functionality on a mobile phone network. Truly revolutionary applications like mobile money transfer have generally been deployed in tight collaboration with network operators—M-PESA was not an independent startup, but an initiative of Vodaphone/Safaricom, with further support from IBM and DFID. It's unclear whether Safaricom would allow a rival mobile banking system to develop expanded functionality and deploy on the same network, or whether regulators would permit all novel financial services that ride atop a mobile phone platform.

Mobile applications in the developing world generally focus on providing services via short message services (SMS). This is due in part to the need to provide services on a wide range of devices, and in part to the comparative ease of deploying SMS gateways without cooperation from network operators. Voice-based services would often be a better technology for the needs of low-literacy users, but IVR (interactive voice response) is difficult to deploy at scale without co-locating equipment with network operators. The developers of Ushahidi, a crisis-

mapping platform that allows citizens to report violence or election fraud via SMS, report that they were able to develop the first version of their Web and SMS application in less time than it took Kenyan mobile phone operators to grant them an SMS shortcode. Unlike the Internet's decentralized DNS system, assignment of shortcodes is generally centrally controlled, giving operators control over the promotion of platforms by refusing to issue easy-to-remember codes. (Imagine if Skype had needed permission from AT&T or France Telecom to register skype.com!)

More Tightly Controlled

Because mobile phone networks are centralized, they are more easily monitored and controlled by governments than the Internet. Filtering and censoring the Internet has proven to be a frustrating catand-mouse game for both governments and activists. Despite millions of dollars spent to filter the Chinese Internet, hundreds of thousands of Chinese users access and publish banned content. By contrast, Ethiopia simply turned off SMS services in June 2005 over fears that students were using the technology to organize protests against rigged elections—services remained turned off for more than two years.

SMS was used in the wake of Kenya's 2007 presidential and parliamentary elections, both to organize political protests and to incite ethnic violence. Two days after the electoral commission declared the incumbent the winner of the presidential election, Kenyan mobile phone companies blocked services that could be used to send large volumes of SMS messages. This may have been an effective measure to limit the incitement of violence, but it also cost the opposition one of its most valuable organizing tools. With close cooperation of mobile phone operators, the Kenyan unity government was able to compile a list of 1,700 phone users who had authored or forwarded incendiary messages, and was considering prosecution of those users.

The perception that mobile phone networks can be centrally monitored and controlled has a chilling effect on the development and efficacy of some critical tools and applications. Activists in Russia have proposed a system to combat police corruption by encouraging drivers to report requests for bribes.

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Research suggested that drivers were unlikely to use the system, either by voice or SMS, because they believed the government monitored mobile phone networks closely and would persecute users of the system.

While the Internet wasn't designed to provide strong anonymity, human rights defenders have embraced the platform because only modest technical effort is required to disguise an individual's identity. This is much harder to accomplish with mobile phone networks, which record a phone's hardware signature and SIM. As governments begin registering SIM cards as a way to track criminal and terrorist activity, anonymous publishing or reporting via mobile phones grows far more difficult.

Steps Forward

Mobile phones offer pervasive access to information on networks built by commercial providers, funded by middle-class and poor users. For everyone engaged in empowering the poor, mobile phones are a critical platform for deploying tools and services. But these platforms have troublesome traits cost, control, and barriers to innovation. They challenge those of us who are excited about technology and development to recognize the unique opportunities and tensions presented by any combination of technologies and social, governmental, and economic structures. Research and policy interventions concerned with the future of mobile phones as tools for development should consider how technological, policy, and economic interventions could build a future where information services delivered by mobile phones are more generative, competitive, and protective of privacy and free speech.

Work by Gillwald and Stork (2008), Song (2009), and others suggests the possibility of regulating mobile phone pricing with an eye toward affordability for poorer consumers. Other regulatory approaches could focus on increasing choice and competition by licensing more carriers and aggressively discouraging price-fixing. Perhaps most promising for the concerns expressed here would be a regulatory structure that encouraged openness of mobile networks to innovation and development of third-party applications and services, preventing mobile operators from vetoing innovative services unless they could demonstrate technical infeasibility. A licensing structure might follow the pattern of

telecom unbundling and the establishment of competitive local exchange carriers that took place in the United States, allowing third parties to sell value-added services on mobile networks and purchase carriage from mobile operators at fixed rates. The effectiveness of any of these regulatory interventions is an open question—it's unclear what strategies would best contribute to a mobile phone ecosystem where prices are affordable, networks are open to innovation, and companies are still willing to invest in expanding networks, or whether any one strategy would work across different markets.

Protecting freedom of speech in a mobile phone environment is likely to be an uphill battle against prevailing norms. Inspired by the Spanish government's success in identifying the Madrid train bombers by tracing mobile phone ownership, governments are working hard to eliminate anonymity in mobile phone networks, requiring identification to purchase SIM cards, which enables law enforcement to connect phone calls or text messages to individuals. States need to carefully weigh legitimate concerns about criminal and terrorist activity against the likelihood that they will eliminate the possibility of anonymous speech in a digital environment. If democratic nations choose a perception of security over a protection of speech rights, it's almost certain that authoritarian states will follow suit. While there is opportunity to research the connection between lessened anonymity and criminal behavior (which might reveal that such measures enhance security less than we perceive), there's a strong need for policy arguments that defend the importance of anonymous speech as an essential component of a free society.

One possible path that could lead to more competition, more open innovation, and more anonymity is the development of decentralized alternatives to mobile phone networks, one that combines some of the most appealing features of Internet and mobile technology platforms. Communities in the United States and Europe have deployed mesh networks as a way of building ad hoc, scalable, expandable network access while minimizing central points of failure or control. The One Laptop Per Child (OLPC) project implemented mesh networking in its XO laptop as a way to allow communities to provide local connectivity in areas where Internet access was expensive or unavailable. As more mobile handsets are supporting Wi-Fi and other

data-networking protocols, it's becoming possible to design and deploy a mobile phone network that runs on a mesh Wi-Fi network, not on centrally located GSM towers.

While a mobile phone network that ran on distributed infrastructure and lacked central ownership would likely address the concerns raised in this article about centralized systems, it's unclear that such a system would be adopted as rapidly as traditional GSM phones have spread in the developing world. In that sense, an experiment in building a decentralized phone system would be an elegant test case for Benkler's theories on the power of communities to cooperatively provide collective goods (2007). A decentralized mobile phone network could be more competitive, generative, and useful for human rights activists—what would be truly revolutionary would be if it also paid for itself.

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