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If we consider Phase I of ICT4D to include technology platforms like PCs and mainframes, and Phase II to include the Internet, then perhaps we are in Phase III, with the proliferation of mobile phones and wireless networks.

Indeed, mobile phones are much more pervasive and more heavily used than PCs and the Internet in many developing countries, so it is imperative that we look at content implications of harnessing mobile devices and wireless networks as

ICT infrastructure in the development agenda. A useful framework for understanding the mobile information society is described in Table 1, based on the "8 Cs" framework of parameters: connectivity, content, community, commerce, capacity, culture, cooperation and capital.

Let us look at specific instances of where developing countries are harnessing mobile communications for development, and the challenges that can arise in some cases.

Emerging economies are fast emerging as crucibles of innovation in such areas as mobile banking, mobile money transfer, and mobile education and medicine, not to mention green initiatives, according to IDC.

According to ITU research, 4.1 billion people -- over half the world's population -- now use mobile phones. That's a sharp rise from the one billion reported in 2002, and represents about 60% of the world's population.

"The spread of mobile cellular services and technologies has made great strides

Content for Development



Photo: BMA/Bangalore

Mobile & Wireless Opportunities & Challenges

towards connecting the previously unconnected. Despite the economic downturn, current global ICT developments are unlikely to change drastically, given the pervasive nature of information and communication technologies," according to the ITU.

SMS Data

In terms of mobile content, services powered even by basic SMS can provide useful information for citizens. For instance, the Gujarat State Road Transport Corporation in India recently piloted a cellphone timetable service, for SMS-based queries on bus timings.

Basic SMS text messaging will be a key revenue driver for mobile network operators in developing regions like Africa and the Middle East over the next five years, helping to offset continuing declines in average revenue per subscriber (ARPS) for mobile voice services in the regions, according to Pyramid Research.

In Africa and the Middle East, SMS rev-

enue is expected to almost double to nearly \$12 billion in 2013, far exceeding the revenues of higher-end data services such as MMS or mobile broadband.

The significance of this development goes beyond the revenue opportunity coming directly from peer-to-peer SMS. Several operators have found ways to capitalize on subscribers' new familiarity with SMS to increase not only their data ARPS, but their voice ARPS, too. The growing popularity of SMS within the region will allow operators to use SMS-based value-added services, sometimes in conjunction with instant-message USSD services, to boost voice ARPS among the mass base of lower-income subscribers.

Internet firm Google Kenya has launched an SMS search service for mobile phone users via the shortcode GOOG. The service is free from Google, but carrier charges apply. Google has also entered into an agreement with Safaricom, allowing subscribers to own unique Google mail addresses linked to their mobile phone numbers, according to Joseph

Mucheru, Google Kenya's Office Lead.

A report by Berg Insight, Mobile Internet 2010, shows that the largest interest for data services over mobile handsets is found in emerging markets, where under-supplied fixed infrastructure makes the portable phone a viable utility for many practical applications, not just communication but also banking, entertainment, and commerce.

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In an interesting case study, Zain announced that its subscribers raised more than \$85,000 in SMS text messaging for Nelson Mandela's Foundation. The texts were sent in response to the operator's call for mobile phone users to send birthday greetings to Nelson Mandela as he celebrated his 90th birthday. Responses came from mobile phone users in countries such as Nigeria, Kenya, Tanzania and Zambia.

Table 1: The "8 Cs" of the Mobile Information Society

	MOBILE DEVICES AS AN INSTRUMENT	MOBILITY AS AN INDUSTRY
Connectivity	How affordable and widespread are mobile devices for the common citizen?	Does the country have manufacturing industries for hardware, software, mobile solutions and services?
Content	Is there useful content (foreign and local) for citizens to use in their daily lives on mobile devices?	Is content being generated in local languages and localised interfaces? Is this being accessed/used abroad?
Community	Are there online/offline forums where citizens can discuss mobile services and other issues of concern?	Is the country a hub of discussion and forums for the worldwide mobile industry?
Commerce	Is there infrastructure (tech, legal) for m-commerce for citizens, businesses and government? How much commerce is transacted electronically?	Does the country have indigenous m-commerce technology and services? Are these being exported?
Capacity	Do citizens and organisations have the human resources capacity (tech, managerial, policy, legal) to effectively harness mobile devices for daily use?	Does the country have the human resources capacity (tech, managerial, policy, legal) to create and export mobile devices and services, and set standards?
Culture	Is there a forward-looking, open, progressive culture at the level of policymakers, businesses, educators, citizens and the media in opening up access to wireless spectrum and mobile devices and harnessing them? Or is there nervousness and phobia about the cultural and political impacts of ICTs?	Are there techies, entrepreneurs and managers pro-active and savvy enough to create local companies in mobility and take them global?
Cooperation	Is there adequate cooperation between citizens, businesses, academics, NGOs and policymakers to create a favourable climate for using mobile devices?	Is there a favourable regulatory environment in the country for creating mobile device/service companies, M&A activity, and links with the diaspora population?
Capital	Are there enough financial resources to invest in wireless infrastructure and education? What is the level of FDI?	Is there a domestic venture capital industry; are they investing abroad as well? How many international players are active in the local private equity market? Are there stock markets for public listing?

Financial Content and Services

The operating environment in developing countries presents unique opportunities for mobile-based financial services, an optimal combination of necessity on the demand side and solid upside on the supply side, according to a recent Pyramid Research report. Payment models are driven by operators, banks, hybrid alliances or third party platform providers.

Mobile banking technologies are powered by SMS, USSD (Unstructured Supplementary Service Data), WAP, Java and SIM toolkits. Players in this space in Africa include M-PESA (Kenya, Tanzania), MTN (South Africa, Nigeria), Celpay (Zambia), MoneyTextMe (Ghana), Sokotele (Kenya) and WIZZIT (South Africa).

The independent Consultative Group to Assist the Poor (CGAP), a World Bank-supported research centre, has identified mobile phone banking as an important tool in Africa, Asia and Latin America. The current global financial crisis makes the need for widespread availability of safe alternatives to cash even more pressing.

Global mobile subscriptions surpassed

four billion at year-end 2008 and are expected to approach six billion by 2013, making mobile services an extremely relevant platform for advertising and transactions for mass audiences.

Compliance with banking regulations and security of the networks have been cited as the major challenges in operating mobile money transfer services in developing countries.

Only one in five African households in Africa has access to a bank account, according to the United Nations, but a much higher proportion have a mobile phone and many operators hope offering financial services will attract new customers.

Some 175 million migrants currently use remittance services, sending money to around 800 million dependent recipients, according to the GSM Association. Remittance flows have reached USD 320 billion and are estimated to reach USD 700 billion by 2012.

Uptake of mobile technology for banking services is set to hit 900 million users worldwide by 2014, according to analyst Berg Insight. The predictions indicate a compound annual growth rate of 89 per cent from the 20 million users using mobile channels in 2008, with Asia being the fastest growing market and representing about 65 per cent of users.

Mobile technology will therefore play an important role in bringing financial services to people in the Middle East and Africa who do not use bank accounts. "Mobile handsets are in an excellent position to become the primary digital channel for providers of banking and related financial services on emerging markets,"

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according to Berg Insight telecom analyst Marcus Persson.

Juniper Research forecasts the average revenue opportunity for carriers, for both national and international mobile money transfers combined (based on estimated commission levels that they will be able to charge), is in excess of \$5 billion by 2013.

Mobile Healthcare

"Mobiles are increasingly the computers of the future and now emerging countries are getting on board rapidly, argues health education specialist Inge de Waard. Continuing Medical Education (CME) is becoming possible also in developing countries thanks to mobile phones.

"We can reach physicians in the field to deliver lifelong learning. Keeping physicians in contact with peers will enhance knowledge exchange in priority settings. Getting the latest medical information out there is crucial, and mobile access to medical Websites or peer to peer knowledge exchange networks is important," she argues.

Success factors include accessibility to medical content via cheap phones, receiving relevant alerts on time, and providing certification for medical education modules. Challenges remain, of course, since graphics and tables are sometimes unclear on small screens, and battery life can interrupt long education sessions.

Maryland-based communications firm Danya International has used mobile video-enabled phones in meeting the requirements for monitoring medication adherence by tuberculosis (TB) patients during the 3rd East African Health and Scientific Conference. The Mobile Direct Observation Treatment (MDOT) Pilot Project received high positive ratings from the patients and health care workers who participated.

"Mobile phone technology offers opportunities to expand and enhance medical treatment where direct observation of patients is required," according to Danya CEO Jeffrey Hoffman.

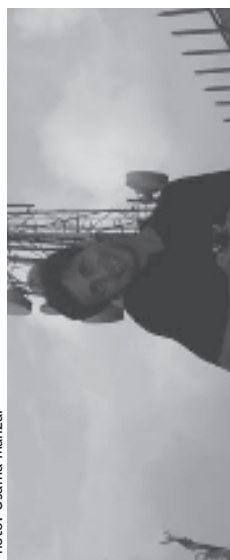


Photo: Osama Manzar

The MDOT Pilot Project follows the experiences of 13 TB patients, their patient assistants, and health care workers over a 30-day period in Nairobi, Kenya. Patients were provided a mobile phone capable of sending and receiving video and text messages. Patients and their assistants video-captured the patient taking their prescribed dose of TB medication in their home and immediately transmitted it to a central database where health care workers viewed the video to assure compliance with the DOT protocol.

Patients also received health messages in video and text formats on their mobile phones. At the end of one month, the participants completed a brief questionnaire on their experiences. Participants expressed satisfaction with the procedures and the use of the mobile phone technology for remote medication monitoring, health education, and communication.

Other partners who supported the MDOT Pilot Project were Safaricom, Nokia Siemens Networks and EPOS Health Consultants.

Project Masiluleke, a mobile health project in South Africa, is using cell phone text messages to reach people in even the most remote areas of the country to encourage them to get information and counseling on HIV/AIDS.

The project delivers about 1 million HIV/AIDS and tuberculosis texts each day to personal cell phones providing the number for the national AIDS helpline along with messages like: "Frequently sick, tired, losing weight and scared that you might be HIV positive? Please call AIDS Helpline."

Since the program began in fall of 2008, the messages have increased calls to the center from about 1,000 a day to between 3,000 and 4,000 a day, according to Gustav Praekelt of the Praekelt Foundation, which designed the technology behind the project.

"Increasingly in Africa we find that the

mobile phone is the prime resource for finding information," according to Praekelt. "I think people often underestimate the penetration of these devices in Africa and what a difference it makes to a lot of people's lives."

Callers to the national helpline can ask questions about HIV, get information about where to get tested and receive counseling.

The project takes advantage of a popular form of texting across Africa, called a "please call me" message, that can be sent for free from a phone even if it is out of pre-paid minutes. The empty characters on the free text are used to convey the health message.

Future phases of the project will allow users to text health questions, if they prefer not to call the line, and will provide an internet portal of information accessible by cell phone for people to learn about HIV. The ultimate goal, says the group, would be to provide free home HIV testing kits that would be supported by mobile counseling, so that people who aren't willing to visit a clinic can find out their status.

Zinny Thabethe, an HIV positive South African and co-founder of the HIV/AIDS education organization iTeach, helped create the program for Project Masiluleke. She said opening a dialogue about HIV/AIDS is so important because the stigma surrounding HIV/AIDS in South Africa is still very strong.

An estimated 18 percent of South Africans between the ages of 15 and 49 are HIV positive, according to the World Health Organization.

"Because [the helpline] is confidential and anonymous they can phone in and talk to someone who doesn't know them, who is in another province, who can help them with their questions and they can be able to be honest," according to Thabethe. South Africa has 13 official languages, and the project sends messages in the major vernaculars.

Aside from initiatives for health outreach and education like Project Masiluleke, there are also pilot programs around the world working on monitoring patients and reminding them to take medications, using mobile technology to quickly collect data about outbreaks so that proper medical response can be deployed faster, and using mobile technology to connect health workers with the training and support they need.

In a world first in HIV education, Metropolitan Life one of South Africa's largest insurance companies has partnered with CellBook to present an information booklet on HIV and AIDS which can be downloaded onto a cellphone. Called "B the Future," the social initiative can potentially reach over 30 million mobile phone users.

"We want to educate South Africans to know their status and take personal responsibility for managing their health," says actuary Nathea Nicolay, Metropolitan AIDS Risk Consulting Manager. "If we are going to beat this epidemic, we need a widespread behaviour change. B the Future aims to educate people on how to live positively and also to prevent new infections."

In order to ensure that the information is accessible to everyone, not just those with the latest cellphones, the information has been compressed to below 300 kb so that the entire book can be easily and quickly sent in a single transaction to a mobile phone.



Photo: Osama Manzari

Uptake of mobile technology for banking services is set to hit 900 million users worldwide by 2014, according to analyst Berg Insight

"At only R1 per SMS, it is affordable and takes less time than it would to download a ringtone. SMS the word HIV to 32907 and you'll get back everything you need to know about HIV and AIDS," explains Bertus Preller, Marketing Executive for CellBook.

Claire Thwaites, who heads the U.N. Foundation's work on mHealth, said the mobile phone technology is already in the hands of 64 percent of people in the developing world, and that number continues to grow.

In Europe, the European Commission has developed a system that alerts public health officials to potential threats by sorting information from news websites. The MediSys system provides European health authorities with real-time information on developing health hazards such as disease outbreaks or industrial accidents.

The system reportedly collects and sorts data from more than 1,000 news websites and 120 public health sites in 32 languages -- and uses e-mail and SMS to automatically alert health officials, giving them timely warnings of possible hazards.

By 2012, 50 percent of all individuals in remote areas of the world are expected to have mobile phones. But the field of mhealth technology needs to be strengthened by rigorous data collection about results before programs can be expanded.

Mobile Education

While the evidence base is still quite spotty, usage models are slowly emerging from m-education pilot projects in places as diverse as Thailand and Mongolia, observes education specialist Michael Trucano. The increasing ubiquity of mobile phones has helped enabled pilots looking at mobile gaming to support literacy in India. Even the World Bank has reportedly got into the act, through Development Marketplace funding for a small pilot in Bangladesh.

Perhaps the most well known, and

biggest, of these pilot programs is the text2teach project in the Philippines (see video at the top of this blog post), which provides a way for teachers to request educational videos via text message, with the videos delivered to a television at the school via satellite.

Canada's Althabasca University has just published a general survey on Mobile Learning: Transforming the Delivery of Education and Training. Many educational mobile learning uses have been explored: from low-cost mass learning opportunities through SMS, to edutainment, to data gathering (surveys, exams, questionnaires) to administrative and learning support, with very different mobile devices.

Mobile Agriculture and Trade

The mobile phone has played an important role in transforming agricultural marketplaces via quantitative analysis.

The Cambodia Crop Production and Marketing Project (CCPMP) has the overarching aim of improving agricultural value chains as a key to sustainable growth and poverty reduction in Western Cambodia. Using mobile technology, the project facilitates the sharing of knowledge and information at all stages of the value chain from farmer to end-user, delivering practical benefits including improved food security, increased income, and reduced vulnerability to disruptions for rural poor farmers.

DrumNet is a pilot project by rural farmers in central Kenya, which provides marketing, financial services and information via their mobile phones. The premise of the Pride Africa project is that a lack of market information is one of the key elements that keeps farmers from getting the full market value for their products.

"As the information flow increases due to

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the mobile phone coverage expansion, the cost of crop marketing is expected to decrease, particularly more so for perishable crops, such as banana, in remote areas because the increased information allows traders to collect perishable products more efficiently," according to Megumi Muto and T. Yamano, in a paper called "The impact of mobile phone coverage expansion on market participation: Panel data evidence from Uganda".

Traders use mobile phones to set up a time and place to trade banana", whereas in the absence of mobiles they just arrive unannounced and buy what's available, waiting until their trucks are full.

On a broader scale, CellBazaar is a service from Grameenphone that allows people to buy or sell over their mobile phones. Customers looking to sell something, post the information on CellBazaar through Grameenphone, and buyers get in contact. Customers looking to buy something, or to use someone's services (e.g., tutor), look for it on CellBazaar and contact the seller directly. When buyers sees items they like, they can call the seller, get additional information, and arrange to meet the seller to complete the transaction. CellBazaar is a platform for buyers and sellers to find each other.

Manobi is a wireless e-service assisting Senegalese fishermen in the marketing of their catch. The Manobi Development Foundation has a much wider remit and operates in the US, France, Senegal and South Africa. Generally, the service allows traders to receive market prices and make trades via SMS. Consumers and restaurants are encouraged to use the service to find and purchase goods from farmers at bid pricing.

The Trade At Hand initiative of the International Trade Centre (ITC) has two modules: MarketPrices and MarketAlerts. MarketPrices uses text messages in order to inform exporters in developing economies about the daily changes in the international price of their export of interest. A module called MarketAlerts enables local trade support institutions to

build more efficient networks of exporters by transmitting information to them about business opportunities and market news.

Mobiles and Social Inclusion

Mobile phones have been distributed to cooperative women's farming groups in different agro-ecological zones in Maseru district, western Lesotho, by the Regional Hunger and Vulnerability Programme (RHVP), which builds evidence to help policy-makers working on food security and social protection.

"The phone has transformed the women farmers' lives completely - they are able to market their produce, access information on prices, and it has made them so confident," according to Gladys Faku, national chairman of the Participatory Ecological Land Use Management (PELUM), a network of NGOs and civil society groups working with small-scale farmers in East, Central and Southern Africa.

RHVP ran the project as part of a pilot programme to see how vulnerable people benefit from cellphones, to disprove arguments against the use of mobile phones for cash transfers, and to prove that illiterate people are able to embrace technology.

"The pilot also took a step further to prove that not only are illiterate people able to handle technology, but also benefit from improved communications, both in terms of their farming activities and the reduced time and cost of staying in touch with each other," said Katharine Vincent of RHVP.

The women managed to use the mobile phones as a tool to generate income by selling airtime on their phones, and extended their mobile network by using the money from selling airtime to purchase more phones. One of the groups also used the money to buy piglets, which were sold to generate more money.

Saving in time and travel costs have also been realised in mountainous Lesotho,

which has enormous distances and a poor public transport system. In Maseru district in western Lesotho, the distance between cooperative groups can be up to 200km - a 16-hour round trip by taxi costing about \$13, with an overnight stay.

However, Richard Heeks, director of Manchester University's Centre for Development, cautions: "We talked a few years back about the 'digital divide', now we are recognising the mobile divide."

In a study of a group of workers in Nigeria's informal cloth-weaving sector, it was found that weavers without a mobile were forced to go on costly and sometimes dangerous journeys, making it increasingly hard to obtain orders.

Along with the contribution mobiles can make to securing livelihoods, they are also important in reducing the vulnerabilities that people face as a result of lack of information and isolation, according to Abi Jagun from Strathclyde University's Department of Management Science.

Mobile Content in Developing Countries: The Road Ahead

Mobile users in developing countries express a stronger desire for content and advanced features, according to a "Global Mobile Mindset Audit" study released by the Forum to Advance the Mobile Experience (FAME), part of the CMO Council and Global Market Insight (GMI), and sponsored by Palm.

U.S. users lag most behind other countries in terms of accessing the Web, or wanting access, using cellular phones. In the U.S., 22.6 percent find the feature important or very important. Other countries exhibit higher demand: Western Europe (30.4 percent); Eastern Europe (53.9 percent); Asia (56.4 percent); and Latin America (63.5 percent).

"The difference between developing countries and the U.S. and Western Europe really is played out throughout the survey in terms of advanced services



and how interested users are in accessing them," according to Dave Murray, director of the CMO Council's FAME Group.

In some cases, mobile services can compensate for a lack of infrastructure in phone and Internet services, as well as in other areas. One example Murray cites is a demand for mobile network banking access.

"In India there is a lack of an established consumer ATM network," according to Murray. "The idea of a lack of infrastructure goes beyond communications, lack of infrastructure in banking, commerce, and entertainment, which is leaving users in developing countries to rely more heavily on mobile devices."

A dotMobi Advisory Group has been formed to assess market requirements, localisation strategies, business models, funding approaches, and best practice recommendations for developing countries using .mobi domains and solutions.

The Task Force has now agreed to create a sub-group to contribute specifically towards a prototype for the World Digital Library (<http://www.worlddigitallibrary.org>), as part of the wider content delivery strategy to developing countries with mobile content delivery being one of the key vehicles to achieving this.

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