

Helpdesk Research Report: Impact of telecommunications reform on service delivery

Date: 18.05.12

Query: Please identify, review and synthesise literature on international experience in telecommunications reform contributing to service delivery and the potential add on services for service delivery in fragile and weak states. Areas of interest are: what is available, extent of adoption, practical challenges for implementation, and evidence of sustainable improvements in service delivery.

Purpose: to inform AusAID's thinking in this area.

Enquirer: Samantha Bowman, AusAID Samantha.Bowman@ausaid.gov.au

Author: Claire Mcloughlin, GSDRC claire@gsdrc.org

Contents

- 1. Overview of main findings
- 2. Potential benefits of telecommunications for service delivery
- 3. Practical challenges in implementation
- 4. Sources

1. Overview of main findings

Telecommunications have been shown to have a range of direct, indirect and intangible benefits on development and poverty reduction goals (Bhavnani et al, 2008). This report focuses specifically on the potential applications and impact of telecommunications in the area of service delivery. It identifies a range of ways in which telecommunications have been used in both the productive (e.g. agriculture, financial services) and social (e.g. health, education, water) sectors¹. Where the literature allows, the report includes examples of how telecommunications reform has enabled better service outcomes in fragile and conflict-affected states, and some of the challenges of implementation in these types of environments.

¹ It may be possible to produce more in-depth reports on the impact of telecommunications in some of these sectors.

The literature on telecommunications reform in developing countries is limited in several ways. First, though a strict definition of telecommunications would encompass a variety of ways of transmitting information via a wired or wireless network (including mobile and land line telephones, internet and radio), the vast majority of recent policy literature has been primarily concerned with the mobile phone sector. Second, it is notable that the literature is unevenly focused on the health and agriculture sectors, and there is relatively little evidence of the effects of telecommunications on education, or water and sanitation. Third, while there are a growing number of illustrative case studies indicating the potential impact of telecommunications on service delivery, there are very few examples from so-called fragile states. In general, there is a paucity of literature addressing the particular challenges that might be encountered when using telecommunications to enhance service delivery in highly political settings. Finally, while illustrative case study examples of impact are available. telecommunications for service delivery is a relatively new area, and many interventions to date have taken the form of pilot initiatives. Evidence of their impact often tends to be anecdotal (Aker and Mbiti, 2010). This has led some experts to advocate for more rigorous evaluations to assess the cost-effectiveness and impact of telecommunications on actual service outcomes (Zhenwei Qiang, 2011, 2012; Aker and Mbiti, 2010).

Potential applications of telecoms to service delivery

Notwithstanding the need for more rigorous evidence of impact, there is consensus in the literature that the potential benefits of telecommunications reform for service delivery are wide-reaching. A recent report by the International Telecommunications Union (ITU, 2011) stated that:

'Information and communication technologies offer LDCs an opportunity to introduce improvements in health, education, and public service delivery, meeting broader developmental goals that have a positive impact on the quality of life of the population. There is now wide consensus that ICT provide opportunities to reduce social and economic disparity and to support the creation of efficient and transparent administration mechanisms' (ITU, 2011, p. 17).

Much of the literature emphasises that the key contribution of telecommunications to service delivery is to enhance the exchange of information and data, thereby reducing transaction costs for poor people, and addressing information asymmetries that can occur in any sector and hinder service outcomes for users (Aker and Mbiti, 2010; Rashid and Elder, 2009). Some of the main potential impacts identified in this helpdesk report are summarised in the table below.

Sector	Potential impact of telecommunications
Micro-finance	Expand access to finance and insurance for
	smallholder farmers.
Health	Promote public health messages; help
	patients manage their treatments; support
	better supply of medicines; make reporting
	and patient record keeping more efficient for
	health workers.

Sector	Potential impact of telecommunications
Education	Promote literacy for adults; provide access to
	online e-learning facilities.
Agriculture	Transport substitution; greater market
	integration; productivity gains; reduce
	feelings of isolation and risk; improve supply
	chain efficiency.
Cross-sectoral impacts	Increase economic opportunities for women;
	build social capital; crowdsourcing; connect
	rural populations to urban centres; support
	disaster response and climate change
	adaptation.

As the table highlights, telecommunications are also seen to offer cross-sectoral opportunities to promote inclusive development. There are several examples where women, people with disabilities, and people living in remote and rural areas have been able to engage in productive exchanges, accountability mechanisms and enhance their livelihoods partly because of the availability of telecommunications. There is also a growing literature on how telecommunications, and social media in particular, can contribute to less tangible outcomes such as building social capital and enhancing social development².

Main challenges in implementation

Several challenges in applying telecommunications to service delivery have been identified, both at the level of infrastructure and institutions. Poor quality or lack of infrastructure, particularly in rural areas, coupled with low investment and state monopolies, has been a barrier to universal coverage (Williams, Mayer and Minges, 2011). Political and regulatory instability can add to these problems (ITU, 2011). Several reports identify the problem that there has been a proliferation of pilot schemes that have been difficult to scale up in practice (ITU, 2011; Zhenwei Qiang, 2012; Kaplan, 2006).

Extent of adoption

The exponential growth in the telecommunications sector over the past two decades (particularly the mobile phone sector) in both developing and developed countries is now widely documented (Aker and Mbiti, 2010). Quantitative studies have found correlations between living standards and the availability and use of telecommunications services (see Bhavnani et al, 2008 for a comprehensive overview). According to the International Development Research Council (IDRC), mobile phones are increasingly accessible to lower-income groups in developing countries:

² See for example a recent report by the World Bank on 'The role of Mobile-enabled social media in social development':

http://siteresources.worldbank.org/INFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Reso urces/Mobile_Enabled_Social_Media.pdf

'The proliferation of mobile phones experienced in most developing countries needs to be understood in the context of the continued absence of other ICT infrastructure, most notably fixed phones. Mobiles simply offer the poor with a relatively affordable and accessible option, compared to other ICTs' (Rashid and Elder, 2009, p. 15). However, the growth in telecommunications has not reached all segments of the population. A report by the World Bank stressed that because of a range of institutional constraints, lack

of absorptive capacity, and poor infrastructure, the majority of the rural poor have been left out of the ICT revolution (Bhavnani et al, 2008).

2. Potential benefits of telecommunications for service delivery

Direct, indirect and intangible effects

A recent report by the World Bank's ICT Policy Division (Bhavnani et al, 2008) identified a range of direct, indirect and intangible ways that access to and use of mobile phones can be beneficial for rural poverty reduction. In *direct* terms, mobile telephony has been associated with GDP growth, job generation (both in the mobile industry and the wider economy), higher productivity, and increased taxation revenue (mobile operators are usually a sizeable contributor). *Indirectly*, mobile telephony can have wider economic and social benefits in terms of enhancing entrepreneurship, reducing information asymmetries and market inefficiencies and acting as substitute for transportation. At the *intangible* level, mobile telephony can enhance and promote the growth of societal ties. Mobiles have enabled the dissemination of locally-generated and locally-relevant educational and health information, and promoted social capital and social cohesion.

Specific examples of some of these cross-cutting impacts of telecommunications are:

- **Job creation**: Deloitte (2008, cited in Bhavnani et al, 2008) has shown that mobile sector employment in developing countries has been significant (e.g. data from 2007 indicated the creation of 244,000 full time jobs in Pakistan).
- Entrepreneurship: Mobile communication can lower the costs of running a business and may enable an entrepreneur to start one up. In Pakistan, for example, there is some evidence that women have been able to run small beauty and hairdressing businesses via phone without needing to set up beauty salons (Bhavnani et al, 2008).
- **Transport substitution**: Mobile phones allow information to be exchanged between buyers and sellers and can avoid the need for either to travel. This is particularly significant in rural areas where traders would otherwise often need to travel long distances to urban areas to check demand for goods and/or to negotiate on price.
- Social capital: A study in South Africa and Tanzania found links between mobile usage, rural communities and social capital (Goodman, 2005 cited in Bhavnani et al, 2008). Mobile communications can facilitate social capital by helping reinforce strong links with family and friends and other community members, and to mediate weak links with individuals 'outside' the community (e.g., businessmen, government officials, tradesmen, etc.)

In addition, telecommunications have capacity to reach rural and excluded populations. According to the ITU:

'Increased access to information in rural and remote areas in LDCs through mobile phones, telecentres and information kiosks is helping empower women, youth and other groups, and giving them reach to education on topics relating to their daily activities, such as agriculture and health'.

ITU has been engaged in the development of telecommunications infrastructure in **rural and underserved** areas of developing countries through the installation of multipurpose community telecentres (MCT).³ These provide Internet access, access to libraries and databases, as well as government services and information. Benefits include easy access to education materials through e-education; access to medical information and services; and the dissemination of business-related information that has enabled farmers to easily access market data (e.g. prices of products, government online information) (ICT, 2011, p.62). MCTs designed to provide ICT access to **persons with disabilities** (PwDs) have been implemented in Ethiopia, Burkina Faso and Mali. Similar projects have trained blind students, government employees and others to use computers equipped with adaptive devices such as voice synthesizers, magnifying hardware and software, as well as Braille embossers, scanners and printers (ITU, 2011, p. 64).

Disaster response

Mobile devices have been used to collect data to support disaster relief and emergency response. In the aftermath of Haiti's devastating earthquake, for example, a crisis map was developed using real-time data from incident reports submitted using SMS, the Internet, and email (Bhavnani et al, 2008). During severe flooding in Indonesia in 2007, a mobile operator DiGi was able to identify customers who had fled to Malaysia, and offered them free airtime. Mobile operators have also been active in disaster relief efforts in Pakistan and Thailand, providing emergency-related communications infrastructure (Bhavnani et al, 2008).

Reducing vulnerability and protecting the environment is a priority area for the ITU (ITU, 2011). It has undertaken multiple activities to assist countries in disseminating alert messages, setting up early warning systems, designing national emergency telecommunications plans and climate change adaptation plans, designing standard operating procedures, training, and establishing national operations and coordination centres.

Crowdsourcing

A recent report by the World Bank argues the global spread of mobile phones has been a key enabling factor in the global growth of so-called 'crowdsourcing' – defined as a collaborative exercise which enables a community to form and to produce something together (Bott, 2011).

³ during the period 2001-2010, these have been installed in Bhutan, Burkina Faso, Cape Verde, Haiti, Lesotho, Madagascar, Malawi, Mali, Myanmar, Niger, Samoa, Senegal, Solomon, Islands, Sudan, Tanzania and Uganda.

To date, there have been a number of applications of crowdsourcing to governance and social accountability in fragile states. Two examples are:

- In 2009, in a context of massacres, mass rape, and political suppression, a crowdsourcing and citizen reporting platform was established by the civil society group 'Alliance Guinea' to monitor elections. Using a combination of SMS, email, web form, and twitter aggregation system, *Guinée Vote 2010 Témoign (GV10)* encouraged people to report both positive and negative information on how the electoral process was operating. Over 2,000 reports from around the country were collected and the process was seen as highly complementary to formal election monitoring (Bott, 2011, p. 26). In Kenya, such citizen-based monitoring was mapped via a software called "Ushahidi" ("testimony" in Swahili) to allow Kenyans to report post-election unrest via voice, text message, and Internet (Aker and Mbiti, 2010).
- Mobile applications have been used to enable **participatory post-conflict and recovery mapping** in Sudan. 'The benefits of mobile applications are that they can provide real-time transmission, sharing and analysis as a form of conflict early warning in fragile and constantly shifting settings' (Bott, 2011, p. 26).

Applications in the health sector

'**mHealth**' –defined as the use of wireless telecommunications to transmit information about health care- has been shown to have a range of applications in developing countries. It has the potential to address challenges to do with access, quality, affordability, matching of resources, and behavioral norms (Zhenwei Qiang, 2012). For example:

'Far more families around the world can now simply call a doctor when sick, often for the first time. But mobile phones also provide a convenient source of health information, an alert service when medication is due, and an expert consultation service. When faced with an unfamiliar skin disease, a doctor in a rural area can simply take a snapshot and send it to expert consultants for analysis. Medical records can be collected and uploaded and outbreaks of infectious diseases can be tracked in real time' (Zhenwei Qiang, 2012, p. 4).

Some specific examples of mHealth applications include:

- Promote public health messages and prevent disease. In Haiti, the Trilogy/International Federation of the Red Cross's Emergency Relief programme used targeted SMS messaging to disseminate information about the cholera outbreak to at-risk populations (Zhenwei Qiang, 2012). In rural villages in Samoan islands of Upolu and Savaii, telecentres are being used to transmit information for a national programme to promote healthy living. Women and youth have been active in managing some of these centres, which have contributed to rural connectivity (ITU, 2011).
- Help patients manage their treatments when attention from health workers is costly, unavailable, or difficult to obtain regularly. A randomised control trial of an initiative in Kenya that provided SMS-based messaging to monitor and support

antiretroviral (ARV) therapy showed that SMS communications raised ARV patients' adherence to their treatment regimens by a quarter (Lester, 2010). The study concluded that 'mobile phones might be effective tools to improve patient outcome in resource-limited settings' (Lester, 2010, p.1).

- **Patient tracking** using mHealth applications can also support the coordination and quality of care, especially in rural and underserved communities including the urban poor, women, the elderly, and the disabled. Kenya's ChildCount+ registers pregnant women and children under 5 and collects basic information about their health to prioritize visits by community health workers (Zhenwei Qiang, 2012).
- Mobile phones are also **extending the reach of medical workers and medical services**. In the Democratic Republic of Congo, mothers can call a hotline to ask questions about their child's health status (Aker and Mbiti, 2010).
- mHealth can also support more efficient supply chain management. It can reduce delays in medicine shipments. For example, the 'Stop Stock-Outs' campaign across six Sub-Saharan African countries encouraged pharmacists and consumers to report shortages of medicines and other products using SMS. This resulted in hundreds of reports in a six-month period (Zhenwei Qiang, 2012).
- Making health sector human resources more efficient: It is argued that mobile tools can help health workers keep better records and report data to funders. It can also help them to provide treatment based on best practices, international protocols, and patient histories (Zhenwei Qiang, 2012). A report by the IDRC cites the case of the Uganda Health Information Network (UHIN), where health workers used handheld devices to transmit electronic information to and from district offices. A cost-benefit analysis of the project showed that the network delivered 24% savings per unit compared to the more traditional manual data collection and transmission (Rashid and Elder, 2009).
- A recent review of progress made in the telecommunications sector by the International Telecommunication Union (ITU, 2011) cites an example of the extension of telemedicine facilities through ISDN links:

'Two central hospitals, one in Maputo and one in Beira, were connected by a telemedicine link using the existing telecommunication infrastructure. The establishment of a link between the two sites was for clinical and educational purposes. Doctors are now able to discuss cases that require high-level interpretation. The transmitted images are used to obtain a second opinion and to assess whether hospitalization is required before the transfer of patients to Maputo' (ITU, 2011, p. 60).

Kaplan (2006) examined the evidence to support or refute the idea that fixed and mobile telephones can be an effective healthcare intervention in developing countries. He found that although there is a paucity of evidence of actual impact, certain **functional and structural properties** of mobile phones seem to make them an attractive option for use in a healthcare intervention. These are: Low start-up cost (there is no need for a land line); User friendly-SMS (less expensive than a phone-call); Forms of payment and market potential (most developing countries use a pre-payment mechanism). However, the study notes that low literacy and high costs continue to limit access to and usage of mobile phones for these types of purposes.

Applications to agricultural marketing

Mobile phones have been shown to have benefits in terms of facilitating access to agricultural market information. Up to date consumer prices for goods can be accessed instantly, even though farmers often live tens of kilometres from the nearest large market (Aker and Mbiti, 2010). According to a report by the World Bank, mobile apps for agriculture can address the asymmetrical **access to information** that is a pervasive weakness of rural markets in developing countries. They provide users with access to useful, relevant information – for example a farmer can get commodity prices in various urban markets through a simple request made on a mobile phone (Zhenwei Qiang, 2011).

Mobiles may also help generate efficiencies in terms of **automating the supply chain** (Zhenwei Qiang, 2011). For example:

 Virtual City's AgriManagr illustrates the benefits of automating the supply chain in Kenya's export market for tea. This app, called AgriManagr, automates purchases and strengthens relationships between the leading chain of tea factories—the Kenya Tea Production Authority (KTDA)—and tea growers and transport companies. It has proven beneficial for small tea growers, and the average weight per transaction has increased by about 9 percent. It has also lowered administrative costs: 'Before AgriManagr, the average annual factory cost for paper, data entry reconciliation, communication, and fraud was approximately Kshs 60 million, or \$600,000. This has been reduced by replacing paper documents with electronic data entry and reconciliation' (Zhenwei Qiang, 2011, pp. 29-30).

A study in Kerala in 2006 tested whether or not increased access to mobile phones actually made rural **markets more efficient** (Abraham, 2006). It found that wide-spread use of mobile phones in the fishing industry did lead to greater market integration, as well as gains in productivity and a reduction in price fluctuations. The study also showed that the quality of life of the fishermen improved with the increased mobile usage because they felt less isolated and less at risk in times of emergencies.

Based on a case study of the cloth-weaving industry in Nigeria, Jagun, Heeks and Whalley (2008) argue that mobile telephony can provide an opportunity to address the informational challenges of **micro-enterprise** supply chains, but that these effects are limited. Whereas some costs and risks are reduced – for example, travel time is reduced - physical meetings are still needed to engender trust, physical inspection and trade of goods. The study also identified a growing 'competitive divide' between those with and without access to telephony.

A study of agricultural marketing in Tanzania concluded that the ability to communicate using these new information and communication technologies (ICTs) does not significantly alter the **trust relationship** between producers (in this case farmers), and purchasers (Labonne and Chase, 2009). The study showed that many farmers were unable to exploit new mobile phone-based services to seek information on market prices or seek other buyers because

'doing so runs the risk of breaking a long-term relationship with a buyer who is willing to supply credit because of their established business interaction' (ibid, p. 1).

Applications to micro-finance

Mobile apps can also support markets by **expanding access to finance and insurance**. An example put forward by the World Bank is:

'G-Cash in the Philippines have attained widespread trust and acceptance among rural populations as safe, easy ways of making and receiving payments and storing money. Banks and businesses also recognize these m-ARD apps as efficient means of administrating payments and money transfers. And, in these countries at least, m-money is increasingly accepted by banks as a legitimate platform to pay for agricultural inputs and outputs' (Zhenwei Qiang, 2011, p. 31).

There is some evidence that the use of **mobiles for micro-payments** and mobile-enabled financial services (known as 'm-Banking') can help to enable socio-economic development in poor countries (Wishart, 2006). In the Philippines, for example, 3.5 million people are using a service that allows them to transfer money over the two major mobile networks operated by SMART Communications and Globe Telecom. This is seen as a far more secure and flexible system for formal banking than payments using cash, plus it enables greater access to financial services for otherwise excluded groups such as people living in rural areas (ibid).

Applications in the education sector

Mobile phones are being used to **promote literacy for adults** in Africa (Aker, 2009, cited in Aker and Mbiti, 2010). One intervention has taught adults in Niger where to find letters and numbers on a mobile phone and how to send and receive text messages. This has allowed them to send text messages in local languages to their friends and family:

'In a country without local language newspapers and village-level libraries, text messaging makes literacy functional. Preliminary results suggest that the mobile phone-based participants are learning faster than students in normal literacy classes, achieving levels that are 30 percent higher (Aker, 2009). Similar mobile literacy projects are starting in Senegal, and others in India are using smart phones and mobile games for children' (Aker and Mbiti, 2010, p. 24).

3. Practical challenges in implementation

General constraints in the enabling environment

Studies have shown that **state monopolies and licensing restrictions** can raise prices and hinder telecommunications reform. 'Major reform in sector management has been the key factor in the dramatic improvement in ICT services in Africa. Previously, a state-owned monopoly operator provided all ICT services in a country. Beginning in the 1990s, however, African governments began liberalizing their telecommunications markets by issuing multiple

licenses and allowing operators to compete with one another. Private investment now drives network expansion, and privately owned operators are the main service providers' (Williams, Mayer and Minges, 2011, p. 37).

Powell, Ford, and Nowrasteh (2008) analysed how telecommunications have taken off in Somalia in the period since the country became 'stateless'. They argue private investment has increased in the absence of the state's monopoly control over the sector. Somalia now ranks surprisingly high in mobile phone coverage and quality (16th) and number of internet users (11th) among a survey of selected African countries (ibid).

The World Bank stresses that while liberalization and competition can help the sector meet many of its objectives, regulation is key, and the public sector may also need to provide **incentives** to companies to meet objectives such as coverage in rural areas (e.g. by providing direct financial subsidies or tax breaks to make remote locations more attractive to operators) (Williams, Mayer and Minges, 2011, p. 72).

A recent report by the ITU (2011) identifies some of the bottlenecks and constraints that impede progress in the deployment and upgrade of ICT and telecommunication networks. At the technical level, these include poor availability of affordable, adequate and reliable bandwidth on international links, weak investment in telecommunication and ICT infrastructure, and inadequate and poorly maintained ICT infrastructure. **Political and regulatory instability** can exacerbate these problems. For example, civil strife and war can damage existing infrastructure, and lack of regulatory clarity can act as a disincentive for private investment in the sector. Developing locally relevant content in different languages is also a challenge. Small-scale pilots have 'failed to reach economies of scale due to lack of interoperability, depleted capital, or incompatibilities with national development priorities' (ITU, 2011, p. 65).

Overall, there is a need for more funding for monitoring and evaluation (M&E) and more and better **impact evaluations** to provide the evidence required to inform policy-making and encourage large-scale investment. 'The challenge lies in extending these programs and replicating successful applications in and between countries. There is a need for comprehensive impact evaluations that show the costs and benefits of mobile health. Policy makers grapple with the challenges of developing the right mix of policies and regulations to promote mobile health applications' (Zhenwei Qiang, 2012, p. 4).

Sector-specific challenges

Zhenwei Qiang (2012) argues that mHealth initiatives can produce a **proliferation of pilots** that go nowhere, and few interventions have demonstrated the capacity to serve millions of people because of fragmentation in financing, partnerships, and health systems. Creating a sustainable, large-scale mobile phone/healthcare model requires agreement among different **stakeholders with different agendas** (Kaplan, 2006, p. 10)

Scaling up is difficult because m-apps in developing countries have to provide information that is **hyper-local and tailored to requirements**, right down to the village level. Furthermore:

'Health systems usually do not provide the impetus for the development of mHealth interventions. Instead, their development is usually driven by people adept with technology, members of nongovernmental organizations (NGOs), and private enterprises. Similarly, aid organizations are bearing the cost of experimentation in this area, and relying on them may slow innovation. Moreover, the lack of coordination between them may be fueling a wasteful proliferation of pilot projects but little financing for achieving scale' (Zhenwei Qiang, 2012 p. 12).

Ensuring that affordable ICT services are provided in **rural areas** has been a major policy challenge. It can be especially difficult to implement mHealth services in rural settings, because skilled workers and the data needed to design business models (e.g. on the potential size of the market) are scarce (Zhenwei Qiang, 2012 p. 12, p. 12). Poor network coverage can mean fewer customers to attract mobile network operators to these areas and, linked to this, there is a need to raise consumer **literacy in ICT** (so they can use the technology) (Ibid, p. 14).

4. Sources

References

Abraham, R., 2006, Mobile Phones and Economic Development: Evidence from the Fishing Industry in India, Cornell Univ., Ithaca, NY http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=4085513&tag=1

Aker, J., and Mbiti, I., 2010, Mobile Phones and Economic Development in Africa, Working paper, Centre for Global Development, Washington http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1693963

Bhavnani, A., et al., 2008, The Role of Mobile Phones in Sustainable Rural Poverty Reduction, ICT Policy Division, The World Bank, Washington <u>http://www.i-</u> gov.org/images/articles/7576/The_Role_of_Mobile_Phones_in_Sustainable_Rural_Poverty_ <u>Reduction_June_2008.pdf</u>

Bott, M., 2011, Crowdsourcing for better governance in fragile state contexts, The World Bank, Washington

http://www.scribd.com/WorldBankPublications/d/75642401-The-Role-of-Crowdsourcing-for-Better-Governance-in-Fragile-State-Contexts#download

ITU, 2011, ICT and communications in least developed countries: Review of Progress made during the decade 2000-2010, International Telecommunication Union (ITU), Geneva

http://www.itu.int/ITU-

D/ldc/turkey/docs/ICT_and_Telecommunications_in_LDCs_Review_of_Progress_made_during_the_Decade_2000_2010.pdf

Jagun, A., Heeks R., and Whalley, J., 2008, The impact of mobile telephony on developing country micro-enterprise: A nigerian case study, Journal of Information Technologies and International Development, Volume 4:4 pp. 47-65 http://dl.acm.org/citation.cfm?id=1487629

Kaplan, W.A., 2006, Can the ubiquitous power of mobile phones be used to improve health outcomes in developing countries?, Globalization and Health 2006, 2:9 <u>http://www.biomedcentral.com/content/pdf/1744-8603-2-9.pdf</u>

Labonne, J and Chase, R., 2009, 'The Power of Information: The Impact of Mobile Phones on Farmers' Welfare in the Philippines', World Bank Policy Research Working Paper Series http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=2636104

Lester, R.T. 2010. Effects of a Mobile Phone Short Message Service on Antiretroviral Treatment Adherence in Kenya (WelTel Kenya1): A Randomised Trial. *The Lancet* 376: 1838–45.

http://www.weltel.org/weltel randomised

Powell, B., Ford, R., and Nowrasteh, A., 2008, Somalia after state collapse: Chaos or improvement? Journal of Economic Behavior & Organization, Volume 67, Issues 3–4, September 2008, Pages 657–670

http://www.sciencedirect.com/science/article/pii/S0167268108001017

Rashid, A., and Elder, L., 2009, Mobile Phones and Development: An Analysis of IDRC-Supported Projects, The Electronic Journal on Information Systems in Developing Countries <u>http://www.ejisdc.org/Ojs2/index.php/ejisdc/article/view/529</u>

Williams, M., Mayer, R., and Minges, M., 2011. Africa's ICT Infrastructure: Building on the Mobile Revolution, The World Bank, Washington http://siteresources.worldbank.org/INFORMATIONANDCOMMUNICATIONANDTECHNOLO GIES/Resources/AfricasICT_Infrastructure.pdf

Wishart, N., 2006, Micro-Payment Systems and Their Application to Mobile Networks: An Assessment of Mobile-Enabled Financial Services in the Philippines, InfoDev http://www.infodev.org/en/Publication.43.html

Zhenwei Qiang, C, et al, 2011, Mobile Applications for Agriculture and Rural Development, World Bank, Washington http://siteresources.worldbank.org/INFORMATIONANDCOMMUNICATIONANDTECHNOLO

GIES/Resources/MobileApplications_for_ARD.pdf

Zhenwei Qiang, C., et al., 2012, Mobile Applications for the Health Sector, The World Bank, Washington

http://siteresources.worldbank.org/INFORMATIONANDCOMMUNICATIONANDTECHNOLO GIES/Resources/mHealth_report_(Apr_2012).pdf

Key websites

PPIAF Public-private Infrastructure Advisory Committee <u>http://www.ppiaf.org/page/strategic-themes/fragile-states</u> International Telecommunication Union <u>http://www.itu.int/en/pages/default.aspx</u> ICT, World Bank <u>www.worldbank.org/ict/</u> ICT for development <u>http://www.ict4d.org.uk/</u> InfoDev http://www.infodev.org/en/Index.html

Experts consulted who did not respond before the deadline

Ioannis Kessides, World Bank Wei Lei, Virginia University Maja Bott, UNDP Tim Urwin, Royal Holloway University Roger Noll, Standford University

About Helpdesk research reports: Helpdesk reports are based on 2 days of desk-based research. They are designed to provide a brief overview of the key issues, and a summary of some of the best literature available. Experts are contacted during the course of the research, and those able to provide input within the short time-frame are acknowledged