

## Research Article

# Mobile Phones and Expanding Human Capabilities<sup>1</sup>

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## Introduction

The explosion of mobile phones and their impacts on human well-being have been a central focus of ICT4D research of late (Donner, 2008). This prominence is deserved and should continue in the foreseeable future. This article argues that mobile phones constitute the basis for one of the greatest expansions of human capabilities in known history, and in a remarkably short timeframe. Furthermore, this expansion is expected to continue apace and, more likely, to accelerate. In particular, this article applies Amartya Sen's capability approach (1999) which highlights expansions of freedoms in areas such as social and governance networks that encourage us to look beyond economic measures of development.

The paper advances with two strands. It begins by conceptually linking mobile phones and the expansion of human capabilities. It then presents evidence that mobiles have been the platform for a uniquely massive and multidimensional enhancement of capabilities in developing countries. Following this, the paper reflects on some policy issues and implications, particularly with respect to regulatory reform, universal access, and the uses of mobile communication in increasing non-economic capabilities and freedoms.

## Mobile Phones and Capabilities

This paper takes Sen's capability approach (CA) as a starting point (Deneulin & Shahani, 2009; Sen, 1999). Sen's CA is a normative framework for evaluating human development (Robeyns, 2005) that views human development as the "process of expanding the real freedoms that people enjoy" (Sen, 1999, p. 1). Sen argues that the evaluation space for human development should be individuals' and groups' capability sets; that is, the freedom people have to be and to do (their functionings) those things that they have reason to value. The CA contrasts with welfare economic models that focus on income or commodities, and with utilitarian models that focus on desire-fulfillment (Clark, 2005; Robeyns, 2005). The CA is also appreciatively broader (multidimensional) than familiar economic models of development; it includes a wide range of dimensions of human and social life, including the political, social, cultural, and ethical alongside the economic. The concept of capability is also relational; that is, an individual's set of capabilities is a function of both his or her own capacities and relative position in society, which determines that individual's access to resources, both human and material (Smith & Seward, 2009).

A few authors have begun to make theoretical links between ICTs and

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1. The authors would like to express their appreciation to the various reviewers who provided some excellent insights.

their interaction with capabilities (e.g., Alampay, 2006; Gigler, 2004; Johnstone, 2007; Kleine, 2010; Zheng, 2009).<sup>2</sup> This link is most commonly made by viewing mobiles and the mobile network as a tool in one's context that provides access to more resources than were previously available. Mobiles and their networks alter users' capability sets through the changing of their positions in relation to important development resources in at least two ways: 1) increased access to timely and/or relevant **information**, and 2) expanded possibilities for **connectedness** between people.

Information is theorized to be a key input into many developmental activities (Benkler, 2006; Mchombu, 2003; Menou, 1993). The mobile phone allows for, among other things, location-independent sending and receiving of asynchronous and synchronous information. The increase in the ability to cheaply send and receive available relevant and timely information alters individuals' access to a key developmental input, thus removing one of the barriers to expanded capabilities. For the most part, the majority of the information available over mobile phones in the developing context has been limited to information that can be simply displayed or communicated by voice, such as personal, health, weather, and market or financial information, although it is expanding to other domains, such as education.

Mobiles, and their corresponding infrastructure, also provide the platform for a new level of connectedness both between individuals and between individuals and institutions. This connectedness, and the information-sharing that it entails, provides for a range of functionings that simply were not possible before, or that were possible, but with high to very high transaction costs.<sup>3</sup> We have categorized these functionings into three networking dimensions (note that the order does not suggest importance):

1. Enable or strengthen **social networks**. This is, especially in the rural and poor contexts,

extremely important for well-being/survival/security purposes.

2. Enable or strengthen **economic networks** (e.g., connecting citizens and financial institutions, expanding market boundaries, improving supply chains).
3. Enable or strengthen **governance networks** (e.g., increased access to government services, political mobilization, election monitoring, early warning systems, crisis management, etc.).

It is important to note that the above discussion has focused on the positive capability expansions enabled by mobiles. As with all capabilities, it is certainly not a foregone conclusion that these capabilities will result in their correlated functionings. Also, sometimes, the positive benefits are counterbalanced by the emergence of new behaviors and practices. For example, mobile access may create the "unfreedom" associated with the expectation to always be online. Furthermore, mobiles can also be instruments for the restriction of capabilities. For example, mobile phones have been used to fan and organize civil violence (Goldstein & Rotich, 2008)<sup>4</sup> or to plot terrorist activities.

Our proposition, however, is that, on the whole, the impact has been a huge net positive. As Sen recently argued,

Those [negative] possibilities exist (and there are few social generalizations for which we cannot find any complicated exception whatever, if we work hard on it), but in general, the impact of more telephones is to make things more agreeable and more enabling for others. (2010, p. 2)

While the remainder of the paper focuses on positive capability expansion due to the mobile phone, the negatives should not be dismissed; they are taken up in the section on policy implications.

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2. More recent articles and journals focusing on ICTs and capabilities include (Spence & Smith, 2010) and several articles in *Ethics and Information Technology*, Volume 13, Number 1, March 2011.

3. While this paper does not explicitly address other dimensions of functionings and freedoms, such as the cultural and ethical, it is important to acknowledge them. Liang (2010) argues, for example, that "we also have to recognize that ICT technologies are a serious redistribution of the means of thought and expression" (p. 67). These dimensions were omitted because there is not as much data that has been collected on them.

4. Interestingly, Goldstein and Rotich (2008) also point out that, in the case of Kenya, the many-to-many nature of SMS meant that counter narratives—encouraging civility rather than ethnic division—were also disseminated through the network.

## Evidence of Expanding Capabilities

There has been a massive diffusion of mobiles in the past decade. The worldwide survey done by the International Telecommunication Union (ITU) indicates 4.6 billion mobile phone subscriptions globally in 2009, a figure that is expected to reach 5 billion by the end of 2010 (with a world population of about 6.8 billion).<sup>5</sup> The impacts in terms of new functionalities and capabilities are available to a huge portion of the earth's population. Presented below are research results on the impacts of mobiles, both for the "bottom of the pyramid," and for the social, economic, and governance spheres just noted.

When considering this evidence, there are two important points to keep in mind. First, the benefits of mobile phones might be proportionally greater in resource-constrained settings, e.g., the poor and rural populations (Donner, 2004, 2008; Rangaswamy & Nair, 2010). This is particularly true of extreme poverty that results from isolation (Sachs, 2008). Second, these benefits still do pertain, even for those who are not mobile phone owners and only access mobiles through the sharing of mobile phones or mobile phone kiosks.<sup>6</sup>

Below is a small sample of data for each of the three networking dimensions (social, economic, and governance) that are illustrative of the types of positive changes that are happening.

### Social Networks

Research has illustrated that people in the developing world tend to use mobiles for more social than business interactions (Castells et al., 2007; Souter et al., 2005), although the line between the two is often blurry (Best et al., 2010; Donner, 2004). It is through the strengthening of social networks that, at least in the first wave of mobiles, a majority of the benefit is found for the widest swath of people.

Figures 1a, 1b and 1c illustrate how poor people

value mobile phones in terms of maintaining family and social relations, the ability to act in an emergency, and the efficiency of daily activities. These findings are not surprising, as they match similar benefits accrued to people in Europe (Ling, 2004).

These findings are mirrored in studies in Africa and Latin America (Best et al., 2010; Galperin & Mariscal, 2007). One example of this research that is indicative of the benefits found in a study of four countries in Africa, that the most direct benefits were in terms of savings in time and travel, "but the most important benefit was the ability to communicate and be connected" (Mascarenhas, 2010, p. 40). Importantly, these benefits have been obtained by a large majority of the population. In another study, 91% of respondents in Tanzania and 77% in South Africa called friends and relatives, rather than traveling to see them, and the majority of the respondents in Tanzania and South Africa reported large savings in travel time and travel cost (Samuel, Shah, & Hadingham, 2005).

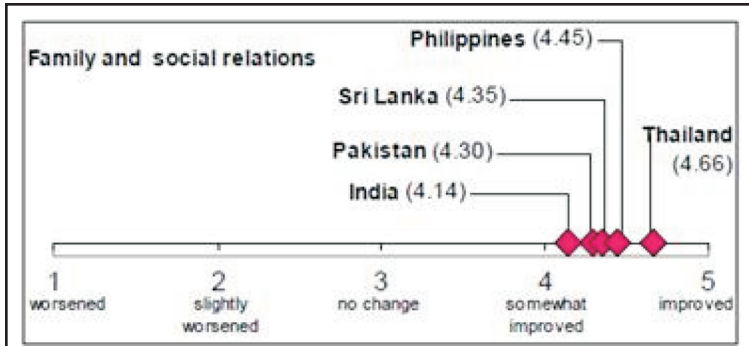
The critical importance of mobiles, as indicated above, is also reflected in the relative amounts that poor people are willing to pay for mobile connections. One review of studies on expenditure patterns of mobile phone users at the bottom of the pyramid in India, Sri Lanka, Brazil, and Argentina found that spending on mobile phones as a percentage of income ranged between 3–8% (Rashid & Elder, 2009).

### Economic Networks

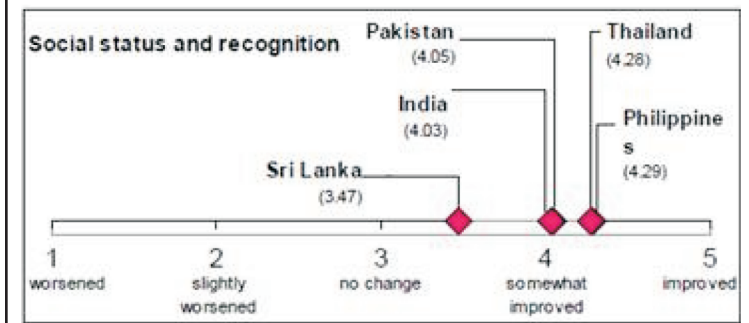
There is a lot of research that illustrates the economic benefits of mobiles (e.g., Aker & Mbiti, 2010; Best et al., 2010; Galperin & Mariscal, 2007; Rangaswamy & Nair, 2010; Samuel et al., 2005). See, for example, Figures 2a and 2b. Interestingly, the economic benefits are generally not perceived to be as great as the social benefits. Given the domi-

5. While the developing countries accounted for around one-quarter of the world's 700 million mobile phones in 2000, by the beginning of 2009, their share had grown to three-quarters of the total, which, by then, had risen to more than 4 billion (The Economist, 2009).

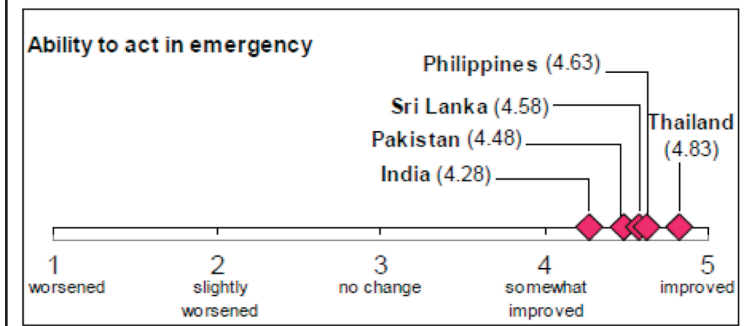
6. Subscription data (5 billion subscriptions) tends to overestimate usage due to some owners having multiple SIM cards, but also to underestimate it even more due to the sharing of phones and sale/purchase of minutes. De Silva and Zainudeen's (2007) data shows mobile usage (in the last three months of their survey) in the base of the pyramid in India, Pakistan, Sri Lanka, Thailand, and the Philippines to be 92–98%. Aker and Mbiti (2010) found that 80% of people surveyed in Kenya reported having access to a mobile through either ownership or sharing. A report by the Business Monitor International estimated that the number of mobile subscribers reached 70% of Ghana's total population in 2010 (Dogbevi, 2010).



a. The impact of direct access to telecom on family and social relations (mean response)



b. The impact of direct access to telecom on social status and recognition (mean response)



c. The impact of direct access to telecom on the ability to communicate in an emergency (mean response)

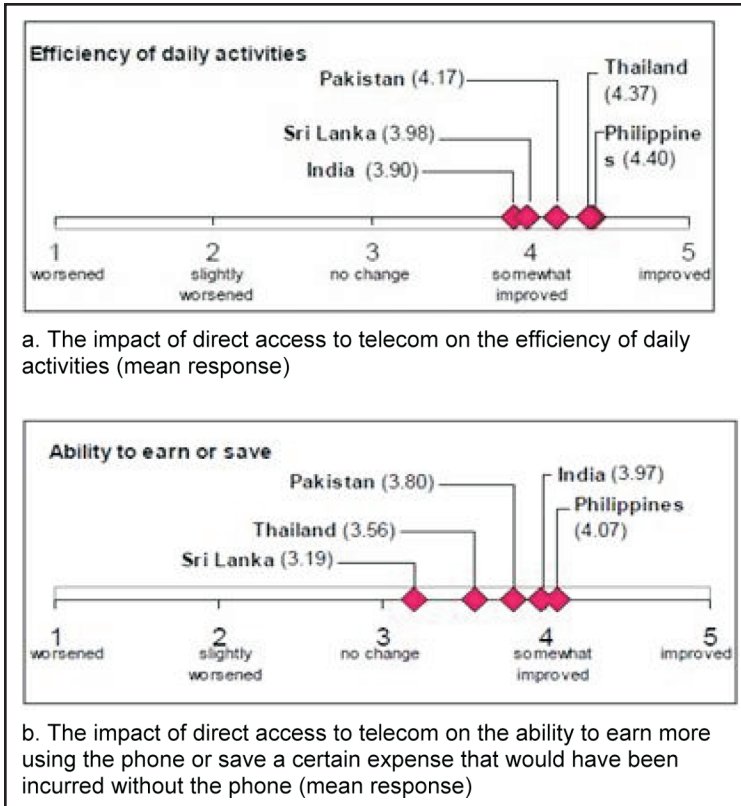
Figures 1a, 1b, and 1c. Perceptions of the Impact of Direct Access to Telecom on Family and Social Relations; Social Status and Recognition; and the Ability to Communicate in an Emergency.

Source: De Silva & Zainudeen (2007, pp. 10–11).

nance of the economic paradigm, there is a tendency to see economic benefits as most important. As mentioned, a strength of the capability approach is that it accords as much importance to social, political, cultural, and ethical freedoms as it does to economic.

Compared to social and emergency benefits (Figures 1a, 1b, and 1c), the efficiency of daily activities is seen as similarly improved, and the ability to earn or save is not perceived to be as strong an impact of mobiles as the social network benefits, though both are positive and significant.

Fundamentally, mobiles 1) greatly reduce the transaction costs associated with markets (e.g., search costs), and 2) expand market boundaries (Aker & Mbiti, 2010; Waverman, Meschi, & Fuss, 2005). According to Waverman et al. (2005), a 1% increase in mobile penetration increases GDP by 0.5–0.6% in low-income countries. Another, more recent Vodafone study in India shows a 1.2% increase in growth rates for every 10% increase in the mobile phone penetration (Kathuria, Uppal, & Mamta, 2009). While mobiles have been linked to macro-level economic gains, case studies provide insight into how these macro-level gains are made (Rashid & Elder, 2009). In particular, a series of studies provide evidence that mobiles can increase market efficiency (Aker & Mbiti, 2010). For example, studying fishing prices on the Kerala coast in India, Jensen (2007) found that the arrival of mobiles brought significant and immediate reductions in the variability



Figures 2a and 2b. Perceptions of the Impact of Direct Access to Telecom on the Efficiency of Daily Activities and the Ability to Earn or Save.

Source: De Silva & Zainudeen (2007, pp. 8–9).

of price and the amount of waste in the fishing system. In Niger, it was found that cell phones reduce grain price dispersion across markets by a minimum of 6.4%, and reduce intra-annual price variation by 10% (Aker, 2008). Studies also illustrate that mobiles can play an essential role in start-ups, particularly in the service sectors, and that they can also help to increase profits (Samuel et al., 2005). Similarly, another study of SMEs (small- and micro-enterprises) in Bombay found that most (male and female) micro-entrepreneurs who used a mobile for

broaden access and be transformational (Porteous & Wishart, 2006).

## Governance Networks

Of the three domains, there is the least evidence to speak to the role of mobiles in the expansion of capabilities in the governance dimension. However, within this dimension, mobiles may prove to be as or even more significant in expanding capabilities and contributing to broader societal-level change. This may reflect the effects over time of widespread

business purposes reported a rise in incomes (Vigneswara Ilavarasan, & Levy, 2010).

Another area of significant impact is through the provision of financial services with the mobile phone. Mobile payment systems are perhaps the most significant example. The SIM card–mobile phone combination has become a vehicle for a whole range of financial transactions, critical for the high proportion of the world's unbanked population that lives in developing countries.<sup>7</sup> The first mobile payments systems started in the first years of this decade (2000s). Early examples in the Philippines (Mendes et al., 2007) and Kenya grew very rapidly. Significant savings are to be found, both in foreign remittances and within-country transfers.<sup>8</sup> While there is little hard evidence yet of unbanked people being served on a large scale by existing m-banking services, in part because most models are very recent, there is reason to believe that m-banking systems have considerable potential to

7. Half the world is unbanked, and nearly 90% of the financially unserved live in Asia, Africa, the Middle East, and Latin America (Financial Access Initiative, 2009).

8. The numbers here are significant: Global foreign remittances now amount to more than US\$400 billion, with another estimated US\$200 billion going unreported, and mobile (SMS-based and voice) transfer systems, both inexpensive and convenient, could save up to \$25 billion in remittance transfer costs annually (N. Spence, 2010; World Bank, 2010).



(mobile) communication and information exchange in developing public debate and informed discourse, needed ingredients for ongoing social choice.

Mobiles have potential as an alternative service delivery channel for government (m-government), with particular relevance for generally isolated populations (Bhatnagar, 2009). M-services are beginning to expand into areas of health and education. For example, in Uganda, health workers using timely two-way electronic information transmission to and from district offices by mobile caching servers to transmit data over the cellular network were able to make 24% savings in spending over the traditional manual data collection and transmission approaches (Rashid & Elder, 2009). Mobile phones, particularly SMS technologies, have been shown in some cases to offer a lot of flexibility and increased learner performance and satisfaction, as was evident in m-learning projects in several countries in Asia (Ramos, 2008; Valk, Rashid, & Elder, 2010).

The data from political mobilization impacts of the mobile phone (and other ICTs) are anecdotal at this point; however, there are some interesting and suggestive anecdotes. Three examples illustrate the potential of these technologies: First is the story of protests in different countries that were sustained and coordinated through SMS—sometimes with significant political impact, as when mobile coordination helped to overthrow the president in the Philippines (Rheingold, 2002), and other times less successfully (Aday et al., 2010). Second is the story told by Sen (2010), where a video of a woman being beaten in the Swat Valley, taken and transmitted by an observer with a mobile phone, had major political impact. As Sen writes, “It is hard to think of another case in which one courageous person and one bit of mobile technology have brought about such a radical change in the participatory politics of a country” (ibid., p. 3).

Finally, there are the more recent examples of the uprisings in Tunisia, Egypt, and other Arab countries. In these scenarios, the potentially repressive regime has greatly reduced control over the flow of information, and this has translated to a direct loss in power. Indeed, an indication of the political power of mobiles is that so many regimes shut down the mobile networks during times of political tension.

We argue that a significant impact of mobiles, and in particular, mobiles enabled with camera or video capacity, is the way they work to increase the general awareness and mindset of people, particularly youth, as well as to enhance the situational awareness of protestors, the international community, the military, and even the authoritarian regime, of the events occurring on the ground.<sup>9</sup> This systemic self-awareness is a critical input that enhances the possibility for self-organizing that can propel and sustain protest movements without a central organizing structure.

Recent innovations combining mobiles and computers have opened up new spaces for citizen participation in other areas of governance, including election monitoring and crisis management. Take the example of Frontline SMS, a free platform that enables large-scale, two-way communication through text messages. This platform has allowed for a variety of activities, such as providing election monitoring (Banks, 2007), enabling health workers to communicate, enhancing the transparency of legal systems, and supporting education and capacity-building initiatives. Similarly, Ushahidi is an open source, crowd-sourcing platform that has been deployed in a variety of development contexts, including violence tracking in Kenya (Goldstein & Rotich, 2008); crisis mapping in Haiti and Chile; vote monitoring in countries like Sudan, Mexico, and India; and tracking medical supplies in Kenya, Uganda, Malawi, and Zambia. Despite the growing prevalence of such activities, their overall impact is not yet well understood.

### The Near Future

While the information in the prior sections represents a significant expansion of potential functionings across a variety of areas of social, political, and economic life, it is only the tip of the iceberg. We expect these expansions to accelerate, perhaps significantly, for some time. Any particular configuration of mobile phones and the networks they run on has a level of “generativity” or “innovative character” (Zittrain, 2008) that determines the potential for, and spread of, innovative uses of the technology. Mobiles have four of the five character-

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9. See, for example, Preston and Stelter (2011) and Beaumont (2011).

istics of high levels of generativity: they are excellent at their task (communication), easy to access, and easy to master, and innovations in the technology are easily transferred to others. However, the relatively basic models of mobiles used in a majority of developing country contexts, and the often rather controlled nature of the infrastructure on which they run, limit the upper end of adaptability (the fifth characteristic).<sup>10</sup> Generativity is a relative concept, and the limitations of the mobile/mobile network combination are particularly evident when compared to the range of innovations that have emerged from the generativity of PCs and open end-to-end Internet architecture (Bar et al., 2008; Benkler, 2010; Zuckerman, 2010). That said, the level of generativity is also relative to one's past access to such resources, and consequently, the mobile phone does represent a substantial leap for many in the world.<sup>11</sup>

However, as Web-based technologies begin to link mobiles and the Internet, and as smartphones with Internet access begin to replace the more simple current models, the level of generativity, and therefore the range of potential innovations, will increase.<sup>12</sup> This pattern can be seen in the example of Frontline SMS. The increased scope for innovations translates into a theoretical expansion of potential functionings through both the ability to innovate and the range of innovations that will emerge. This could easily constitute the second stage of capability expansion based on mobile phone technologies, provided that the necessary enabling conditions are met.

## Policy Issues and Implications

An important and contested question is in what contexts the enabling conditions should include gov-

ernment involvement in terms of support and regulation. This final section starts with a standard "welfare economics + public finance"<sup>13</sup> look at rationales for public involvement, considers the practical application of these principles and additionally considers when the non-economic freedoms or dimensions of well-being are added to the picture.

## Infrastructure and Delivery of Public Services

Mobile phone systems can be seen as both ICT *infrastructure* (shared-use goods) and either providers or *enablers or enhancers for a wide range of private and public goods* and services. The public goods include many collective-benefit services in, for example, education, health, and security.<sup>14</sup>

As *infrastructure*, there are two welfare economics cases for public sector support for mobile network expansion:

- Efficiency gains through investment in the early stages of large-scale infrastructure before economies of scale can be obtained by private investment, thereby jump-starting the process; and
- equity gains through achieving universal service.

In practice, however:

- Jump-starting the development of mobile phone networks has been needed in few cases. The success of mobile voice and text expansion has been based mostly on private investment and an absence of public interference.
- Developing country experience with public attempts at Universal Service Funds and Universal Access (UA) has not been good; only in a few

10. For example, generativity may be constrained by restrictions imposed by cellular carriers, such as the practice of disabling the ability to interact with other networks, restricting users to only the services that the primary network and their affiliate sources supply (Bar et al., 2008).

11. Thanks to Laurent Elder of IDRC for pointing this out.

12. The line between smartphones and tablets looks likely to narrow, with slightly less functionality, but more ease of use. More computer-like phones, things like a tablet plus a netbook in a smartphone size, can't be too far behind.

13. This term is used for a post-WWII body of economic theory that addresses maximizing the material welfare of a society and its individuals—welfare derived from consumption of goods and services—and public finance for public goods and services. Foundations of Economic Analysis by Paul Samuelson and Public Finance in Theory and Practice by Richard A. Musgrave and Peggy B. Musgrave are seminal treatments. Normative welfare economics includes equity and efficiency, as well as the analysis of equity characteristics of public expenditures, taxes, policies, and regulations.

14. Public goods/services include (a) services that are non-excludable and nonrivalrous; e.g., national defense or the justice system and once provided, none can be excluded and one person's benefit does not rival or diminish others and

cases have the funds been spent, and spent well.<sup>15</sup>

As *service enablers* and *facilitators*, mobiles also help to generate *collective-benefit* uses and services in health, education, social security, political and social mobilization, and human development. Benefits go to many more people than the direct individual consumer. The welfare economics cases for public investment and involvement in collective-benefit goods are also well known:

- Efficiency gains, through increased resource allocation to these e-services to capture their collective benefits; and
- equity via redistribution through service provision favoring the least advantaged.

In practice:

- Most governments are engaged in improving the delivery of education, health, and other public services through investments in e-services, including mobile-phone-based services. These involve a wide range of investments in facilities and human capacities in both service supply and demand/use. Public investment in mobile phone networks and access comes mostly as a byproduct of social services investments that use mobiles to improve service delivery.
- Most governments do make efforts to favor poor people in public service and e-service provision. This in turn adds to the pressure for universal service.

### Delivery of Non-Economic Benefits (Capabilities and Freedoms)

In the social and governance examples above, as in the economic, there is an element of collective-benefits rising with network size; i.e., the “significant positive network externalities associated with communication” (Malik, 2008).<sup>16</sup> However, do all of these qualify as collective-benefits? While social activities (e.g., maintaining family relations) may primarily benefit individuals or small groups, there appears to be more collective benefit

in governance-improving systems enabled by mobiles (e.g., early warning or transparency/accountability mechanisms). In principle, there is a case for governments to invest in such governance-improving mechanisms, and mobile networks to the extent that they are essential enablers of these systems.

In practice, however, there are a number of difficulties and obstacles to the provision of the right kinds of government support for these goods. One challenge is to establish good ICT regulation and taxation/expenditure, including universal service obligation (USO) management. Depending on the context, however, doing so is not necessarily straightforward:

- There has been much regulatory attention and improvement over the past decade to the regulation and competition for cost reduction and both market and content openness. However, experts warn that there are significant forces emerging that are pushing in the opposite direction (Melody, 2010).
- As mentioned above, developing country experience with universal access attempts has not been good, as it faces significant challenges. The lesson here is that “the government should try to correct a market failure only when the risks of ‘government failure’ are low” (Malik, 2008).
- Samarajiva (2009) and others argue that many governments tax mobile usage more heavily than other goods, seeing the sector as a cash cow, and that low or no taxes provide a better policy target for advancing universal services in the many countries where public management of an efficient USO mechanism is not possible. Further research on taxation and incidence/impact in the mobile sector would appear valuable, along with the continuing search for better universal service funds and other mechanisms.

Finally, governments seldom invest in mobile networks and use for more political reasons. One reason is that governments tend implicitly to assume

(b) services that have positive externalities in consumption; e.g., health and education, when one person is healthier or better educated from these services, others benefit. The focus here is on the latter: collective benefit services.

15. See also Alampay (2006), Malik (2008), and Samarajiva (2009).

16. While differentiated here from collective-benefit public services (education, health), there is an element of collective benefit, or externality, in network expansion. One person's benefit (from the network) rises at no cost to the individual when other people and organizations (that they interact with) are also accessible.



that the social return to such investments is zero (M. Spence, 2010). A second reason is that investments in mobile networks might run counter to the government's interests as they may actually enhance the political capabilities and freedoms in the society, acting as an instrument of liberation that ultimately threatens the government itself (Sen, 2010).<sup>17</sup>

## Political Control and Manipulation

It may be the case that there are also network externalities in terms of another aspect of openness, in addition to economic/competition openness, i.e., "political" control and manipulation ("political" meaning non-economic—political, religious, social, cultural). Even large, low-cost networks won't serve early warning or transparency or political participation initiatives if not allowed to. In some countries, political control may be just the other side of the coin of poor economic management. But this is not always the case; political repression is certainly not confined to inefficient regimes.

In this context, there are a variety of factors that shape the relative amenability of technology platforms to manipulation and control. Compared to a PC-based Internet network, mobile devices exist in an ecosystem of infrastructure, devices, and software that is more easily controlled by the operators (be they government or private corporations) (Benkler, 2010). Other research argues that a critical mass of users of the technology platform (Palfrey, Etling, & Faris, 2009) as the determining factor for the likelihood of closure and manipulation of the infrastructure. It is clear that there is need for further research on mobiles and political freedoms.

## Conclusion

This article argues that mobiles are making substantial contributions to capabilities and freedoms in economic, social, and governance spheres, in particular. To continue and expand this trend, the basic "how-to" is known in terms of regulation, public investment, public subsidy, and public commitment. Implementation, however, is easier said than done. The resistance, whether it is to universal service in basic mobiles or to "enhance the battle for freedom

and against the viability of repressive regimes" (Sen, 2010), comes primarily from vested political and economic interests, and secondarily through a simple lack of capacities and of awareness in many governments of the collective benefits. The battle for inclusion is no different for mobile communication than for ICTs in general, *but the general battle may increasingly hinge on mobile and other communication and information networks being opened and kept open.* ■

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17. For examples of the use of the Internet and social networking sites for both political activism and political control, see Palfrey et al., 2009. *The Arab uprisings, as sketched above, have been a laboratory for the many ways in which mobiles and ICTs impact political freedoms.*

## MOBILE PHONES AND EXPANDING HUMAN CAPABILITIES

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## MOBILE PHONES AND EXPANDING HUMAN CAPABILITIES

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