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Sida Review

Johan Hellström

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List of Abbreviations

APC	Association for Progressive Communication
ARPU	Average Revenue Per User
ART	Anti-Retroviral Treatment
CAPEX	Capital Expenditure
CCK	Communications Commission of Kenya
CSR	Corporate Social Responsibility
CTO	Commonwealth Telecommunications Organisation
DNS	Domain Name System. Hierarchical naming system for networked computers and services
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product, a basic measure of a country's overall economic output
GIS	Geographic Information System
GNI	Gross National Income is the dollar value of a country's final income in a year. GNI per capita (GNI divided by its population) reflects the average income of a country's citizens.
GPRS	General Packet Radio Service mobile data service
GSM	Global System for Mobile communications. An open, digital cellular technology used for transmitting mobile voice, SMS and data services
GSMA	GSM Association
HIPS	Health Initiatives for the Private Sector
ICT	Information and Communication Technology
ICT4D	Information and Communication Technologies for Development
IM	Instant Messaging
IP	Internet Protocol
ISP	Internet Service Provider
ITU	International Telecommunication Union
IVR	Interactive Voice Response
M4D	Mobiles Phones/Communication Technology for Development
MIT	Massachusetts Institute of Technology
MMS	Multimedia Messaging Service
M-Pesa	Mobile-based money transaction service (pesa means money in Swahili)
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organisation
OPEX	Operational expenditure
PIN	Personal Identification Number
PMTCT	Prevention of Mother-To-Child Transmission
PRS	Premium Rate Services
RIM	Research In Motion
Sida	Swedish International Development Cooperation Agency
SIM	Subscriber Identity Module, miniature smart-card that associate a mobile subscriber with a mobile network subscription. The SIM card holds the subscriber's unique identity, storage, contact lists, text messages sent and received, logos and in some cases small Java programs.
SMEs	Small and Medium-sized Enterprises
SMS	Short Message Service or Silent Messaging Service
TCRA	Tanzania Communications Regulatory Authority
UBOS	Uganda Bureau of Statistics

UCC	Uganda Communications Commission
USSD	Unstructured Supplementary Service Data
VAS	Value Added Service
VoIP	Voice over Internet Protocol (delivery of voice communications as packets over Internet Protocol networks
WAP	Wireless Application Protocol
WiMAX	Worldwide Interoperability for Microwave Access, intended for wireless transmission of data in "metropolitan area networks"

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Executive Summery

This report gives an overview of the current state of mobile phone use and services in East Africa. It outlines major trends and main obstacles for increased use as well as key opportunities and potential for scaling-up mobile applications. The report draws on secondary data and statistics as well as field work carried out in Kenya, Rwanda, Tanzania and Kenya during 2008 and 2009.

The report identifies relevant applications in an East African context for reaching and empowering the poor and contribute to social and economic development. The identified mobile applications, listed in Appendix 2, range from small pilots to scaled-up initiatives – from simple agricultural, market or health information services to fairly advanced financial and government transaction services.

East Africa has more than 120 million citizens with a large majority living in rural areas. Almost half of its' population is under the age of 15 years and about one third of the grown up population is illiterate. The region is characterised by general weak infrastructure, such as bad roads, poor transport systems, non-existent electricity, few health units, financial institutions, weak public offices etc... Yet, by the end of 2009 there were almost 50 million mobile subscribers in the region resulting in a mobile penetration of 40% of the total population. This makes mobile phones one of the most widely available platforms for information dissemination and interactive communication. Due to technological advancements, the mobile phone has become an all-in-one device that can be carried and used almost anywhere. Internet is going mobile, from desktop to pocket, and innovative simple applications are today a great opportunity for businesses, organisations and governments to reach out and interact with clients and citizens.

Mobile subscription statistics are hard to obtain though and not necessarily particularly reliable. The actual number of people and handsets behind the subscribers can differ quite substantially mainly due to multiple SIM ownership and the way service providers report their subscriber data. However, a clear majority has access to mobile communication, either direct or indirect through infopreneurs and village phones. How can real access and use be promoted even further? First it is important to understand what the barriers to mobile use are in order to provide solutions. The most significant barrier is that the total cost of ownership and use, i.e. cost of device, airtime, charging, etc., is too high. Lack of electricity is also a major hindrance as well as illiteracy.

The 'killer application' in East Africa is peer to peer communication, i.e. voice, SMS and beeping. The number of subscribers who use their phones to access internet is however steadily growing, which opens up for a whole range of new applications and possibilities. Many of the existing SMS based applications that could benefit the poor the most are still in their infancy in the region. A few successful cases, namely mobile money transaction systems and various health related solutions are being used at scale, but the fact remains that the number of scaled-up mobile services are still few and/or limited geographically. So, what hinders the take off of mobile applications for economic and social development in East Africa?

First the cost of communication must go down – SMS is very overpriced and so is voice and data traffic. Secondly, many applications and services never reach out to the masses due to poor marketing and the non-existing meta data about the available applications. Subscribers must know what solutions are available, why and how to use them. This will lead to volumes intensive which will eventually lower the price of the particular service. In other words, there is a huge need for marketing (of the product) and education (for the end user) in order to make mobile applications sustainable. Thirdly, many interventions are not designed with scale in mind. Few implementers are familiar with all the costs involved and seen from a technological point of view, the requirements on networks and different requirements on handsets and end-users that mobile applications have must be understood better.

Despite these challenges, we are witnessing a small revolution regarding new applications and services added to the mobile phone. Some high potential application areas include financial services and various governance related services. After successful implementations of mobile money services in Kenya, Tanzania, Uganda and most recently in Rwanda, m-banking is set to grow. As it grows, there will be an integration of m-transactions systems into existing applications and services and m-commerce in general will thereby take off rapidly and widespread. Public service delivery can be improved by integrating services with m-transactions and facilitating interaction between the state and its citizens.

Introduction

Background

During 2006 and 2007, Sida commissioned a project that was carried out in the Philippines that looked at the potential of mobile applications (m-applications) and its possible impact for development. Meetings, field visits and a workshop in Manila were organised and the report *"The innovative use of mobile applications in the Philippines – lessons for Africa"* was published in September 2007. The report positions the Philippines as the leader in the use of m-applications for access to a range of services from m-banking to m-learning and m-governance. The Philippines experience shows that it is possible to increase access to mobile phones, not only for the well-off but also for the poorer segments of society.

The report finds that the success in the Philippines was due to a number of reasons including; appropriate regulatory policies, a developed retail network and prevalence of a pre-payment system, low cost ratio of SMS (Short Message Service, texting) to voice, and a critical mass of users (Sida 2007). Many of these prerequisites exist in East Africa, i.e. in Kenya, Rwanda, Tanzania and Uganda. However, despite the fact that the vast majority of East Africans have access to mobile networks, and the number of users is constantly increasing, while the prices are decreasing, the fact remains that the number of sustainable, scaled-up mobile services for social and economic development are still few and/or limited geographically.

The key questions that this report seeks to answer are therefore; what hinders the take off of m-applications for development in East Africa and what role can donors play in this process?

The report includes:

- a *descriptive* part that gives an overview of the current state of m-applications in East Africa and a review of the development of mobile applications in the region as a tool for economic development and poverty reduction; and
- an *analytical* part that outlines the major trends, the main obstacles for increased use of m-applications as well as the main opportunities and potential for scaling-up of m-application implementation in East Africa.

The goal is to identify which applications are most relevant in an East African context for reaching and empowering the poor and contribute to social and economic development.

Method

This report draws on secondary data and statistics and builds on comprehensive desk based research. In addition, field work was carried out in Kenya, Rwanda, Tanzania and Kenya during 2008 and 2009. A number of interviews, meetings and discussions with key stakeholders in East Africa where conducted and numerous workshops and conferences were attended. See Appendix 1 for a list of people consulted and workshops visited.

Mobile phones for economic growth and development

The notion of mobile communication and applications as a tool to alleviate poverty is becoming increasingly mainstreamed. Even though long-term impact studies are scarce, the potential and perceived benefits regarding innovative mobile phone usage for social and economic development are enormous. The basic mobile phone is seen as a tool that supports bottom-up economic development.

It is also seen as a way of empowering individuals by encouraging entrepreneurship and innovation as well as giving the poor a voice. Through mobile phones, farmers get access to market prices, young urban citizens can transfer money back to their home villages, health workers can give diagnoses and collect data, family and friends can easily connect and communicate, news can be spread and read in crisis situations, citizens can build opinion and mobilise. In just a few years, mobile phones have transformed East Africa, not just seen from a social and cultural point of view, but access to and use of mobile phones and applications is also shaking up the region's entire economic system.

Jan Embro, President of Ericsson in sub-Saharan Africa and representing one of the leading infrastructure suppliers in East Africa believes that:

> *"Mobile communication significantly improves quality of life, providing the tools to deliver enormous socio-economic benefits to people in developing countries. Connectivity helps to offset a lack of resources, particularly in rural areas, and provides access to a range of services, including education and healthcare"* (Ericsson 2008).

The Chief Executive Officer of the leading mobile operator Safaricom in Kenya, Michael Joseph, stated in an interview that mobile phones have made a bigger impact in Kenya than foreign aid:

> *"Foreign aid changes people's lives temporarily and that's it, when it's gone it's gone. Mobile phones have made a huge impact in places like Kenya. In Kenya 70 percent of our economy is in the informal sector. This means that a lot of the people are just doing small jobs, or are small-scale farmers, they're just doing work on the side of the road, they sell things, they're traders. And they're all doing it because the mobile phone has allowed them to do it. I've said many times I think half the GDP growth in Kenya comes because of the mobile phone revolution, not because of anything else. It has provided these people means of communication. Particularly things like money transfer, which we have been doing now for nearly two years, it has made a huge impact on people's lives"* (AllAfrica 2009).

The impact that mobile phones has had on GDP has undoubtedly been over-hyped, but it is clear that the spread of mobile phones has transformed peoples' environment, both socially and economically. Increased connectivity has been documented to have a positive economic effect. If there is a causal link between mobile phone access/use and poverty alleviation, how strong is the alleged causality? According to a highly cited Vodafone study from 2005, a *"1 per cent increase in mobile penetration rates is associated with 0.5–0.6 per cent higher rates of FDI/GDP"* (Vodafone 2005, p. 28). A more recent macroeconomic study published in 2009 and carried out by Christine Zhen-Wei Qiang of the World Bank, *"found that an increase of ten percentage points in mobile phone adoption in a developing country increased growth in GDP per person by 0.8 percentage points"* (The Economist 2009).

It is complex and hard to measure the impact of mobile phones on the society. If the causal link between mobile phone penetration/adoption and GDP growth is proven, how does it look like? Ethan Zuckerman, founder of Geekcorps and co-founder of Global Voices Online and who currently serves as a fellow at the Berkman Center for Internet and Society, writes that:

> *"The changes brought by mobile phones are both subtle and omnipresent – mobile phone numbers painted above shop doors allow merchants to untether from their stalls; carpentry ads scrawled on road signs turn a craftsman with a phone into an independent, mobile business; secure money transfers from abroad pay the village school fees that grant a child an education"* (Zuckerman 2009).

Accessibility and access; the simple fact that people can be reached and that they can reach out makes a difference and increases people's productivity and well-being. However, as sales, access, and coverage continue to grow, *"it is yet to be seen whether the mobile phone will play a significant, sustained role in alleviating pov-*

erty in the developing world" (Corbett 2008). The signs are undoubtedly positive but there are many key questions that still need to be answered. How exactly does the causal link look? How does the mobile phone enable and empower citizens in developing countries in their social, economical and political life? How can mobile phones generate social capital and how can this capital be transformed into economical opportunities and political participation and mobilization?

Mobiles phones for development (M4D), sometimes referred to as mobile communication technology for development, is a broad concept and the term covers many different technologies and sectors. There is great diversity of projects and approaches and many different stakeholders are involved. The number of available and relevant simple applications for social and economic development are still limited seen to the potential and number of subscribers. Small pilot projects are too often labelled success stories despite lacking a recipe for scaling up.

The 'killer' application in East Africa is still voice. Two other strong candidates are SMS and beeping, i.e. to call someone and hang up before the call is answered with the hope to be called back. Data traffic in East Africa is not yet widespread but is coming strong. The simple mobile applications that do exist are mainly in the financial, health and agriculture sectors with a few in education and governance. This study has identified more than 120 interesting applications (see Appendix 2 for the full list), ranging from many small pilots to a few full- scale implementations. So under which conditions are these applications deployed? The following section will give an overview of the state of East Africa's ICT (information and communication technology) sector with a focus on the mobile market.

Overview of East Africa's ICT sector and mobile market

UN's International Telecommunication Union, ITU, estimated that there were 4.6 billion mobile phone subscriptions globally by the end of 2009 (ITU 2009b), two-thirds of them in the developing world. A quarter of a billion mobile subscribers can be found on the African continent and the number is constantly increasing as it is the region with the highest annual growth rate in mobile subscribers (ITU 2009a).

As seen in data from ITU in Table 1, computing technologies are unfamiliar and unaffordable – internet users are few and computers in households are rare. The fixed line sector has remained stagnant since the East African countries decided to abandon government-run telecommunication systems and instead offer mobile network licenses to the highest-bidding private investors. The region's mobile sector on the other hand, has achieved remarkable growth and expansion in the past decade and the annual growth rate in East Africa has been above the African average (Table 2)

Table 1: Internet users, computer ownership and fixed lines

	Kenya	Rwanda	Tanzania	Uganda	Africa
Internet users per 100 inhabitants, 2008	9%	3%	1%	8%	4%
Households with a computer, 2007	5%	0.3%*	2%*	5%*	5%
Fixed telephone lines per 100 inhabitants, 2008	0.7%	0.2%	0.3%	0.5%	2%

Source: ITU 2009a. *Figures are estimates or refer to years other than those specified.

Table 2: Mobile penetration and growth rate

	Kenya	Rwanda	Tanzania	Uganda	Africa
Mobile cellular penetration*, 2003	5%	2%	2%	3%	5%
Mobile cellular penetration*, 2008	42%	13%	31%	27%	33%
Compound Annual Growth Rate, 2003–2008	54%	55%	68%	56%	44%

Source: ITU 2009a. * Mobile penetration is defined as the number of active SIM cards/population so can exceed 100%

East Africa's mobile communications market is still relatively young, but the level of competition in the mobile and internet market has increased dramatic over the past few years. Improved regulatory structure and technology advancement has led to an unprecedented growth. However, according to the ITU statistics, overall penetration rates remain low even though mobile network coverage reaches areas far beyond that covered by fixed line infrastructure. For example, 84% of the Kenyan population have mobile coverage (CCK 2009) so there is significant room for expansion compared to mobile penetration. Statistical data like this is not giving the whole picture though. Taking East African demographics into account, where 42–49 per cent are under the age of 15 years, gives a total different penetration rate since the use of mobiles should be per adults, not per total population. See the paragraph "Actual phone-ownership and use" for a more detailed discussion.

The recent global economic crises has affected the market and while European and Middle East telecom companies' are slowing down their investment, Asian, mainly Indian, companies step in. The East African market will most likely become even more competitive in the few years to come, and due to the launch of several key projects and products, mobile services other than voice are expected to boom.

The competitive environment has also encouraged innovation and East Africa has emerged as a testing ground for new applications. For many end-users though, the environment is *not* good enough. Handsets are too expensive, airtime credit runs dry too quickly, promised service is not delivered and applications and solutions are not well known. This creates other types of innovations: unconventional ownership models such as village phone concepts and shared handsets practices but also multiple SIM card ownership. Decentralized prepaid payment plans and electricity constraints also creates another type of usage compared to other parts of the world.

Actual phone ownership and use

The tremendous growth that the region has experienced over the past few years is linked to the improved regulatory structure and technology advancement but also to the phenomenon of multiple connections per user. Users tend to have more than one SIM card depending on a number of things like operators differences in geographical coverage, varying quality of the network, and the cheapest prepaid deal currently on offer.

Mobile penetration is defined as the number of active SIM cards divided by the country's population. Operators use different techniques to decide their customer base and subscriber numbers are computed in a myriad of ways. Some count every SIM card ever sold while other look at active subscribers. The latter technique is called dynamic validity: subscribers are customers who have participated in a revenue generating activity in the last 90 days. Why do some operators want to communicate that they have a high subscriber base and what is the problem doing it? Ewan Sutherland, Research Fellow at LINK Centre, University of the Witwatersrand, explains:

> *"Having a large number of customers looks good for mobile network operators, especially when making a case to government. On the other hand, it reduces the Average Revenue Per User (ARPU), since the total revenues must be spread more thinly, and thus it disappoints financial analysts"* (Sutherland 2008).

Regardless how the operator counts the subscriber number it does not address the problem of multiple SIM card ownership. There is a clear difference between mobile subscriptions (SIM ownership) and actual ownership and use (phone ownership and access). An individual may only have one SIM card and no phone, others may have many SIM cards and one phone while others yet may have many SIM cards and many phones.

A sound hypothesis is that actual ownership of mobile phones is much lower than that of the subscription statistics in East Africa. Richard Heeks, Professor of Development Informatics in the Institute for Development Policy and Management, University of Manchester, writes in a blog post that mobile subscription figures are overestimates of in-country mobile ownership due to a number of reasons like multiple subscriptions, short term visitors in the country, subscribers in neighbouring countries. He asks:

> *"How big is this effect? Of course it varies, but a gratingly rough estimate is that in-country ownership is 75% of the subscription figure"* (Heeks 2009).

However, one must remember that mobile subscription figures might be underestimates of in-country mobile phone access. Heeks give us two reasons: first private mobile phones are commonly shared with family, friends, neighbours, etc. Secondly, public mobile phones are accessed by many (Heeks 2009). A large proportion of the rural population in East Africa are covered by a mobile signal and through indirect access, i.e. sharing of handsets and using public phones, they too can benefit and communicate. Heeks end his blog post by stating that *"ownership might get messed up by age demographics"* since a big portion of the population *"might be seen as too young (10 or under) to own a mobile phone"* and that *"the mobile subscription per capita figures and the actual ownership per capita of adult populations could [ironically] be about the same"* (Heeks 2009).

Internet and submarine cables

In terms of Internet connectivity, East Africa has been among the worst places in the world, hampered by expensive satellite access and non-sufficient traditional fixed-line networks. However, international undersea fibre optic cables, some which have been in the pipeline for years, have finally landed on the East African shores. Seacom was the first submarine cable to connect in Mombasa in July 2009, TEAMS landed shortly thereafter. One can wonder why it is has taken so long to connect East Africa to the international submarine cable systems. The answer is not so much of a technological issue, rather one about lack of agreement among the African governments, companies and international institutions about tariffs, access models and other management issues. And that of pirates outside the coast of Somalia.

With the arrival of the long awaited undersea cables, major shifts in the internet service provider (ISP) business is taking place as players position themselves. Several competing wireless broadband networks and national fibre backbones are being rolled out. For example, industry top players in Kenya like Safaricom, Zain Kenya, Access Kenya, and Wananchi Group are all buying smaller ISPs in search of value buys. Landing of the cables have improved internet capacity in terms of bandwidth, speed and reliability, and it is perceived that the cost of communication will drastically reduce as competition is heating up. This will eventually lead to a rapid increase in internet penetration and open up internet to the majority in the region that still lack affordable access. However, there is still a long way to go and despite the arrival of two submarine cables, prices for internet connectivity remains high. Most ISPs have doubled the bandwidth while keeping the same prices instead of lowering the prices. This is unfortunate since lower prices is what the region needs considering the fact that internet still remains out of reach to the majority of East Africans, especially in rural areas. Capital FM in Kenya reports that *"the providers have been accused of behaving like a cartel but they have defended themselves arguing that they need to recoup their investments"* and that the Kenyan government *"has sent out a warning that it would be forced to step in and regulate internet connectivity charges if the prices will not come down significantly"* in the near future (Njoroge 2009).

Not only do mobile operators become ISPs, when mobile phones to a larger extent are used as an internet access point and mobile usage of laptop computers is becoming more common, the role of Internet Protocol (IP) as *the* platform for future mobile services is being established.

Table 3. East African undersea fibre optic cable systems

Project	Official launch	Length (km), capacity and landing points	Comment
SEACOM, www.seacom.mu/	July 2009	17,000 km, 1.28 Tb/s. Links South Africa, Madagascar, Mozambique, Tanzania, and Kenya with India and Europe.	Private initiative, majority of its shareholders based in Africa. Total investment US$600 million.
TEAMS (The East African Marine System)	September 2009	4,500 km, 1.2Tb/s. Links Kenya with the United Arab Emirates.	Spearheaded by the Government of Kenya. Major owners are the government, Etisalat, Safaricom and Telkom Kenya.
EASSy (The Eastern Africa Submarine Cable System), www.eassy.org/	Planned June 2010	10,500 km, 1.4 Tb/s. Will link Kenya, Tanzania, Sudan.	Indicated launch in 2005 but internal struggle delayed the process. Initiated by operators and supported by NEPAD.

Source: SEACOM 2010, Wikipedia 2010, EASSy 2010

Kenya

East Africa's most prosperous economy is not surprisingly the regions mobile technology cluster. Kenya with its capital Nairobi, has a vibrant ICT community with a number of top-class, innovative technology firms and research and development facilities. With the deregulation of the telecommunications sector, Kenya moved beyond a duopoly consisting of Safaricom and Kencell (today Zain Kenya) at the end of 2008 when Orange Kenya and Yu launched services as the third and fourth players. Combined, the total subscriber base is over 18,5 million users (CCK 2009) out of a population of about 40 million (UN 2009). The deregulation, together with the introduction of a single license for ICT service providers, have in many ways levelled the playing field for other service providers and lead to increased competition. In this streamlined licensing framework, a holder of a single license can offer many different services without additional licenses. Also, during 2009, the telecommunication regulator in Kenya *"established policy guidelines on infrastructure sharing in an effort to ease the investment burden of new entrants into the market and avoid duplication of resources"* (CCK 2009). As a result, Zain Kenya and Yu agreed to share infrastructure.

The operators in Kenya have really made an effort to reach more users through creative marketing, compelling tariffs and promotions, and expanded network infrastructure. The high number of subscribers is however a double-edged sword for operators. The overall revenues are still high and increasing but the Average Revenue Per User, ARPU, has declined. Due to increased competition, operators are forced to lower their prices which opens up for new subscribers among low-income groups, i.e people who can not spend too much. Statistics from the Kenyan regulator on mobile traffic reveal that in average, a Kenyan subscriber talk only 48 minutes per month and send 16 SMS (CCK 2009).

In Kenya, the main institutions in the sector are:

- The Ministry of Information and Communications (www.information.go.ke/), which was created in order to facilitate ICT development in Kenya. The functions of the Ministry are mainly to formulate and implement ICT policies, promote the development of ICT capacity and to disseminate and enhance public access to information.
- The Communications Commission of Kenya (CCK, www.cck.go.ke/) is the independent regulatory authority for the communications industry in Kenya. Its role is to license and regulate tele- and radio-communications, and postal/courier services in Kenya. It was established in February 1999 by the Kenya Communications Act, 1998.

- Kenya ICT Board (www.ict.go.ke) mandate is fourfold: market and promote Kenya as an ICT destination both locally and internationally; advise the government on all relevant matters pertaining to the development ICT in the country; capacity building for government and other stakeholders; and project management, i.e. coordinating, directing and implementing ICT projects in development.

Table 4: Kenya

Kenya population	40 million (urban 41% rural 59%)
Surface area (square kms)	580 thousand
Under the age of 15 years	43%
Illiteracy rate	26%
Mobile subscribers 4Q 2009	18,5 million
GNI per capita 2007, US$	777
Mobile and broadband price basket 2009 (% of GNI per capita)	12 respectively 68
Mobile coverage (population)	84%
Mobile coverage (land)	33%

Source: CCK 2009, UN 2009, UN 2010, ITU 2010.

Rwanda

Rwanda has a very clear vision about ICT as a tool for development, which is well articulated by the authorities. However, the aftermath of the 1994 genocide and a mono/duopolistic market structure of MTN Rwanda and Rwandatel until 2006 have halted the developments in the sector considerably. According to ITU, the penetration rate was 13% in 2008 (ITU 2009a), and around 20% end of 2009, which means that the market is still untapped and with a lot of potential. Rwanda is now catching up with other markets in East Africa using different methods. In 2007, the government reclaimed the company Rwandatel from Terracom for a payment of just US$25 million stating that *"Terracom had not honoured network deployment contracts"* and sold it off for US$100 million to the Libyan company LAP Green just a few months later (Cellular-news 2007). At the end of June 2008, the Rwanda Utilities Regulatory Agency (RURA, www.rura.gov.rw/) invited bids for a third licence with the hope that increased competition would lower the prices for subscribers and thereby dramatic increase the mobile penetration rate closer to the African average. Zain, with operations in neighbouring countries of Kenya, Tanzania, Uganda and Democratic Republic of Congo, put a bid but lost to Millicom, who operates under the name Tigo in sixteen countries in Asia, Latin America and Africa. Tigo launched in late 2009 and have since created a regional roaming network covering Rwanda, Tanzania and the Democratic Republic of Congo where it operates under the same name.

A National ICT Plan has been developed and ICT has been identified as the primary catalyst empowering the government's vision for Rwanda, which seeks to transform itself from an economy largely based on agriculture to one based on knowledge and information. This commitment by government to make sure that the ICT strategy is followed is unique. The Rwanda Information Technology Authority (RITA, www.rita.gov.rw) was created in 2002 to coordinate the implementation of the strategy. Due to this commitment and to its small size, Rwanda has good geographical coverage of the mobile network and one of the most developed national fibre infrastructures in the region, now connected to the high-bandwidth submarine cables by the East African coast. Rwanda has a very flexible licensing regime offering something close to a universal telecommunications license.

However, one has to remember that Rwanda is good at promoting itself as an information hub, and is using all sorts of ICT terminologies to do so. Despite all the progress, when talking to people on the ground the story is usually different. Some believe that there has been some real progress and that the status is at an advanced level, while others stress that everything that exists is just a good plan and good marketing but concrete actions are yet to be seen. Many challenges remain at private sector level: the

problems of quality of service, lack of competition, high prices etc., are still big issues. Rwanda still has a long way to go to become the regional ICT hub it aspires to become.

Table 5: Rwanda

Population	10 million (urban 16% rural 84%)
Surface area (square kms)	26 thousand
Under the age of 15 years	42%
Illiteracy rate	31% (whereof male 41% female 59%)
Mobile subscribers 4Q 2009	2 million
GNI per capita 2007, US$	351
Mobile and broadband price basket 2009 (% of GNI per capita)	19 respectively 258
Mobile coverage (population)	100%
Mobile coverage (land)	90%

Source: NISR 2009, UN 2009, RURA 2009, ITU 2010.

Tanzania

When The United Republic of Tanzania passed the Tanzania Communication Act no. 18 of 1993 it lead to the opening of the telecommunications markets and the establishment of Tanzania Communication Commission. It later merged with Tanzania Broadcasting Commission and became the Tanzania Communications Regulatory Authority (TCRA, www.tcra.go.tz/), established by the TCRA Act no. 12 of 2003. In September 2005, the Government of Tanzania and Tanzania Communications Regulatory Authority (TCRA) introduced a converged licensing framework and the concept of technology neutrality, which was meant to enhance the provision of communication services in the country. It has worked and the mobile market in Tanzania has been growing at more than 60% per year in the last five years and passed the 17 million subscriber mark in December 2009 (TCRA 2009).

Tanzania now has a fully competitive telecommunication sector with six operational mobile networks. The four major dominating companies are Vodacom Tanzania, Zain Tanzania, Tigo and Zantel. BOL Mobile and TTCL Mobile are both still below the 200,000 subscriber mark. There are another seven additional players licensed under the converged regulatory regime (TCRA 2009) but if they will go live any time soon remains to be seen. More than 1,7 million new subscribers registered in the first half of 2009, this means that every day almost 1,000 people bought a new SIM card (TCRA 2009). The SIM card penetration level is still low though, estimated at 32% of the population (ITU 2009a) so the market growth is set to continue.

Table 6: Tanzania

Population, 2008 prediction	41 million (urban 26% rural 74%)
Surface area (square kms)	945 thousand
Under the age of 15 years	45%
Illiteracy rate 2002	29%
Mobile subscribers 4Q 2009	17,3 million
GNI per capita 2007, US$	366
Mobile and broadband price basket 2009 (% of GNI per capita)	28 respectively 173
Mobile coverage (population)	48%
Mobile coverage (land)	N/A

Source: UN 2009, TCRA 2009, National Bureau of Statistics 2009, ITU 2010.

Uganda

Since Celtel (today Zain) launched Uganda's first mobile network in 1995, followed by MTN in 1998, Uganda has witnessed a revolution in mobile growth. In 1999, Uganda became the first country on the African continent where the number of mobile subscribers passed the number of fixed-line users. This is because there were, and still are, so few fixed-lines in place. The telecommunication sector transformed when the market opened up. First out was Uganda Telecom Ltd in 2001 followed by Warid Telecom in 2008. Orange entered in 2009 after buying a majority stake in the country's fifth mobile licence, HITS Telecom, and pledged to invest hundreds of millions of US dollars. Two interesting low-cost operators have recently entered the market. Smile Communication of South Africa, which is one of the first VoIP (Voice over Internet Protocol) over WiMAX phone and service on the African continent, and I-Tel Ltd of Uganda who are using CDMA technology. The entrance of Smile and I-Tel Ltd brings the number of operating companies to seven, and yet more operators are knocking on the door.

Despite the fact that the market is consistently growing, penetration rate is still low below the African average of 33% (ITU 2009a). This indicates that SIM cards and handsets remain beyond the reach of the masses in terms of affordability. In order to address this and other access related problems, Uganda, as one of the first countries in Africa, developed a policy on universal access and set up a Rural Communications Development Fund (RCDF) in 2001. Operators in Uganda have to pay a 1% levy on revenues to this fund, money that is later used to implement internet points of presence, internet cafés and public pay phones in rural areas.

Most key policies, laws and regulations are in place: Uganda Communications Act of 1997, National ICT Policy of 2003, and various supporting regulations came in force 2005. Also, a simplified licensing regime has significantly reduced barriers to market entry and increased competition, which has lead to lowered tariff rates across the sector. In 2008, as the market's old trio of Zain, MTN and Uganda Telecom Ltd prepared to take on new entrants Warid and Orange, they lowered the tariff rates by 10%.

The key players in the sector are:

- The Ministry of Information and Communications Technology (www.ict.go.ug/) that was established in 2006. It has a mandate to provide overall coordination, support and advocacy on all matters of policy, laws, regulations and strategy for the ICT sector in Uganda. The Ministry has divided the sector into three levels: policy, regulatory and operational. The operational level is composed of telecommunications, postal and broadcasting operators. The regulatory level is composed of Uganda Communications Commission (UCC) and the National Information Technology Authority (NITA-U).
- The Uganda Communications Commission (UCC, www.ucc.co.ug/) is the regulatory body in charge of the communications sector in Uganda with the principal goal of developing of a modern communications sector and infrastructure in the country. Recently merged with the Broadcasting Council and will thereby oversee both communication and broadcasting matters.
- NITA-U was set up in 2009 to coordinate, promote and monitor ICT development within the context of national, social and economic development.

Table 7: Uganda

Population	33 million (urban 15% rural 85%)
Surface area (square kms)	241 thousand
Under the age of 15 years	49%
Illiteracy rate	26%
Mobile subscribers 4Q 2009	11,8 million
GNI per capita 2007, US$	396
Mobile and broadband price basket 2009 (% of GNI per capita)	23 respectively 555
Mobile coverage (population)	Close to 100%
Mobile coverage (land)	65%

Source: UN 2009, UBOS 2010, ITU 2010.

Major operators in East Africa

The impressive development of the East African mobile market described above has been driven by two main factors, namely drastic technology advancement and deregulation of the telecommunication markets. Competition in the East African mobile market has lead to major investments and is intensifying even more as major players race to win the remaining mobile phone licences. Company ownership keeps switching and operators disappear and merge. For years, European, Middle Eastern and South African operators have dominated the East African mobile sector. Recently Asian service providers have woken up and scramble for their piece of the cake. At the moment it is mostly Indian firms that are looking at new markets.

By looking at ownership structures it becomes clear that investors have operations in many East African countries (see table 8) and economically this makes sense. In Rwanda, Tigo for example with its strategic position between its operations in Tanzania and Democratic Republic of Congo opens up for huge possibilities and offers potential operational synergies.

Table 8: Operators in East Africa

Kenya

Operator	Launch	Subscribers 4Q 2009	Ownership
Safaricom (www.safaricom.co.ke)	Mar 1997	14,9m	Vodafone, public float
Zain Kenya (www.ke.zain.com)	Aug 2000	2,2m	Bharti Airtel
Orange/Telkom Kenya (www.orange.co.ke)	Sep 2008	0,8m	France Telecom, Telkom Kenya
Yu Essar Telecom Kenya (www.yu.co.ke)	Nov 2008	0,6m	Essar Group

Rwanda

Operator	Launch	Subscribers 3Q 2009	Ownership
MTN Rwanda (www.mtn.co.rw)	Sept 1998	1,7m	MTN Group, Tri-Star Investment
Rwandatel (www.rwandatel.rw)	Dec 2008 (re-launch, CDMA services prior this)	0,2m	LAP Green (a subsidiary of Libyan African Portfolio, LAP), National Social Security Fund
Tigo (www.tigo.co.rw)	Dec 2009	N/A	Millicom International Cellular (MIC), Marathon Corporation

Tanzania

Operator	Launch	Subscribers 4Q 2009	Ownership
Vodacom Tanzania (www.vodacom.co.tz)	Aug 2000	6,9m	Vodacom Group (Pty) Ltd (South Africa), Mirambo Ltd (Tanzania)
Zain Tanzania (www.tz.zain.com)	Dec 2001	4,9m	Bharti Airtel
Tigo, www.tigo.co.tz)	Sep 2000	4,0m	Millicom International Cellular (MIC)
Zanzibar Telecom Ltd (ZANTEL, www.zantel.com)	Aug 1999	1,4m	Etisalat, Zanzibar Telecom Ltd
TTCL (www.ttcl.co.tz)	Apr 2006	0,1m	MSI (Netherlands), Detecon (German), Government of Tanzania
BOL Mobile (www.bolmobile.co.tz)	Jan 2000	0,003m	Benson Informatics Ltd. .

Uganda

Operator	Launch	Subscribers 4Q 2009	Ownership
MTN Uganda (www.mtn.co.ug)	Oct 1998	5,2m	MTN Group
Zain Uganda (www.ug.zain.com)	May 1995	2,3m	Bharti Airtel
Uganda Telecom Ltd (UTL, www.utl.co.ug)	Feb 2001	2,3m	LAP Green (subsidiary of Libyan African Portfolio, LAP)
Warid Telecom Uganda (www.waridtel.co.ug)	Feb 2008	1,6m	Essar Group, WARID Telecom International
Orange Uganda (www.orange.co.ug)	Mar 2009	0,4m	France Telecom, HITS Telecom
Smile Communication (www.smilecoms.com)	Nov 2009	N/A	Al-Nahla Technology (Saudi Arabian consortium), South African investors.
I-Tel Ltd (www.itelug.com)	Sep 2009	N/A	Ugandan investors.

Source: Industry data

East Africa's mobile phone market is dominated by Zain, MTN, Safaricom and Vodacom (see descriptions below). In terms of services offered they are quite similar; they all have data services and some offer 3G, their roaming services in the region are well developed and they are all struggling with declining ARPU. In order to address this particular problem and to contribute towards customer loyalty, they all have a robust mobile money transaction service and an applications menu that is entertainment focused.

ZAIN

Zain operates in 23 countries in Africa and the Middle East. In East Africa they can be found in Kenya, Tanzania and Uganda. Other sub-Saharan Africa countries where Zain operates are Burkina Faso, Chad, Democratic Republic of Congo, Republic of Congo, Gabon, Zambia, Malawi, Madagascar, Niger, Nigeria and Sierra Leone. Zain launched in Uganda in 1995 as Celtel, in Kenya in 2004 also as Celtel after acquiring KenCell, and in Tanzania in 2001. They were all re-branded to Zain in 2008 following the acquisition of mobile communications entrepreneur Mo Ibrahim's Celtel networks in 2005. Zain then embarked on an aggressive marketing and subscriber recruitment drive but has struggled to maintain its profits in a tight mobile market.

One Network is a border-less network that Zain first introduced and piloted in September 2006 in East Africa. The idea is to allow customers to make calls at local rates and receive calls for free within the operator's network. George Held, Zain's Marketing Director for Products and One Network, states in a interview that they *"believe geographical borders are for historical reasons and should not stop people's interaction"* (New Vision 2009). According to Held, Zain has seen a substantial increase in the customer base in the region after One Networks introduction. For example, when Zain launched it in Democratic Republic of Congo in 2007 *"there was a surge in customers in Uganda, Kenya and Tanzania because of these cross-border activities, especially the lake area"* (New vision 2009). Seen from an alignment perspective, Zain is able to synergise and develop products that are global and fairly easy to scale-up. The One Network initiative being one example, their m-commerce platform Zap another.

Zain has been in numerous discussions with potential buyers the last few years. The Indian company Bharti Airtel is the latest in line that has entered into talks regarding the acquisition of Zain Africa. With successful operations in India, which is also characterised by huge rural population and low incomes and tariffs, Bharti Airtel has been looking to expand its African footprint for several years, with two failed attempts with MTN Group. First quarter 2010 Bharti Airtel signed a deal with Zain valued US$10,7 billion.

MTN

The Johannesburg based pan-African mobile operator MTN is currently operating in 21 countries across Africa, Asia and Middle East. In mid May 2009, the company passed the 100 million subscribers mark and is thereby Africa's largest mobile operator by subscriber numbers (MTN 2009). Its network covers a population of approximately 500 million, meaning that 1 in 5 people where MTN operate is a subscriber (MTN 2009). MTN is also the market leader in both Rwanda and Uganda. At the time MTN entered the Uganda market in 1998, the Ugandan government had just opened up the sector and in the first five years of operation, MTN went from zero to 1 million subscribers and today MTN is one of the leading taxpayer to the Ugandan Treasury. Its major products in the region as MTN Mobile Money, MTN Village Phone and MTN Zone, which is a tariff that gives location based discounts depending on the location at the time of calling and the level of traffic on the network.

Lately it has been rumours about MTN moving its headquarters from South Africa to the Middle East and Dubai since much of the company's growth is due to the success operations in the Middle-Eastern markets (Cellular-news 2010b).

Safaricom

Safaricom has the largest customer base of any kind in Kenya and is one of East Africa's most profitable and respected companies. Safaricom made a staggering 58,8 billion Kshs (US$839 million) in revenue on voice only from 31 March 2008 to 31 March 2009. That represents more than 80% of the total revenue. In other words, voice is still the "killer" application and generates most of the revenue (Nairobist 2009). In a strategy to keep subscribers happy and increase the revenue even further they run a content platform called Safaricom Live for digital media such as applications and games, ringtones, music and video clips, wallpapers, images and text, e.g. news, horoscopes, jokes and more. From March

2008 to March 2009, SMS constituted roughly 7% of the revenue, data traffic about 2% and Safaricom's most successful product, the money transaction application M-Pesa, generated 4% up from 0.6% in the previous year (Nairobist 2009).

Through various acquisitions and going by the new CCK licensing regime, Safaricom is becoming a leading ISP in East Africa. Safaricom has acquired substantial bandwidth on the SEACOM project and have paid for a 20% stake in TEAMS undersea fibre optic cable. With products like M-Pesa and data services through its 3G network, Safaricom looks quite confident on its position as the market leader in Kenya.

Vodacom

Vodacom Tanzania is the largest telecommunications company in Tanzania followed by Zain Tanzania. Vodacom went live in August 2000 and four years later Vodacom connected its one millionth customer. In March 2006 there were two million customer, in January 2007, three million, and in end of 2009 they had over 6 million subscribers and the company continues to grow rapidly (Vodacom Tanzania 2010). Vodacom has always been at the forefront in Tanzania by introducing new services like 3G in Dar Es Salaam in early 2007 and rolling out M-Pesa in 2009. The other main products are; VodaFASTA which is an airtime distribution and recharge service; a set of content services run by Starfish Mobile East Africa LTD called VodaFLAVA; and the East African roaming service Kama Kawaida.

Prepaid mobile phone rates

Table 9 give a broad overview of prepaid services and basic prices for the two biggest operators in each of the East African countries. The Data show that it is cheaper to make a call and send SMS on network, i.e. communicate within the same carrier. It is relatively more expensive to make calls in Tanzania than in the other East African countries but SMS charges are about the same. The prices can differ quite a lot between operators within the same country, explaining the phenomenon of multiple SIM card ownership. This is a very popular practice and users usually carry around a phone with one SIM card in it but if they need to call someone on another network they simply switch the SIM, make the call and later switch it back. Some users even have a different mobile phone for each operator, one phone in each pocket and one around the neck. Mobile phones designed for dual SIM cards are also popular.

As seen in Table 9, roaming agreements between regional networks reduce the rates. Roaming means that subscribers can receive or make calls in multiple countries without having to replace the SIM card, given that there is an agreement between the operators. This attracts people to stay on the network and keep their number instead of switching to another operator. Operators in East Africa have taken a world lead role by abolishing international mobile roaming surcharges and sharing of infrastructure including the airtime vouchers. For example, MTN Uganda is partnering with Safaricom Kenya, Vodacom Tanzania and MTN Rwanda, which according to the marketing slogan creates "the largest mobile family in East Africa". Rwandatel has started a roaming service with UTL Uganda who also has an agreement with Safaricom Kenya and Vodacom Tanzania. Call rates are kept low for voice and SMS in most roaming agreements. Many operators do not have application or data roaming agreements and the ones that do have usually charge data roaming rates which can be extremely costly. However, roaming might be a thing of the past when the market consolidates and new technologies are helping operators to avoid the high operational costs related to roaming. Zain's One Network, which is a seamless roaming platform for all its operations in Africa and Middle East, leads the way and other operators in the region follow suit. MTN with their product MTN One World is a clear example.

Table 9: Call rate per minute and SMS charges

Operator	Call rate per minute, prepaid peak*					SMS		
	On local network	Regional network partners	To other local networks	Regional/ other networks	Interna-tional	On local network	Regional	Interna-tional
Kenya								
Safaricom	8 (0.10)	18 (0.23)	12 (0.15)	30 (0.38)	25–50 (0.32–0.64)	3.50 (0.04)	5 (0.06)	10 (0.13)
Zain Kenya	8.50 (0.11)	34.50 (0.44)	18.50 (0.24)	51.50 (0.65)	112.50 (1.43)	5.50 (0.07)	3.50 (0.04)	10 (0.13)
Rwanda								
MTN Rwanda	90 (0.15)	128 (0.22)	126 (0.22)	140 (0.24)	250 (0.43)	30 (0.05)	53 (0.09)	80 (0.14)
Rwandatel	72 (0.12)	120 (0.20)	120 (0.20)	120 (0.20)	120 (0.20)	10 (0.02)	15 (0.03)	15 (0.03)
Tanzania								
Vodacom Tanzania	384 (0.28)	422 (0.30)	499 (0.36)	448 (0.32)	448–896 (0.32–0.64)	53 (0.04)	53 (0.04)	118 (0.08)
Zain Tanzania	265 (0.19)	340 (0.24)	340 (0.24)	350 (0.25)	400–700 (0.29–0.50)	59 (0.04)	59 (0.04)	132 (0.09)
Uganda								
MTN Uganda	340 (0.16)	450 (0.22)	500 (0.24)	550 (0.26)	600 (0.29)	110 (0.05)	130 (0.06)	220 (0.10)
Uganda Telecom Ltd (UTL)	320 (0.15)	450 (0.22)	320 (0.15)	550 (0.26)	650 (0.31)	133 (0.06)	133 (0.06)	169 (0.08)

Source: Industry data. *Peak hours are not readily defined, usually Mondays–Fridays 07h00–20h59. Vodacom define peak Mondays–Sundays 17h00–20h59. All rates are inclusive of VAT and excise duty, prices in local currency and US$.

Tariffs and promotions

It is not easy for a mobile phone customer to choose the best call tariff. The high number of new tariffs and promotions launched in the market easily cause consumer confusion and thereby create opportunities for operators to overcharge. Even though the operators offer cheap rates, they know exactly what they are doing and how to control the costs to still make a profit. Profit in this case is a game of margins multiplied by volumes. Designing the tariffs is also a numbers game and there is always a precondition before the customer joins a tariff. The basic logic behind promotions and tariffs is that if the operators can afford to bring down margins they will do it because it will increase usage that in the end will make profitability go up.

Typical offers by the East African operators are about free calls within the network, given that you spend a minimum amount daily or load a certain amount of credit. Offers are usually sent by USSD when loading airtime or by SMS. A typical "offer" from an operator sent by SMS can look like this:

> *Enrich your Lifestyle!!! Fully furnished homes, cars and more. Buy a Zain product, type *150#, pick yes/call to enter the draw. For more information please call 1100. Terms and conditions apply.*

Innovative tariffs can be a real milk cow for operators. When MTN Uganda launched the MTN Zone in July 2008, it became so popular that it, according to MTN Public Relations Officer, Ms Sheila Kangwagye, *"is by far one of our best product launches onto the market next to the SMS product"* (Wafula 2008). Basically, MTN Zone tariff offers discounted calls depending on network load at any particular time, sometimes, but rarely, up to 99% discount. It is in other words a dynamic tariff that gives discount when there is capacity, and if there is not enough capacity in the network, no discounts. Calling odd hours usually gives higher discount. Since the offer is so compelling, the network is usually too busy which means that the discount rate is closer to zero.

Another very popular promotion was one that UTL in Uganda ran in 2008. This could be read in Uganda's daily New Vision:

> *"utl, the 'Vroomula' promos is real*
> *The ongoing utl Vroomula is quite impressive in its consumer outreach. Just think, the average person has a chance to win one of the Premios [Toyota saloon, refurbished]. In the past few weeks, we have seen two students, a prison officer, a local trader and a banker win Premios. The cars look beautiful and manageable, and I must say, the choice was well-thought of. Since the beginning of the promotion, I enter the draw five times a day. You might think I am crazy to enter so many times, but I surely stand a higher chance of walking away with a Toyota Premio. good work Uganda telecom and keep it up"* (New Vision 2008).

Some operators practically run lotteries on their networks. Users send a premium SMS to enter a draw, which can be done as many times as the user prefer. The result is a lottery, since the promotion is not tied to any particular service.

Regulators usually step in when operators go too far. In Uganda in 2008 when competing operators started to offer off-peak call rates discounted up to 100 percent, which led to heavy traffic but also resulted in poor quality of service and jammed switches, the regulator UCC forced the operators to either stop the promotions or upgrade their switches and network capacity. In 2009, the regulator in Kenya, CCK stepped in and tried to introduce new price regulations that will force the operators to notify the regulator well before they want to change a tariff or put a stop to long-running promotions.

Mobile phones and usage

The mobile phone has evolved from just a tool for making calls and handle voice; even the basic, low-end mobile phone on the market today is quite powerful; it handles SMS, text and digital storage and often comes with key functions such as an address book to store contact information, a clock that can be used for alarms and reminders, a calculator etc.. Some basic models even have a small torch. Slightly more advanced models have a music player with an audio recorder, a camera to shoot photographs and short videos, and a platform for games. Most new models are now IP (Internet Protocol) enabled and can function as an internet access point: to upload and download information, for social networking and blogging, send and receive e-mails and stream media. With the spread of mobile money transactions, mobiles have begun to replace wallets as well. As the technology grows increasingly sophisticated it replace earlier technologies and different technologies are merging into one universal gadget, much thanks to internet's open standards, which have accelerated the convergence of voice, SMS, data, video and wireless services. All this have generated new business models, products and services.

How is the mobile phone used by people in East Africa to access and disseminate information? Below (Table 10) is an overview of seven possible forms of access to information and communication services and the various channels that can be potentially used for service models. It is compiled by the Technical Centre for Agricultural and Rural Cooperation (CTA) who is working in the field of information for development.

Table 10: Forms of access and the various channels

Methods of access	Channels	Examples
Radio The most accessible and widely used form of communication across the region	Broadcasting Community Radio Feedback through mobile phone: SMS to radio Mobile phones equipped with an FM transmitter	Common ways to combine mobiles and radio: Channel for listeners to contribute news, views, stories and feedback Sending SMS to listeners on upcoming programmes, competitions or events Using SMS to transmit important information to be broadcast on radios during emergencies, for search and rescue, alerts and early warnings etc
Basic mobile phones Low-end mobile phones	Voice SMS Voice to text/text to voice Interactive voice response (IVR)	Voice conferencing 'Dial-up radio' Data collection and monitoring Logistics coordination
Mid-range mobile phones	Data transfer through GPRS Java (J2ME) enabled Mobile WAP Additional features such as camera, bluetooth	Mobile mapping Mobile community market Instant messaging
Smart mobile phones High end mobile phones (mobile phone as a computer)	Sensor Rich Application (All Purpose Tool) Global Position System (GPS) Social network features Mobile web Video and audio recording and sharing	Mobile sensing Community-based monitoring Social network applications
Indirect access For people who do not have direct access to mobile phones, computers or internet	Infopreneur (use of intermediary to access information) Village phone Village area networks	Shared access Shared handsets

Source: CTA 2009.

The majority of handsets in circulation in East Africa are presumably more basic models and innovators and entrepreneurs are finding new uses for a tool thought of as simply a voice and SMS communication device. Therefore, most of the existing services are SMS-based and designed to work with low-end devices, in order to reach the broadest possible audience or all within the target group.

Why mobile phones?

A very typical East African mobile subscriber owns one or two, sometimes three SIM cards, have a basic Nokia phone, are on a prepaid scheme on a per-second billing tariff. Preferred mode of communication is voice followed by SMS. Although, a very common phenomena and mode of communication is to beep someone (see below). The phone is mostly used to communicate with friends and relatives and sometimes used to check the latest football results from Premier League. So why have mobile phones become an important tool in development? Kerry S. McNamara, Scholar in Residence, School of Communication, American University, believes that the interplay of four elements creates a "virtuous circle" of innovation that can benefit even the poorest (McNamara 2009):

- Access – innovations in network design, communications hardware and infrastructure financing are steadily expanding the mobile "footprint" to cover a larger percentage of the population;

- Affordability – relatively low total cost of ownership due to the combination of prepaid service plans and cheaper mobile handsets, makes it easier for the poor to afford and use mobile services. Affordability is still a major concern though discussed more below;
- Appliance innovation – the growing multi-functionality of mobile devices, and innovations are making these devices more adaptable to a range of needs and services relevant to the poor;
- Applications – there has been a vast increase in the past few years in the development and roll-out of mobile applications relevant to the needs of the poor, often building in unexpected ways on one of the simplest functionalities of mobile phones: SMS.

Access to mobile phones and networks empowers the individual in many ways. It opens up for possible interaction and for a two-way dialogue as opposed to radio, television and written media etc. Mobiles make communication more efficient, often more private, and increases efficiency in daily activities, time management and general organisation. It influences the personal life and strengthens primary relations. In situations and emergencies, mobiles can mean safety and security. Finally, but not last, mobile phones help to have fun and can make time fly.

There are a number different technologies offered by the mobile platform, but it is only SMS, USSD and beeping beyond voice that is being adopted by the masses in Eastern Africa. The text below describes these functions and some others.

Beeping

To beep means to call another mobile phone and hang up before the call is answered, often with the hope to be called back. A person who beeps is a beeper and the practice is considered a bit rude, yet very popular all over East Africa. This practice is also called to *flash* or to *tickle* someone. To have beeping power means to have sufficient funds to beep – as prepaid credit is needed to be able to place the call. People usually beep to avoid paying for the call and can therefore be seen as initiating a collect call. Economically empowered persons, like family and business heads, are normally always beeped. To beep someone could also encompass a particular message, i.e. to communicate something already decided like "I will beep you when I get there". Jonathan Donner from Microsoft Research, argues that beeping is *"a form of code which, intentionally or not, serves to strengthen relationships and reinforce social norms"* (Donner 2007). Often the receiver of the beep knows the intention behind it. Sometimes it is a simple "hi how are you?", other times "please call me". Journalist Robert Kalumba writes in Uganda's leading newspaper that:

> *"These people have perfected the art of beeping that you don't even hear the beep. You are alerted by the flashing light on your phone and the alert '1 Missed call'. Even those who owe you money have the audacity to beep you, for you to call them, and if you do, they will inform you that they can't pay you"* (Kalumba 2009).

Usually, operators do not like beepers as they are jamming the network since voice always have the highest priority. However, the operators have seen the need and have come up with a solution and developed a free service where a beeper instead can send a "Please Call Me" message. A USSD message, as seen below, is sent on a channel that use very little bandwidth. Vodacom Tanzania rolled out a beeping replacement application in 2008 under the slogan *"Cannot call? Send a 'Call Me'!"*. The free service enables Vodacom Tanzania subscribers to request a call from any other mobile network subscriber in Tanzania. The customer dials *140*075xxxxxxx# and a *"Tafadhali Nipigie! Kutolea: 075xxxxxxx"* followed by a Vodacom advert, is sent to the receiver. Subscribers can send three 'Call Me' requests per day.

Joshua Goldstein, a technology consultant and blogger, wonders how beeping can be used to collect information and serve as a platform for mobile services and comes up with this suggestion in his blog:

"Beeping' as Instant Feedback and Poll-Taking

Imagine you are in Pader, one of the major towns in northern Uganda. During a drought, your community receives food aid in six different locations from six different donor agencies. As you walk into town, you see a billboard that asks: which of these six locations serves you best? Each location is tied to a mobile number. To vote, you just beep the appropriate number, and the votes are tallied by a simple piece of software on a computer attached to the six different phones. [the software would check for repeat numbers, etc.] The same system could be used for conducting local elections" (Goldstein 2009).

SMS

Short Message Service (SMS) is a telecommunications protocol that allows the sending of short, 160 characters or less, text messages. SMS is commonly used for person-to-person (peer-to-peer) communication and simple provision of information where content providers make use of SMS to send dynamic information such as news, exchange rates, weather reports etc., and information more of a social type like horoscope, Bible quotes etc.. Since SMS can carry binary data it can be used as a transport medium of wireless downloads like ringtones, wallpapers, pictures or it could contain an address to a file for automatic download. In short, SMS applications are good for notification services, information services and location-based services.

SMS aids simple, rapid and spontaneous communication. Pricing and interoperability are two key success factors for SMS usage. SMS is usually attractively priced to compete with voice for certain user segments (particularly during traditional "peak hours") and SMS can be sent from any standard GSM handsets device between any operators' networks. However, in East Africa SMS communication is considered expensive by the average user. The prices are kept high by a combination of network provider choice and interconnection fees between operators. These costs could all be abolished if the operators decided so. On top of this are high taxes that keep the prices up.

The cost of a SMS within a provider (for example Zain to Zain) is next to zero because it is sent on the signalling channel (control protocol) which is always active, regardless if there is traffic or not, and it does not use bandwidth that would otherwise be used by voice or data. The signalling channel is needed for the base stations and phones to keep in contact so that the system knows that the phone is connected and if the phone should switch to another base station. A SMS message simply fills up the remaining space in this channel with its 160 characters. This also explains why SMS technology is not an instant delivery system but a store, and forward oriented technology. Usually messages are sent immediately but sometimes the network is congested and the signalling channel is used to control the network instead, for example during new years, crises and graduation when many use the network.

An operator setting up a GSM network for voice basically gets the SMS infrastructure for free and as explained above, to send and receive a SMS does not cost the operator much (Song 2009a). Interconnection charges for the operator exist but also those are quite low and *"the "actual" cost of interconnection is a subject of much debate because it represents both a cost and a source of revenue for operators, the details of which are rarely revealed to anyone by the operators"* (Song 2009b). According to Steve Song, Safaricom in Kenya charges a 43% interconnection fee for connecting with other operators nationally, MTN in Rwanda charges 77%, and MTN Uganda a whopping 160% fee (Song 2009b). In an article published by Huawei in 2005 it is stated that operators *"SMS margins estimates vary, but typically maximum of up to 80–90% of SMS messaging revenues being profit are often quoted"* (Poulbare 2005). If operators zero-rated or priced SMS much closer to their real cost, more people would use the service and the load on the voice/data network would be reduced considerably, meaning fewer problems with bandwidth and congestion.

The SMS habit is not that profound in East Africa compared to other regions and countries. The Philippines constitutes a good example. One of the explanations to why mobil applications took off so well there, is that a culture of texting already existed. SMS was introduced as a free service by the mobile phone operators in the Philippines. When the operators saw the value in SMS and wanted to start charging for SMS use, consumers put up a fight and operators were forced to keep the prices low (Sida 2007).

In East Africa, highly priced SMS and per-second billing have changed the landscape. A per- second scheme can give more value for money than using SMS does – if you hang up in time that is. Per-second billing makes it more expensive to talk a whole minute but much cheaper if you stay brief. This is one explanation to why the SMS culture is not deeply rooted in the region. Illiteracy and ICT illiteracy are other reasons. Even if the user knows how to read and write on paper, she might not know how to send a SMS. It could also be that she knows how to receive and read a message but is then illiterate in the local language and cannot reply. Trust in oral communication and a distrust in technology are other reasons why people do not SMS that much. A common phenomenon is that people send a SMS just to call the minute later to see if the SMS went through. According to the Uganda 2002 census, half of the households use "word of mouth" as their main source of information (UBOS 2003). Trust is on voice, not in technology or SMS.

There are some technical problems that persist with SMS that needs to be taken into account when implementing SMS applications in East Africa. SMS is not a particularly robust system and subscribers may get messages minutes, hours and even days later if they are out of range of the base station or roaming. Applications where guaranteed delivery and real-time interactivity are an issue are therefore not recommended. Interoperability difficulties between operators prevail and a fragmentation of carriers exists.

Premium SMS services or reverse SMS billing, e.g. where the recipient rather than the message sender is charged for the SMS, can be problematic in a prepaid environment. Usually, poor people top-up only when they need to make a phone call or SMS, which means that rest of the time credit is low or next to zero. But if there is no credit on the subscriber's phone there is no service. This affects the completion rate for premium SMS in a negative way since the billing platform only works if there is money on the subscriber's phone. Value added services (VAS) providers in East Africa talk of a completion rate of less than 20%. This means that the actual revenue for a VAS is 1/5th of the actual subscriber base. Related to this is another challenge. For some messages it is imperative that they are delivered in real time. For news alerts for example, if the message is not delivered immediately due to lack of credit, there is no point in trying to deliver the message at a later stage as it won't be breaking news any more.

Bulk SMS

Bulk SMS is a system by which an institution, company or organisation is able to send or receive a large volume of SMS. Many companies in East Africa offer this service which has become a popular method for SMS spammers, wedding planners to raise funds, night club owners to promote an event etc.. Also NGO's take advantage of the technique like WOUGNET (Women of Uganda Network) in collaboration with Women's Net and APC (Association for Progressive Communication) and their yearly "16 Days of Activism Against Gender Violence" campaign. The worldwide SMS-based campaign sent out an SMS on each of the sixteen days of activism to all registered individuals and organisations and one could participate by sending a SMS back. If chosen, it was then sent out to all participants (Hellström 2009a).

Some of the companies who offer bulk SMS and provide SMS gateway connectivity in East Africa are Cellulant (sms.cellulant.com), Symbiotic (www.symbiotic.co.ke), MySMS (www.mysms.co.ke), Air (www.air.co.ke), True African (www.trueafrican.com), kenTEXT (www.kentext.com), D-Mark Mobile (www.dmarkmobile.com), Mobile Planet (www.mobileplanet.co.ke), and SMS Media (www.smsmedia.rw and www.smsmedia.ug).

FrontlineSMS (www.frontlinesms.com/) and RapidSMS (www.rapidsms.org) are two non commercial alternatives. FrontlineSMS is a free open source software platform that enables large-scale, two-way text messaging using only a laptop, a GSM modem, and inexpensive mobile phones. Once installed, it acts as an SMS gateway that enables users to send and receive SMS and can be used for data collection, coordination or monitoring. RapidSMS is a free and open-source framework for dynamic data collection, logistics coordination and communication. While the commercial companies offering bulk SMS has negotiated discounted bulk rates straight with the operator, FrontlineSMS and RapidSMS have not, a user must pay full price for each message sent.

Voice SMS

Voice SMS is an interesting innovation that addresses a number of limitations of text SMS; illiteracy, the hassle of writing the text, the impossibility to convey emotions, etc.. Voice SMS usually have additional features like scheduling and dynamic group SMS. To record and send a message, users simply dial * followed by the number and speak for 30 seconds. The recipient receives an SMS notification for each new message and can listen by dialling *0*.

For example, the operator MTN has launched this service in a number of countries, including Uganda. The service is dubbed MTN Voice SMS and is based on technology from Kirusa (www.kirusa.com/) who specialises on voice SMS and other value added services.

The number of applications that build on voice are not many in East Africa. Interactive Voice Response (IVR) and voice based applications are difficult to implement without the operators consent since the equipment needs to be co-located with the operators. However, taking illiteracy levels into account and some users resistance towards SMS, it would be preferable to develop more IVR services and applications since voice driven technologies will likely find good acceptance for delivery of information and services. However, while working as a consultant for a Grameen Foundation survey, Ali Ndiwalana realised that people did not seem to like to talk to machines and using computerised voice menus etc.. This might also explain why loading airtime via USSD/SMS is more popular than the voice option. More research and pilots exploring voice applications are needed.

MMS

Multimedia Messaging Service, MMS, is not as utilised as it could be in East Africa. Not all operators offer the service and of those who do, there are many network issues. MMS is a standard for telephone messaging systems that allows users to send messages that extends text messaging to include longer text, graphics, photos, audio clips, video clips, using a phone with GPRS (mobile data) capabilities. It is usually a bit more expensive to send than a standard SMS (e.g Vodacom Tanzania offer MMS for US$0.06 compared to a SMS for US$0.04). Although the MMS technology is supposed to follow certain standards, different handsets have different formats on photos, videos and audio and a picture sent might not be displayed on another type of handset. In Uganda, Grameen Foundation has been testing various services involving taking pictures and sending MMS. Their experience is that they had difficulties to get people to use the cameras on their phones in a productive, useful way. ICT illiteracy and lack of sufficient training proved to be a real challenge. Some people had challenges taking pictures at all, many more had problems to take pictures in focus, and more still had problems to insert the picture in an MMS. In addition to this, users have to activate the MMS function of the phone by contacting the operators. With time and training though, MMS can prove to be very powerful tool in agriculture (in case of disease incidence), in health (instant capture and transmission of medical images) and in governance (publish online instantly and unobtrusively) for example.

USSD

Another message technology is USSD, Unstructured Supplementary Service Data. This technology establishes a bi-directional open channel between the user and application until the session is terminated. It is therefore considered more reliable compared to SMS and works exceptional well for mobile applications that requires a quick, secure and inexpensive communication.

USSD communication is near real-time and the end-user experience remains the same regardless on the handset, e.g. it works on any GSM phone and no configuration is necessary. From a users perspective it works in the following way. The user enters a short USSD service number, e.g. *100# and press call. The USSD service receives the request and responds by sending a menu to the user from which the user enters a character that corresponds with her selection.

The USSD protocol is a preferred method for prepaid top up or balance requests and some m-transaction applications also use this protocol. Voucher-less top-ups is another existing services using USSD, allowing any customer to become a peer-to-peer retailer through credit transfers generating savings in card printing and distribution for the operator. USSD is ideally used by the service provider when they need the subscriber to confirm some action, e.g. a balance transfer service, when a simple menu is needed, or when they must be sure that a message can reach all subscribers disregard of handset model or settings. Eyeline Communication (2008) summarise USSD usage like this:

- Balance inquiry (e.g. *100#)
- Balance top up (e.g. using scratch cards, with Zain Uganda you enter *130*access number#)
- Balance transfer (payment from one's balance to another balance, MTN Rwanda's service MTN Me2U use *772*number*amount#)
- Call me (requesting a call, Vodacom Tanzania dial *140*number#)
- Profile management (add someone to your plan, change plan, manage services – portal with a menu at *111#)
- Mobile banking (e.g. M-Pesa in Tanzania and M-Sente in Uganda for example)
- Notifications ("Time to top-up")
- Subscriptions ("What you like to subscribe? 1=Yes, 2=No")
- Voting ("Please rate our customer service: 1=Good, 2=OK, 3=Bad")
- Games
- Delivering non-intrusive personalised mobile advertising ("Your balance is Shs 100. Switch to new SMS plan, call 100 now")

For the operator, USSD means minimal network investment and low operational costs. And for the end-user it is easier to initiate USSD in comparison to SMS. So why are not more USSD applications rolled out? Two reasons are that USSD is not as flexible as SMS and the information cannot be shared or saved because USSD menus and texts are not stored on the handset or the SIM card. It improves the level of security on the users' side though. Seen from a developer's point of view, implementation requires close collaboration with the operator. However, USSD ports are usually open for roaming traffic and USSD requests are always routed back to the home network. No application identified has yet taken full advantage of this worldwide access opportunity. Due to its characteristics, USSD could function well as a complimentary technology rather than a substitute to other technologies, i.e. if developed further it could be used as an entry point to other services.

Mobile broadband

With the introduction of IP included in mobile networks, and with the new high-bandwidth submarine cables built along the east coast of Africa, mobile operators are becoming serious internet service providers and are rapidly making internet accessible by the masses. As a reference, the biggest operator in Kenya, Safaricom, saw a fivefold increase in data revenue in just one year (Nairobilist 2009). Some operators, like Orange in Kenya and Uganda, are using mobile broadband as a differentiator in a crowded market.

While a significant proportion of mobile phones deployed in East Africa are low-end units designed for voice and SMS functions only, cost on mid-range and smartphones, are expected to decrease significantly over the next few years. With more and more people acquiring web-enabled phones that support IM (instant messaging) and VoIP (voice over Internet Protocol) and other internet based applications, mobile phones are likely to be the dominant access mode to internet in the near future, outnumbering wired and PC/laptop users by far. One could therefore boldly state that internet connectivity comes with the mobile phone connectivity and that the number of potential direct and indirect internet users equals that of mobile phone ownership in East Africa. At least in the near future when all mobile phones on the market will be data enabled.

Mobile broadband has the potential to grow in a virtuous circle. Capacity in terms of technology and technical know-how drives content. Content is going to be a huge driving factor for the demand for bandwidth, data services, handsets etc., which drives capacity and supply. However, mobile broadband could also be vicious circle if capacities and technical know-how are not found or developed.

Mobile broadband will likely be a fast growing market over the next few years in East Africa. Key though is that operators reduce the cost of mobile internet even further in order to increase penetration level and usage among the masses. Unfortunately, mobile internet tariffs in the region are not pro-poor today. Data transfer via the phone where the user pay per bit using prepaid credit is expensive and the option to pay a flat, monthly fee upfront does not exist for most poor people. Simple technology such as SMS and USSD can be set so that there is no cost for the end user, i.e. the application provider bears the whole cost. This cannot be said about data traffic where the end-user always pays. However, even though SMS will remain a killer application for some years to come, and would be even more revolutionary if prices were lower, the trend is clear that East Africa's mobile application future is IP based, not SMS based.

While operators must reduce the cost, content providers must adjust and make their services accessible via the mobile. Websites need to be configured, for example by setting up .mobi domains, and mobile web browsers must improve and become even more user friendly. There is a risk for information overflow and that the market will be flooded by services and content that will only eat the user's money. Portals with relevant development oriented content must be designed and marketed. There is also a need for education for the end user. Configuring the phone for WAP and GPRS usage is a difficult task for the majority of users.

Box 1: Smartphones and application stores
Stakeholders in the field have realised the revenue-generating potential of getting into the mobile application business. Recent developments have created disparate application environments. Smartphones, which runs on an operating system software, provides a standardised platform for application developers. There are quite a few operating systems, thougt with Symbian in the lead, followed by RIM (Research In Motion) Blackberry, Apple iPhone OS and Windows Mobile. Handset producers and operation systems creators, promoting their own mobile application stores, are typically linked to a specific device platform meaning that applications do not run across all devices and networks.

The competition is getting intense and the well-established mobile application stores like Apple's App Store, BlackBerry's RIM and Vodafone 's 360 are challenged by a number of newcomers. Twenty-four of the world's largest operators, backed up by GSMA, have agreed to build an open international application platform that will deliver applications to all mobile phone users. The alliance is called the Wholesale Applications Community and **"aims to unite a fragmented marketplace and create an open industry platform that benefits everybody – from applications developers and network operators to mobile phone users themselves"** (Wholesale Applications Community 2010). Even the mobile infrastructure supplier Ericsson has launched a white label application store as a service to mobile operators. The service, known as eStore, will help operators to set up their own application stores. Ericsson will keep a small percentage of the revenue but the bulk will go to the operator. Usually application stores take a 30 percent share of revenue from every application it sells via its platform while remaining 70 percent instantly go to the developer.

Open source mobile operating systems find its way into the market too. Examples include Maemo Linux and Google Android with its Android Market. Nokia, who acquired Symbian in 2008 and established the independent non-profit Symbian Foundation, open sourced all Symbian smartphone codes in beginning of 2010 (see http://developer.symbian.org/). There are many advantages with open source; it makes it easier for third party applications to find a market and tools like Qt Creator allows programmers to use same source code and deploy to many open source devices.

Android includes an operating system, middleware and key applications. Java programming language is used to develop applications on the open development platform. Developers can take advantage of the device hardware and reuse components and key applications.

The biggest operators in the region, like MTN, Safaricom, Vodacom, UTL and Zain have all brought BlackBerry solutions that enabled the customer to access e-mails among other things. Orange, on the other hand, was the first to introduce iPhone on the East African market (Kenya and Uganda). A major problem though is to get access to and buy applications. Applications for iPhone can be downloaded directly to handset, or downloaded onto a computer via iTunes as long as an account has been set up. However, to get an iTunes' (or PayPal for that matter) account from which you can buy applications is a real challenge as they require a credit card account, and to get a credit card, customers must be considered creditworthy by the bank. In other words, it is almost impossible to buy applications at the moment. This could be solved though by m-payment solutions like Zap and M-Pesa and by solutions like MobiPay's partnership with KDN (www.kdn.co.ke/).

Social networks and instant messages

In East Africa, social networks like Facebook, Skype, Live Messenger and Twitter are mostly used by the young, connected and urban and continue to be out of reach for a significant portion of the region's population. The fact that these networks have opened up to mobile access through mobile data and SMS, and that new phones come with features and popular applications integrated with the phone, might change the scenario and make it easier for new user groups to connect. This can prove to be very profitable for mobile operators, if they figure out how to cost effectively handle traffic. What makes social networks and social media extra interesting is that it offers a platform for disseminating on-demand, locally relevant content related to health, agriculture and governance for example. Users can easily engage as producers of information, not just consumers.

In May 2010, Facebook negotiated deals with over 50 operators around the world who have agreed to provide access to a stripped-down version of Facebook free of data traffic charges. This means that the their customers can view their news feed, update their status, like or comment on posts, and send other Facebook users messages absolutely free. Pictures, videos, external links etc. will attract regular data fees and generate revenues to the operator. This is the main reason to why operators have agreed to offer this service for free: it will lead to overall increased data traffic and customers will get familiar in using mobile internet services. And as pointed out, data will be a big part of the future of mobile innovation in Africa. Facebook might be the service that makes mobile internet and instant messaging as widely-used as SMS and beeping.

In East Africa, the site 0.facebook.com is only available on the MTN networks in Rwanda and Uganda. Other users can still access the standard mobile site m.facebook.com but then operator's data charge apply. Orange in Uganda however, decided to offer m.facebook.com for free to all their customers and other operators are likely to follow. It seems like Facebook have understood the cost of access issue while competitors like Google struggle to find a functioning business model in Uganda (see Box 3).

MXit is another mobile instant messenger and social networking application that allows the user to chat anywhere optimised for web enabled mobile phones. It is developed in South Africa and has become extremely popular due to cost factors and critical mass of users. In May 2010, when other operators signed deals with Facebook, Safaricom in Kenya announced a partnership with MXit. Safaricom customers can download the client for free and then send messages at a fraction of a cost of a SMS. At a first glance this might be considered strange – that Safaricom promote a product that potentially will kill SMS traffic. However, since data is the future, controlling the data channel is more important than profits made today.

Box 2: Twitter

Twitter is a social application with focus on status updates (tweets) where you follow and/or are being followed by other users. The length of a tweet is 140 characters, keeping the extra 20 for the user's unique address. Hashtags (words prefixed with a #) are used for searches on the system. For example, #Rwanda Election tags tweets on the Rwanda election, making the tweets easier to find. The @ sign followed by a username is used to send direct messages to each other (although accessible by anyone). Updates are made via the Twitter website using any web enabled tool or via SMS through gateway numbers.

People see Twitter in different ways. Some see it as the main source of news and articles while other just find it noisy and a place for self-promoters. The market research firm Pear Analytics analysed the content of 2,000 tweets (in the United States) over a two week period and captured tweets in half-hour increments. They categorized them into six categories: News, Spam, Self-Promotion, Pointless Babble, Conversational and Pass-Along Value. The study reveals that of the total tweets captured, Pointless Babble won with 41%; Conversational came second at 38%, and Pass-Along Value was third at 9% (Pear Analytics 2009).

Are there any real development benefits in Twitter and sending tweets? Even though most of the tweets are time consuming babbling, some tweets do play a role. Anecdotal stories tell us how Twitter can be used to mobilise, create social movements and be a helpful tool during emergencies in getting information out. In Iran, following the 2009 Iranian Election, Twitter was used as a rallying tool and as a method of communication with the outside world after the Iranian government blocked several other modes of communication. In Uganda, Twitter was used to report incidents and violence during the September Kampala riots in 2009. In a situation where radio stations were closed down, TV shows censored, networks jammed, and public transportation down, Twitter proved to be a good one-to-many solution. Hashtags #kampala and #ugandawitness were then aggregated by a local instance of Ushahidi, www.ugandawitness.net.

With relatively few users in East Africa it is hard to predict future usage. Ugandan operator UTL do their part by offering a Twitter and Facebook SMS service free of charge. Consumers send 'tweetme' or 'fbme' to 2299 to get instructions on how sign up. UTL marketed the product during the riots via Twitter: "ugtelecom Send 'tweetme' to 2299 to be able to tweet about #Kampala while you run, by SMS!".

Shared usage and village phones

While SMS, MMS and USSD etc. are features that are used worldwide, shared phone usage is a phenomena that is rather specific to the developing world. People do not need to own a mobile phone to benefit from one. Many services and applications (address book, SMS inbox, mobile money account etc.) are connected to the SIM card, not to the phone. The practice of sharing mobile phones within families, neighbourhoods and communities are common. Finnish handset manufacturer Nokia has even produced a phone targeting developing countries with features like radio, torch, speaking clock, extra long battery life, anti-scratch cover and dust resistant keypad, and, the most interesting feature: a multiple address book for "private" shared usage.

Mobile phones are sometimes bought privately and then put at the disposal of a community for profit. There are more organised forms of shared usage. Having a fairly successful model from Bangladesh in mind, MTN Uganda together with Grameen Foundation USA through their joint venture Applab, linked the telecom sector with the microfinance sector to enable clients to finance the creation of micro-businesses. The loan makes it possible for rural entrepreneurs to buy a handset, external antenna, charging solution and marketing materials to set up a village phone solution. It has proven to be a win-win solution, creating a business opportunity for rural entrepreneurs as well as microfinance institutions, operators are tapping a new market, and individuals living in rural communities get access to affordable communication. The service is now run by MTN as "Village Phone" in Uganda and Rwanda.

Innovation

East Africa is a region for innovation and a variety of interesting mobile phone related projects and pilots are taking place throughout East Africa.East Africa. The region as a test-bed for new technology implementations, specifically in banking, health and agriculture sectors. In this context, it might be useful to distinguish between different aspects of innovation in terms of who is the innovator.

There are a number of "traditional" laboratory research and development units in East Africa. Computer science, IT and engineering students at the major universities in East Africa (namely University of Nairobi, Strathmore University, Moi University, Jomo Kenyatta University, Kigali Institute of Science and Technology, National University of Rwanda, Makerere University and University of Dar es Salaam) are actively researching and developing applications for the mobile phone.

In 2006, Massachusetts Institute of Technology (MIT) and Nokia launched a trial initiative called EPROM (Entrepreneurial Programming and Research on Mobiles, eprom.mit.edu/) in East Africa to develop a mobile phone programming curriculum within Computer Science departments in Sub-Saharan African countries. In East Africa the University of Nairobi, Kigali Institute of Science and Technology and University of Dar es Salaam are involved.

A number of international non-for profit and for profit organisations have also found their way to the region. Internet giant Google has offices in Nairobi since September 2007 and presence in Kampala since 2008. Google does not only bring existing products into the East African market but also expands into completely new areas and come up with local solutions. Google SMS together with AppLab (see Box 3 below) is a good example.

Nokia Research Africa

One of the world's leading mobile telephone handset makers, Nokia, officially opened a research unit in Nairobi, Kenya in July 2008 that was officially launched in September 2008. The basic idea is to

carry out research on its products and services closer to the intended market. They work together with East African universities and NGOs to develop prototypes of devices and applications designed for the African market. Presence in the region will make it possible for Nokia to better understand the African telecommunications sector in general and the needs of its African customers in particular. Focus is on the handset and the most most profound challenges identified are language issues and poverty itself (total cost of ownership). Jan Chipchase, who has worked for Nokia as a human-behaviour researcher, says *"to design a cellphone that will sell to essentially the only people left on earth who don't yet have one, which is to say people who are illiterate, making $4 per day or less and have no easy access to electricity, the challenges are considerable"* (Corbett 2008).

Ericsson Innovation Centre

Swedish telecoms equipment giant Ericsson opened up one of its three African application development hubs in Nairobi, Kenya in 2008. The other two centres are based in Nigeria and South Africa. The aim of the Ericsson Innovation Centre is to better meet the needs of poor and rural populations and to focus on developing affordable, sustainable applications and solutions in health, education, agriculture and small business development. The centres will further *"develop business cases that enable network operators to introduce and expand mobile broadband services"* (Ericsson 2008) and it will provide tools for local developers and entrepreneurs, and in that way *"foster a good environment for the creation of new small businesses throughout Africa"* (Ericsson 2008). After its launch in 2008 it has been extremely quite from Ericsson Innovation Centre.

AppLab Uganda and Grameen Foundation

AppLab, short for The Application Laboratory, is an initiative of the Grameen Foundation USA in partnership with the operator MTN Uganda (www.applab.org/). Since September 2007 they have been working with different partners in Uganda, to recruit, train, and support local entrepreneurs who can serve as information hubs for their communities. AppLab has piloted a range of mobile applications and in June 2009 they launched a bundle of mobile services together with Google (see Box 3). With grants from Bill and Melissa Gates Foundation, they are now developing a network of 4,000 community knowledge workers in rural Uganda. The project aims to improve information flows and knowledge dissemination through the use of mobile devices with the hope to improve productivity and livelihoods for small-holder farmers. This by using the applications Google Trader, Farmers Friend, CKW Search and the Input Supplier Directory (see Appendix 2 for more information). AppLab are also present in Ghana and Indonesia and there have been discussions about rolling out some applications in Rwanda.

iHub

iHub is a innovation hub located in Nairobi serving the regions technology community (www.ihub.co.ke/). Opened in March 2010, they offer a free open space for technologists, investors, companies and hackers with a focus on young entrepreneurs, web and mobile phone programmers and designers. According to one of its founders, technology blogger and founder of AfriGadget and co-Founder of Ushahidi, Erik Hersman, iHub *"is part open community workspace (co-working), part investor and VC [venture capital] hub and part incubator"* (Hersman 2010). iHub is funded by Ushahidi for the first three years of operation as a nice gesture to give back to the local development community that originally helped to build Ushahidi.

Other hubs for innovation

Innovation is also taking place outside the traditional research and development units. In Kenya, a young, male dominated, community of programmers, bloggers and ICT enthusiasts have developed and "organised" themselves under the name Skunkworks (http://blog.my.co.ke/). They organise meetings almost every week and on the vibrant mailing list, ideas are shared and discussed, service providers praised and bashed, and new businesses are created. Similar communities are I-Network in Uganda (www.i-network.or.ug/) and eThinkTank in Tanzania (ethinktanktz.org/ and groups.yahoo.com/

group/eThinkTankTz/). Mobile Monday (www.mobilemonday.net/), the global community of mobile industry professionals and innovators, launched chapters in Kampala (www.momokla.ug/) and Nairobi in March 2010, creating platforms where various stakeholders can meet and connect to share knowledge.

Some other units worth mentioning are e-Fulusi in Dar es Salaam (www.efulusi.co.tz/, see m-transaction section in this report) and Appfrica Labs, the latter is a for-profit incubator and software development firm based out of Kampala, Uganda. Appfrica facilitates, mentors and incubates entrepreneurs in software in East Africa (www.appfrica.net/). Then there are a number of private training institutes too, like eMobilis Mobile Technology Academy in Kenya (emobilis.org/). Other spontaneous workshops, seminars, bar camps and conferences are constantly taking place all over East Africa.

Box 3: Google SMS

AppLab in Uganda, a joint venture between non-for-profit Grameen Foundation USA and MTN Uganda, has since 2007 undertaken extensive research trying to understand the Ugandan context and what kind of issues and knowledge gaps exist and if and how these can be addressed by a mobile solution. Together they created a "**holistic ecosystem none of the parties involved could have developed on its own**" (Cantor 2009). Grameen Foundation was the convener and stood for overall management and oversight. They were also responsible for general market and business analysis as well as field operations. Internet giant Google gave financial support, access to technology and user experience support. By working together with the country's leading operator MTN they got access to network and distribution and an appealing local brand. Top consultants Gamos and Kiwanja.net came with useful ideas and insight while local NGOs like BROSDI, Marie Stopes Uganda and Straight Talk Foundation contributed with sector knowledge and rural networks. Finally, individuals in the community, including the existing network of Village Phone Operators, gave feedback and thumbs up or down. AppLab finally launched a suit of five mobile quick alert and information services in June 2009:

Google SMS Search – #6006 (think GOOG). Open search about anything.

Health Tips – #6001. Health Tips tries to address the high demand for accurate information on sexual and reproductive health. In partnership with Marie Stopes Uganda, who is a service provider for sexual and reproductive healthcare, and Straight Talk Foundation, who specialises in health communication and information services.

Clinic Finder – #6001. Clinic Finder offers a directory providing the details of local clinics, including services offered, opening times and outreach services.

Farmer's Friend – #6001. A searchable database with both agricultural advice (crop and livestock pest and disease control information, planting, storage and harvesting tips) and regional weather forecasts. The technical farming information for the service Farmer's Friend is provided by Busoga Rural Open Source Development Initiative (BROSDI, www.brosdi.or.ug/), a local NGO that works with a network of farmers to collect and share local farming techniques. Weather reports are provided on a daily and monthly basis by the Government of Uganda's Department of Meteorology within the Ministry of Water and Environment.

Google Trader – #6007. The service is known locally as Akatale SMS and tries to address some of the challenges that Uganda's rural producers and consumers face, such as: linking with existing markets, poor transport networks, no updated market information, etc. This simple market system, which looks like a classified ad system or bulletin board, tries to link buyers and sellers, cutting out the middlemen. It is designed in English but respond to three local languages. Widespread adoption will hopefully lead to lower transaction costs, greater efficiencies and higher price transparency across various markets, bringing increased incomes to smallholder farmers. An online version was launched in November 2009.

In the first three months of operation, Google SMS had over 2 million queries. At first it was a free service for MTN subscribers only but when MTN started to charge 130 UGX per enquiry sent to #6006 and #6007, usage dropped substantially. Interestingly, many users switched from the premium services #6006 and #6007 and started to use the service #6001, which was free at the time (agricultural advice, weather forecasts, health information, clinic finder). MTN later decided to charge for the whole package. At least one lesson can be drawn from this: it is important to have the business model clear from the beginning since users are reluctant to pay for a service that once was offered for less or for free.

However, it is too early to analyse Google SMS impact on the Ugandan society. Various reports are indicating that the product is not that successful after all, mostly due to poor marketing after official launch and technological hiccups where replies are not delivered or when the answer do not correspond to the question asked.

Grass-root innovations

Grass-root innovation is when people create new uses for technology out of necessity. Innovation is not always something new, it could also mean enhancements of existing products to better meet the needs. For example, in Uganda, when it became too expensive and insecure to send money using the bus system, people started to transfer airtime through the Village Phone operator instead. A person living in the city would simply buy airtime, call the Village Phone operator and give the operator the airtime details. The operator then load the phone with the given airtime, charge a commission, and give the rest of the money in cash to the recipient. This practice is called "Sente" which means money in

Luganda and can be seen as a forerunner to m-transactions in Uganda. Or when private ownership is not realistic, a shared village phone might do the trick. A common phenomenon in East Africa is that callers use the mobile phone as an address book but makes the majority of the outgoing calls relying on public payphones – because it is cheaper and sometimes in order to hide their identity. There are some anecdotal stories like dual SIM card hacks (two SIM cards merged into one for better coverage and tariffs), illegal (?) roaming M-Pesa service (see Box XX), extensions of the phones antenna for better reception, the housewife who designed a home made phone charger (Wougnet 2009), two electrical engineering students from Nairobi University who invented a dynamo-powered "smart charger" for bikers (BBC 2009) – all these street/village hacks represent a simple, necessary idea from users who want to increase the use of their mobile. When looking at statistics, numbers and revenue streams it is important to remember innovation and to separate expected and intended usage from actual usage. The rule is that anything that is free or cheaper will have significantly higher use, often out of necessity. Who predicted the ever popular beeping culture for example?

Box 4: Roaming M-Pesa service in Uganda

Along one of the busy roads close to Makerere University in Kampala is an M-Pesa sign. Inside the small office are three desks, seven chairs and a Safaricom poster. Two old Nokia mobile phones and some numbers are scribbled down on the desk. The two phones are equipped with Kenyan Safaricom SIM cards for sending and receiving M-Pesa messages. That the phones automatically roam to UTL does surprisingly not have any impact on the functionality. The customer base mostly consist of Kenyan students who want to send and receive money to and from fellow Kenyans in Kenya using this swift and cheap alternative instead of traditional money transfer services.

A customer who wants to send money to Kenya pay the amount in Uganda shillings plus the M-Pesa charges and a commission which is negotiable depending on the sum sent and bargaining skills. To receive cash, the sender in Kenya sends Kenya shillings to any of the two numbers and the receiver can later pick up the equal amount in Uganda shillings minus a 4% commission. So, basically it is the credit on the accounts on these two phones that makes the whole thing possible. If the accounts are unbalanced, the credit could be balanced through the partner in Kenya which is an M-Pesa agent.

The company that runs the service, the Ugandan registered Mobank Ltd, is not an official M-Pesa agent although Safaricom know about their existence according to members of the staff. Registration was unproblematic but Mobank Ltd had a written agreement with MTN stating that as soon as MTN launched their Mobile Money product, i.e. as soon as the new MTN SIM cards had arrived from South Africa, the place would turn into a MTN Mobile Money agent.

Mr Michael Joseph, the Safaricom Chief Executive Officer, later commented the operation: **"M-Pesa does not officially operate there [in Uganda]. We are investigating. It's quite strange"** (Telecom Africa 2009).

Mobile Applications

While the future is mobile broadband – voice and SMS are by far the most common applications of mobile technology in East Africa today. Mobile phones are mainly used for social networking, e.g. staying in touch with family and friends. There has also been an explosion and a growing popularity of information on demand services, so called value added services (VAS) or premium rate services (PRS). The growth has mainly been in the entertainment sector tailored for the masses, such as ringtones, games and information services including news, latest soccer scores and quotes of the day. These services are usually channelled through SMS short codes or special numbers leased by network operators to the content providers.

Funded by Ericsson, the Commonwealth Telecommunications Organisation (CTO) together with the consultancy firm Gamos, produced a report which tries to describe and analyse the current and future mobile content requirements of end-users in India and Uganda. According to the report:

> *"VAS has become a key way for operators to develop new revenue streams, differentiate themselves from competitors, attract new customers and retain existing ones. Strong growth in the use of VAS such as ringtones, games and wall papers, has seen it contribute between 5%–10% of operators' revenues"* (Ericsson, CTO 2008).

While operator's focus has been people with a high disposable income and revenue generating services (e.g. urban youth and entertainment), "infotainment" services and development oriented applications, which are more customized in nature, have not been prioritised. The numbers of available and relevant applications for economic and social development are therefore still limited.

The mobile applications that do exist in East Africa generally focus on SMS services since they work on a wide range of devices, low-end as well as high-end phones. The drivers of m-application development are once again the high level of mobile penetration and the evolution of mobile technologies, standards and protocols. Projects and approaches are diverse and many different stakeholders, with different roles, are involved. This is often referred to as the mobile ecosystem. Scaled-up, successful mobile applications require a functioning, dynamic and productive mobile ecosystems where the role of various stakeholders in setting up, operating, sustaining and expanding the service is understood and analysed. Stakeholders in the mobile ecosystem include:

- Policy makers and regulators
- Mobile network operators and service providers who own and/or manage the transmission as well as hosting platform
- Handset manufacturers
- Content providers and applications developers
- Government and specific sector players (e.g. financial institutions for m-banking, agriculture associations for market information systems, schools for m-education, clinics for m-health, etc.)
- Private sector, e.g. entrepreneurs and small and medium-sized enterprises (SMEs)
- Researchers, innovators, consultants etc.
- Civil society and users, e.g. citizens and consumers who are the intended beneficiaries of services.

Making the mobile ecosystem functional is not easy, but a prerequisite for a successful, sustainable and scaled-up mobile application implementation. The question is however, what services and applications could make mobiles more useful for socio-economic development? The following part of the report will look at examples of how mobiles could be used for socio-economic development, including m-agriculture, m-health, m-learning, m-governance and m-banking.

m-Agriculture – (written by Kerry S. McNamara)

Farmers and their families, who constitute the vast majority of the rural poor in many developing countries, face a vicious circle of poverty. Their physical isolation is compounded by poor infrastructure that makes it difficult and time consuming for them to access services and markets. They have few physical or financial assets that they can leverage to improve their livelihoods or protect them from unexpected stresses such as disease or drought. They have limited access to government services and little power to enforce their rights. The land they farm is often of poor quality and dependent on unreliable rain. They have inadequate access to vital inputs such as seeds and fertilizer.

Their physical isolation and the disadvantages it generates are compounded by significant intangible impediments. They have insufficient access to information and communication resources and networks, and thus to information that is vital to their productivity, including information about cultivation techniques, new crop varieties and ways to combat crop diseases and related threats to their yields. They have little access to information about markets and prices for their crops. It is difficult and time consuming for them to collaborate with others to protect their common interests and advocate for their rights.

Meanwhile, transformations in agriculture are taking place and these transformations risk passing them by or aggravating their situation. Urbanization and economic growth are increasing the demand for higher value-added agricultural products both in their own country and region and around the world. Regional and global agricultural value chains are becoming more integrated. Also, the growing volatility of regional and global commodity markets make the rural poor more vulnerable, both as producers and consumers.

Yet, evidence is mounting that ICT, if deployed intelligently and affordably, can help create a "virtuous circle" of innovation that can benefit even the poorest farmers and increasingly integrate them into local, regional and global markets. This virtuous circle in the mobile sphere consists of the interplay of four elements: access, affordability, appliance innovation, and applications.

The technical developments make possible a dramatic increase in the information, communication, transaction and networking services and resources available to the rural poor and to agricultural development more broadly.

The multiple dimensions of mobile's contribution to agriculture and rural development

There are many ways that mobile devices and services can support agricultural development, and improve the livelihoods of the agriculture-dependent poor, in East Africa and other developing regions. These improvements can come along the entire agricultural value chain, and can benefit all participants in the value chains.

First and foremost, mobile devices and services can help empower smallholder farmers, and help lift them out of poverty. They can improve smallholders' access to timely information – about; prices and preferences at market (which affects planting decisions, not just post-harvest sales), good cultivation practices, improved crop varieties, pest and disease management. They can improve smallholders' access to information and transactions related to both inputs like seeds, fertilizers, pesticides and outputs. By helping to make markets more efficient and transparent through better dissemination of price information, reduction in search costs for producers and traders, etc., they can reduce waste and price distortion and empower smallholders in negotiation with wholesalers, traders and transport providers. Mobile technology can also facilitate access to vital complementary services, particularly financial services. This is significant because mobile penetration is substantially larger than the presence of formal banking institutions and services in many developing countries. And they can help link smallholders to urban and regional product markets and higher-end agricultural value chains.

Mobile devices and services can also help smallholders, and the rural poor in general, connect with one another for more effective collective action, both as producers through cooperatives and producer organisations, and as citizens in demanding improved, more transparent and responsive governance and public services. They can help improve advance warning of weather risks, pest and disease outbreaks, and other environmental risks, and provide timely, locally-relevant information on how to respond to these.

More generally, mobile devices can, under the right conditions, have a broad positive effect on agricultural markets in general by facilitating just-in-time, many-to-many information flows that are an increasingly important element in developing country agricultural markets that are growing more integrated with, and subject to the shifts in, regional and global markets.

Table 11: Examples of m-agriculture applications

Education and awareness	SMS in support of good cultivation practices, improved crop varieties, pest and disease management. Also information to agriculture extension workers
Commodity prices and market information	Market prices and preferences, which affects planting decisions, not just post-harvest sales
Data collection	Applications using mobile devices to collect and/or access agriculture data
Pest and disease outbreak warning and tracking	Send and receive data on disease incidence and outbreaks

Guiding principles for designing and implementing pro-poor m-agriculture projects

The novelty and power of ICT tools and applications sometimes leads to an enthusiasm for their widespread dissemination and use that is not necessarily grounded in a sober assessment of priority needs of the target audience. Given the complexity and severity of the challenges facing developing country agriculture and the rural poor, it is especially important that m-agriculture projects and all ICT-for-development initiatives begin from a clear identification of the needs, the available options (both technological and other) for addressing those needs, and the costs and benefits of each.

An analysis should assess the information, communication, transaction, monitoring and/or networking dimensions of the problem (e.g. low smallholder productivity, poorly functioning output markets, weak take-up of research and extension information, etc.), and how ICT – appropriately adapted and sustainably deployed – can assist.

Given the necessity for difficult decisions and tradeoffs in an atmosphere of constrained resources, it is also important to be clear about when and why mobility is a virtue in a specific context, and not simply assume that mobility is always a priority. There are a number of virtues of mobility: timeliness, customization of services and information, individual economic and social empowerment, multi-directionality of information and communication flows, etc.. However, there are many vital information and communication functions within rural economies and communities that do not necessarily require mobility and a mobile phone solution, and fixed solutions should not be dismissed *a priori*.

The newest device or application is not automatically the best or most appropriate, if another one can address the specific need in a sustainable and cost-effective way. Radio, for example, is still a very powerful tool if used creatively and interactively, and hybrid approaches that combine radio, mobile devices and fixed devices/infrastructure can be particularly powerful in many cases.

Whatever the device, it does not of itself create or deliver information – people, firms, institutions and markets do. This means that it is particularly important to have a rich understanding of the rural information economy and its constraints in a particular place. In other words, how is information, broadly defined, produced, valued, exchanged and consumed in a given context? What information is most valuable, to whom, under what conditions? How can mobiles and other ICTs promote innovation and efficiency in this information economy?

A key element in improving this information economy is the policy and regulatory environment. This includes not only telecommunications policy and regulation but also the conditions and investments promoting, and the regulations encouraging, innovation and entrepreneurship in technologies, applications, business models and forms of service delivery.

m-Health

There is a severe shortage of doctors, nurses, health workers and drugs in rural East Africa. Many patients never see a doctor or visit a clinic and those who do visit one often do not receive the care and treatment they deserve due to lack of resources. Thousands of people, mostly children, die from mis-treatment (and sometimes from no treatment) of illnesses such as pneumonia, diarrhoea, dehydration, malnutrition and malaria.

Healthcare is usually one of the largest public budgetary expenses. Improved information systems that for example track and coordinate service delivery, establish accountability, and manage patients for better health outcomes, can increase efficiency. The lack of resources and infrastructure prevents health workers from delivering efficient healthcare to rural areas and mobile phones are often claimed to be

> *"the appropriate and sustainable platform for rural healthcare in Africa [...] Commonly proposed uses are for data collection, and decision support for rural health workers. Some projects also use mobile devices as a platform for information dissemination as well as data gathering"* (Ho 2009).

m-Health can be defined as the delivery of health care services via mobile communication devices. Mobile technology has been piloted and implemented in a range of health related areas and is one of the most developed fields in m-applications. With high mobile penetration and insufficient infrastructure, the potential impact and opportunity of successful m-health applications in the region is high. If applied right, mobile solutions can increase the quality of life for patients, simplify and improve the efficiency of healthcare delivery models and reduce costs for healthcare providers. However, the mobile ecosystem needs to be fully utilised and the different roles of the regulatory, handset manufacturers, operators, healthcare professionals, NGO's etc. needs to be established.

The two major innovations in m-health are applications that support information dissemination and platforms that support mobile data collection. Applications intended to reach a mass consumer audience tend to rely on simple, ubiquitous formats like SMS and usually works on any low-end phone. These applications however require access to the target population's phone numbers and a solid business plan, i.e. who will pay for the SMS traffic? As m-health applications move from one-way data towards more interaction and clinical services, e.g. various data collection applications used by health workers, the technical capabilities increase and more advanced, Java enabled phones are needed. This leads to higher costs and more training requirements.

Generally, one way data is good for campaigns, public awareness and emergency alerts while two way data is needed for client record access, emergency tracking, vaccination monitoring and health/client record access. Examples of mobile health interventions are described in Table 12.

Table 12: Examples of m-health applications

Education and awareness	SMS in support of public health and behavioural change campaigns. Also delivery information to health workers
Data collection and health record access	Applications using mobile devices to collect and/or access real-time patient data
Monitoring/medication compliance	Maintain care giver appointments or ensure medication regime adherence via one-way or two-way communications
Disease/epidemic outbreak tracking	Send and receive data on disease incidence, outbreaks and public health emergencies
Health/administrative systems	Drug inventory management
Analysis, diagnosis and consultation	Phone as point-of-care device. Mobile phone based diagnostic applications (combination hardware, wetware and software), or MMS of microscope picture sent to distant reference centres for tele-diagnosis

Source: Based on Vital Wave Consulting 2009.

The benefits offered by mobile services are many, but so are the challenges that prevent access and use. Scalability and sustainability for widespread deployment is a general challenge. So are the common technical challenges such as poor infrastructure; preference for simple, low-end phones with small screen size; non-literate and semi-literate users etc.. More sector specific challenges include patient acceptance, privacy issues, data security and lack of integration into other health information systems. During a M4D workshop held in Kampala in November 2008 (http://m4d.kcl.co.ug/) participants identified the following key challenges in using mobile phones for health interventions:

- Poor internet and mobile coverage in the rural areas
- Difficulty in uptake and understanding technology
- Hardware limitations; bad signal strength and low battery life (and lack of enough charging points)
- Failure to explain m-health applications to household members
- Airtime management and personal calls

The identified solutions were to boost internet as well as GSM signals, equip each handset with multiple batteries and carry out continuous training in phases in project areas. The participants also called for the establishment of a regional m-health network to coordinate all efforts and share experiences. The latter would be a good idea considering the vast number of m-health initiatives piloted and implemented in East Africa.

Box 5: Examples of m-health projects in East Africa

Text To Change is a non-for-profit NGO that uses mobile phones as a medium to communicate health related issues and support existing health campaigns. They started their activities by running a number of pilots in rural parts of Uganda. Their first pilot in Mbarara aimed at expanding HIV prevention and uptake of HIV voluntary counselling and testing through an interactive and incentive based SMS multiple choice quiz. Randomly selected participant received a number of multiple choice questions per week. A correct answer was followed by an explanation while an incorrect was followed by an automated rectifying reply. Participants who sent in answers then stood a chance to win airtime. At the end of the campaign, participants received a SMS to encourage people to go for a HIV test. People who did go as a result of participating in the program got testing and counselling for free and were also rewarded with airtime.

The first pilot saw a 40% increase in the number of patients who came in for HIV/AIDS testing. Part of the success has been attributed to the anonymity built into the SMS campaign. Text To Change have since built a strong track record in developing text messaging programs for the health sector and has run a number of extensive workplace programs. Together with the USAID funded Health Initiatives for the Private Sector (HIPS) they rolled out the first workplace based SMS program targeting 5,000 at three selected companies. Data on knowledge, attitudes and practices regarding multiple sexual partners, family planning and medical male circumcision was collected too.

In 2010 Text To Change teamed up with Zain Kenya who wanted to increase HIV/AIDS awareness via SMS starting at their own workplace, encouraging employees and their relatives to get tested to know their HIV status. The successful program will now scale up and become Zain Group official corporate social responsibility (CSR) initiative in all countries where Zain operate, starting with Uganda and Madagascar in 2010.

Text To Change are now working together with UNICEF on a programme aiming to educate and mobilise pregnant women, mothers and families to demand ante-natal clinics and enrol in PMTCT (prevention of mother-to-child transmission) services. The programme will use radio for general messages and SMS to target women. Text to Change will integrate its software with the tool RapidSMS and make the code open source.

Another health initiative in the region, Dimagi (www.dimagi.com), is a company based in Boston with systems deployed primarily in rural Africa and with projects in for example Kenya, Tanzania and Uganda. Dimagi is working on a range of issues including community health programs, electronic medical records, care coordination, and remote data collection. Together with D-tree International they are leading CommCare, a mobile-phone based application that enables community health workers and home based care providers provide better, more efficient care, while also enabling better supervision and coordination of community health programs.

Cont.

Cont. Box 5: Examples of m-health projects in East Africa

D-tree International (www.d-tree.org/) established presence in Tanzania summer 2008. D-tree is using mobile phones to provide accurate and effective point-of-care diagnosis and treatment in areas where doctors are few or non-existent. The idea is to give support to frontline health workers, such as nurses and community health workers, through mobile access to treatment protocols. The downloadable application takes the health worker step by step through the diagnosis and treatment options for the most commonly diagnosed illnesses. The system also allows health workers to collect other relevant statistical data for evaluation, research, or surveillance. In addition to CommCare mentioned above, D-tree run a number of major projects, namely:

- IMCI Tanzania; e-IMCI (Integrated Management of Childhood Illness) protocols together with Ifakara Health Research and Development Centre
- HIV/AIDS Tanzania; care and treatment to HIV/AIDS patients through a set of clinical protocols. In cooperation with US Center for Disease Control, IntraHealth International and Columbia University this application is extended by a tuberculosis module.
- Diabetes Tanzania; a set of clinical standards of care and data collection, the system stores longitudinal data about each patient for tailor made care. In partnership with the Tanzanian Diabetes Association.
- Reproductive Health; Clinical protocol for health workers at health facilities to accurately assess pregnant patients whether the pregnant patient in labour appears to progress normally. Currently at an initial stage of development.

The applications developed support already existing systems, approaches and protocols and is part of an existing ecosystem. The main challenge for D-tree has been of bureaucratic nature, e.g. to get products approved by the Government. CommCare has been easier to roll out since less medical and sensitive data is collected.

In Rwanda, the m-health scene is dominated by the American firm Voxiva (www.voxiva.com). It runs two similar applications; one is called Phones for Health, a complex public private partnership system developed and deployed by Voxiva at the Ministry of Health supported by the GSMA Development Fund, the U.S. President's Emergency Plan for AIDS Relief (PEPFAR), Accenture Development Partnerships, Motorola and MTN. Phones for Health help community health workers to enter, transmit and access health data from the Ministry of Health via the mobile phone in real time. Health workers can access information on potential outbreaks and shortages of medicines and use the mobile to order medicines, send public health alerts and download medical guidelines. The other related system, on which the implementation of Phones for Health partly builds on, is TRACnet. The application supports the country's HIV/AIDS program and manages critical information on HIV/AIDS patients and monitor anti-retroviral treatment (ART) programs. Virtually all facilities providing ART to HIV patients submit monthly reports using TRACnet. TRACnet is run by Voxiva, TRAC (Treatment and Research AIDS Center, an institution of the Ministry of Health of Rwanda) and the US Center for Disease Control and Prevention. The Ministry of Health is looking into the possibility to expand the system to cover other chronic illnesses too.

m-Learning

Mobile devices facilitate learning in many and often unstructured ways all over the world. Use ranges from the mobile phone's simple inbuilt applications such as the calculator and the notebook function to more sophisticated use like broadcasting TV and radio, slide shows and streaming other media. Lectures are recorded and pictures are taken and with an internet connection it opens up for numerous possibilities. In distance learning voice and SMS are used to coordinate and cooperate and in some occasions used for oral exams. Mobile chat, mobile wikis, mobile blog, tweets, and social sites like Facebook are also efficient tools for cooperation.

The mobile phone can, if used correctly,

- be an efficient documentation tool,
- lead to an increased interaction in the class room, and
- promote cooperation

The majority of existing m-learning related applications in East Africa are of administrative nature; SMS based applications that give access to examination results or send out reminders. A few applications focus on content where access to information, sometimes through the web and/or games, is key. The Ministry of Education in Tanzania is running two projects using mobile phones and networks to increase access to learning materials and to support distance education, namely BridgeIT and ICT BITES (see Appendix 2). Another project worth mentioning is Doctor Math taking advantage of the popular instant messaging application MXit in South Africa (www.mxitlifestyle.com). MXit has become extremely popular among teenagers and the preferred social network due to cost factors and critical mass of users. The instant messaging system is also utilised for educational purposes like Dr Math, launched in early 2007 by the Meraka Institute (www.meraka.org.za) of the Council for Scientific and Industrial Research (CSIR). Learners post a maths question and thereby enter into a discussion with a tutor ready to answer any question from the entire primary and secondary school mathematics syllabus. Tutors are students from the University of Pretoria who are all obliged to do 40 hours of community service work. Similar applications will be seen in East Africa too, that is if the schools do not ban the use of mobiles in class.

m-Transactions and m-Banking – (co-written with Tonny Omwansa)

Few East Africans have access to a formal, regulated financial institution. Even access to the most rudimentary form of informal financial service are lacking for the majority. FinAccess conducted a survey in Kenya in 2009 and established that 33% of Kenyans were financially excluded (use no formal or informal financial services) and only 23% had access to formally regulated financial institutions such as commercial banks, microfinance institutions and credit institutions (FinAccess 2009). Data from a FinScope study in 2006 indicate that the number of financially excluded in neighboring countries are even higher: 54% of the Tanzania adult population is financially excluded and only 9% of the population use formal services. In Uganda 62% of the population is not using any type of financial service provider while 18% use formal institutions (FinScope 2007). Data from Rwanda 2008, also shows that more than half of the adult population *"manage their lives without using any kind of financial product (formal or informal)"* while 14% use formal institutions (FinScope 2008).

The traditional banks have so far failed to reach the masses and the bank branch infrastructure is not well developed in the region. Even where people have access to traditional banks, many decide to rely on informal means to send, receive and save their money. In Kenya for example, the use of non-bank financial institutions has more than doubled from 8% in 2006 to 18% in 2009, an increase that can be attributed mostly to the M-Pesa service provided by Safaricom (FinAccess 2009).

Mobile solutions

In a region where the vast majority either have limited resources, are geographically isolated or do not have a bank account, mobile phone solutions provide a means of extending financial services to these poorer, often rural, segments of the society. Even for those with a bank account and access to financial services, mobile solutions may be considered more convenient, efficient, swift and cost effective and therefore the preferred option to use. David Porteous, the founder and director of Bankable Frontier Associate, categorised these two kind of user groups into transformational, where a new type of service is offered to the "unbanked", and additive, where the service is adding extra value to already existing services (Porteous 2006).

Before moving on, some concepts need to be defined and clarified. There is a broad array of m-banking related services but they can be summarised as:

- m-Transactions and m-Payments are terms used to refer to financial transactions (remittances and payments) made using a mobile phone without visiting a financial institution.

- m-Banking involves financial institutions in cooperation with mobile operators offering a channel to an existing bank account. The service is both transformative targeting the unbanked, e.g. those who do not have bank access or bank accounts, and additive, targeting those who already have bank account by providing an extra means of accessing the bank account (Porteous 2006).
- m-Commerce, sometimes called u-Commerce given its ubiquitous nature, is the buying and selling of goods and services through wireless handheld devices such as mobile phones.
- Airtime transfer or balance transfer is a person to person transfer of the electronic value that has been purchased for purposes of making phone calls or sending textmessages within one network.

Prepaid airtime vouchers can be used in many different and innovative ways. It is sometime used as a way to transfer money. Someone who wishes to send money back to the village buys airtime but rather than loading it into the phone, the person calls the shared village phone operator and reads the code. The airtime is then bought by the village phone operator and the transfer is completed when the operator hands over the money, minus a commission, to the waiting recipient. In Uganda, this practice is called "Sente" (Luganda for money) but is not that common any more due to any other innovative developments. For example, the basic idea behind airtime-sharing applications is to enable users to send airtime to friends and family members in rural areas, who are not otherwise able to buy airtime. However, users quickly came up with other forms of usage and started to use the service as a surrogate for currency. M-transaction services have cut down on the number of transactions and costs further.

In April 2009, Safaricom introduced a service dubbed as "Okoa Jahazi" (Kiswahili for save the moment), which enables prepaid subscribers to access airtime on credit and pay later. Subscribers are allowed to access 50 Kshs (less than one US dollar) credit advance, applicable for calls and SMS to any other local network. There is a service fee of 5 Kshs that will be deducted at next top-up. Maybe this can be seen as a forerunner to SMS loans in East Africa?

Key drivers and main constraints

Over the past few years, more formal mobile transaction/payment solutions have experienced strong adoption in East Africa. The reasons are many. The obvious one is wide diffusion of mobile phones across all socio-economic groups and geographical areas. Cost effective technological solutions have made it possible to lower the cost on previously time consuming, labour dependant small transactions. The mobile platform also makes it possible to un-bundle and re-bundle traditional banking services, meaning that services can be customised.

The key drivers for mobile banking/payments solutions can be summarised as follows:

- Increased diffusion and penetration of mobile phones
- Falling prices of mobile phones and services
- Cost effective mobile solutions
- Strong branding of easy to use mobile applications
- User demand and needs
- Need for banks to reach out and get more customers
- Need for operators to keep customers (loyalty)
- Scalable agent distribution for cash-in cash-out
- Fast and simple customer registration process
- No other alternative?

There are several significant constraints that could restrict the growth and that need to be overcome before the market reaches its full potential. More cooperation and policy coordination in East Africa would be necessary, namely between financial and telecommunications regulatory bodies. The issues related to policy coordination are particularly acute with regard to inter-bank clearing and settlement systems. To further increase the uptake and to intensify volumes, proper marketing and consumer education is needed. Consumer rights concerns is finally something that needs to be addressed too.

Different frameworks

There are a number of different types of mobile payment solutions available and the business approaches vary. Most cases in East Africa are operator led, others are bank dominated and a few are a hybrid or offer an independent third party solution. The operator led cases have proven more successful in East Africa because they address some of the key constraints of mobile money penetration. Mobile operators have experience in handling airtime, can spend much more on marketing, and have trusted brands. Their geographical spread and the technical know-how are far greater than that of banks.

Table 13: Different mobile payment frameworks

Bank-dominated Banks integrate with operator´s network and use it as access point. Bank invests in the application and related infrastructure. Examples: Equity Bank (Kenya)	**Hybrid** Mobile operator and a bank form a partnership where investments are shared. Examples: MTN Mobile Money (Uganda, Rwanda)
Independent third party Acts as single point of contact between operator and bank and handles the platform and all associated security. Examples: MobiPowa (Tanzania)	**Operator lead** Operator invests in infrastructure and integrates with banks (not always). Examples: M-Pesa (Kenya, Tanzania), ZAP (Kenya, Tanzania, Uganda)

There is a whole range of services and solutions offered by a variety of stakeholders. There are three big initiatives run by the four big operators in the region: Zain (Zap), Safaricom (M-Pesa), Vodacom (M-Pesa) and MTN (MTN Mobile Money). Appendix 2 lists a selection of available m-transaction services in East Africa.

M-Pesa in Kenya

M-Pesa has proved to be specifically applicable to the Kenyan market and context. Based on the number of users and transactions, M-Pesa is the biggest success story in mobile applications in East Africa. It all started in 2005 when Safaricom together with Vodafone realised the huge opportunity in airtime transfers and m-transactions and started a DFID-funded pilot mobile payment service later named M-Pesa. Since launch in March 2007, the uptake of M-Pesa has been very impressive the number of agents and subscribers has grown exponentially.

Within the first nine months after its launch, M-Pesa announced a subscription base of a million users and almost 1,400 agents operating across the country. In January 2010, M-Pesa had registered more than nine million customer and there were 17,000 M-Pesa agents in the network (Safaricom 2010a).

Table 14: M-Pesa's exeptional growth

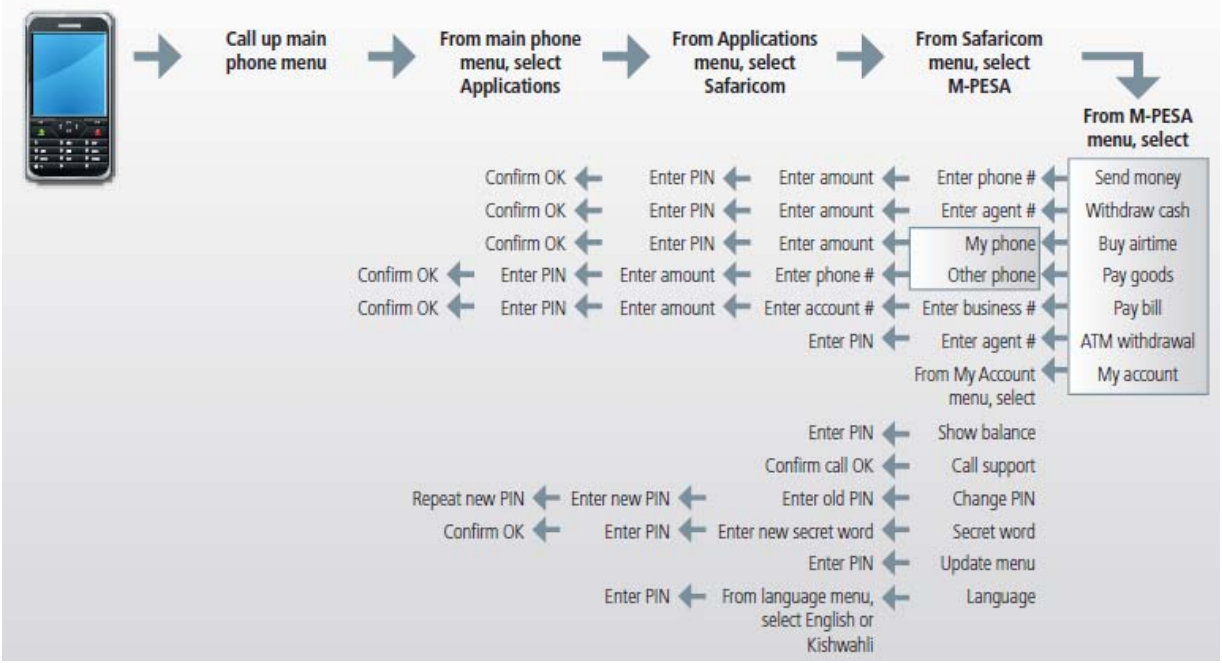
	Nov -07	Jan -08	Jul -08	Jan -09	Apr -09	Jul -09	Oct -09	Jan -10
Customers (Million)	1,0	1,6	3,4	5,5	6,5	7,4	8,3	9,0
Agent Outlets	1,400	1,800	3,400	7,300	9,500	11,600	14,000	17,000
Monthly Value of transfers (Billion KShs.)	2	2	7	14	17	20	25	24

Source: Safaricom 2010a. Figures are as at last date of each month.

The size of Safaricom (critical mass of subscribers and a majority market share), the composition of the management team (collaborative knowledge), the regulatory dispensation, the need of the subscribers (urban-rural remittances was already happening), all contributed to the success.

M-Pesa can be used by anyone with access to a mobile phone and subscribed to the Safaricom network; all that is needed is an authorization and transaction code and proof of identity. Safaricom has been using M-Pesa system as a loyalty product to aid in retaining and acquiring new customers. Beyond money transaction, M-Pesa is now being used in various other ways. Some of the notable forms of usage include saving money, pay bills, buying goods and buying airtime. Figure 1 illustrates the features of the M-Pesa menu while Table 15 summarizes the forms of usage according to a survey conducted by FinAccess in Kenya. The "un-intended usage" of M-Pesa has been innovative, forming a basis for developing new services by Safaricom. For example, it is common to get public transport users to pay via M-Pesa whenever cash is not enough. Safaricom picked this usage to develop a mechanism for travellers to pay for their bus tickets via M-Pesa (Nation 2009).

Figure 1: M-PESA phone menu structure used to initiate customer transactions



Source: GSMA 2009

Table 15: Additional usage of M-Pesa by current subscribers

Service	Percentage
Buying airtime	42
Save money	26
Store money before travelling	17
Make donations	5
Receive payments	5
Buy goods	4
Withdraw money from ATM	3
Pay bill	2
Receive salary	2
Pay salary	2

Source: FinAccess 2009

Safaricom has now partnered with over 100 organisations who accept payments using M-Pesa, ranging from banks, media houses, government agencies, microfinance institutions and insurance companies. Each of the organisations has a unique number which customers enter before specifying their bill number. There is evidence that there are many other organisations which accept payments using M-Pesa informally as well.

An innovative usage of M-Pesa is in a project run by Grundfos LIFELINK, a subsidiary of the Danish water pump manufacturer Grundfos. They are building automatic, solar-powered wells and in order to sustain and maintain these wells, Grundfos and Safaricom have developed a pay-per-use system. The system allows clients to purchase water credits via their M-Pesa account into a Grundfos M-Pesa business account under the Pay Bill functionality. The credit is then loaded onto the client´s smart card. Once inserted *"into a slot on the tapping point, the water automatically starts running until the card is removed and the amount corresponding to the amount of water tapped is deducted from the card"* (Safaricom 2009).

In terms of improving financial access in Kenya, M-Pesa's impact is significantly visible. The survey by FinAccess in 2009 showed that the use of services from non-bank financial institutions had grown from 8% to 18% since 2006. This cumulatively contributed to an increase in those who are financially included from 26% to 41%. M-Pesa also contributed to a significant growth of remittances within Kenya to 52% in 2009 compared to 17% in 2006 (FinAccess 2009).

As from end of 2009, citizens in the United Kingdom can send money to their friends and family in Kenya through M-Pesa. This is made possible through a partnership with Western Union, Provident Capital Transfers and KenTv. About 20 outlets with high local Kenyan population are being used in UK for this service. The maximum amount that can be sent at any one time is £250 and a maximum of £1000 per month. The transaction fees are high though, ranging from £4 to £6.90 (Safaricom 2010b).

M-Pesa Tanzania

Besides Kenya, Vodafone has launched M-Pesa in Tanzania, Afghanistan and is about to bring it to South Africa to be deployed by its subsidiary, Vodacom South Africa and its local banking group Nedbank.

In Tanzania, M-Pesa went into operation in April 2008. The technology underlying M-Pesa differs between Safaricom of Kenya and Vodacom of Tanzania. While Safaricom uses SIM toolkits, Vodacom relies on USSD to provide users with a user interface for accessing the service.

The uptake of M-Pesa in Tanzania was not as rapid as in Kenya. Since the launch, M-Pesa in Tanzania has continuously been adjusted in an effort to maximize adoption and use. GSMA followed the stages of the Tanzania experience and have reported widely on the subject. Several changes including pricing, registration incentives, product features, marketing and the agent network was identified (GSMA 2009). But of greater interest is what exactly made the uptake relatively slower in Tanzania compared to Kenya. Factors identified were: financial access, level of urbanisation, economic development, market share and ownership of the operator, agent network, advertising, fee structure and technology. In conclusion, the report indicates that these factors are overlapping and interrelated but it was not possible to attribute a single cause of the faster uptake in Kenya versus Tanzania (GSMA 2009).

More specifically the report demonstrates the significance of a country context. Though M-Pesa was designed to provide financial services to the unbanked in an emerging market, it cannot function without the presence of the formal financial sector. The bank branches serve as ideal cash-in cash-out points. In addition the report indicates that early adopters of M-Pesa in Kenya and Tanzania were more likely to be mobile phone users who already had bank accounts. The explanation was that these users had faced various challenges and were in a better position to risk trying a new service and as such a large population of formally included users may result in a large pool of early adopters (GSMA 2009).

Zap

When Zain Kenya in February 2009 launched their service Zap, mobile money transaction stepped into a new era. Zain, being the fourth largest mobile network in the world in terms of geographic presence, will through Zap eventually bring mobile banking to almost 70 million active customers in 23 markets in Africa and Middle East (Zain 2009).

In East Africa, Zap is available where Zain is present, i.e. in Kenya, Tanzania and Uganda. Zap provides Zain customers access to a range of transactional services: transfer, withdraw and store money, pay for goods, services and bills, top up or transfer airtime to other Zain subscribers in Africa, and send and receive money to selected bank accounts and manage their bank accounts within Standard Chartered Bank. From end of 2009, Zap customers can receive money from any bank account around the world and send money to any bank in Kenya, Tanzania and Uganda (Zain 2009).

Partnerships with mainstream banks (including Citigroup and Standard Chartered) and other financial institutions such as Western Union, in conjunction with Zain's product One Network is the key behind the operation. Zain's Zap is considered the most comprehensive and accessible package of mobile banking features currently available on the African continent (Wireless Federation 2009). Time will tell if the uptake and adoption will be as impressive as the features.

Other examples and solutions

MTN Mobile Money, E-Fulisi's Mobipawa and Z-Pesa, yuCash by Obopay are all examples of mobile services that are not solely operator or bank dominated. One of the most interesting m-transaction solutions in East Africa is E-Fulusi Africa, which is a young, innovative, Tanzanian research and development firm. Back in 2007, they were the first to offer m-transaction services in Tanzania with a product called Mobipawa. It is a locally developed product that is operator independent and tailor-made for the Tanzanian context. E-Fulusi decided to go by the books and laws (even though legislation in mobile banking was almost non-existent) in Tanzania and acquired an applications service licence from Tanzania Communications Regulatory Authority, TCRA, and a "letter of no objection" from the Central Bank of Tanzania. The Central Bank also insisted that E-Fulusi had to open a trust account with a merchant bank for custody of cash. Not only was it a real challenge to get all the papers in order, it also took them almost a year to get clearance to roll out. One can argue that Mobipawa paved the way for other players to launch their m-transaction services in Tanzania.

Mobipawa has been criticised for not having enough uptake in the market. This is partly due to expensive marketing. Being independent, it does not have *"the kind of marketing an investor or an operator or a bank partner would bring to ramp up take-up levels"* (Balancing Act 2008). It is also due to the fact that E-Fulusi have insisted on working within the Tanzanian regulatory framework, a process that has been very resource consuming, especially considering the duration it took. However, in 2008, E-Fulusi's m-wallet service was adopted as Z-Pesa by Etisalat's Zantel, just some weeks ahead of the Vodacom's M-Pesa launch in Tanzania. According to Balancing Act (2008), Z-Pesa got 2,000 customers the first week with an average account size of Tshs16,000 (US$12). E-Fulusi is now trying to offer their solution to all operators in the region.

Future m-transactions trends

The level of competition in the East African market is high and competitors are many. More players are still to come, as some operators who currently do not have any mobile money solutions are indicating such a launch. The mobile payment market has seemingly become overcrowded and will so be for the next few years. This is creating a scenario where there will be many different solutions offered and no mainstream standard or solution will be anticipated. However, as we have seen with Zap (in partnerships with a number of banks and Western Union) and M-Pesa (in partnership with Equity Bank and Pesa Point), there has been an increase in the ability to interconnect different solutions with one another to create m-commerce platforms.

There is a need for marketing of the products and education for the end user. On the other hand there is also a need for sound policy regimes that allow effective competition and synergies to be created between the telecommunication and banking sector.

Most m-transaction services available enable customers to purchase airtime via their handsets. This presumably eliminates the need for airtime retailers as well as the need to for the operators to pay commissions to airtime retailers. How this will affect the market, built upon the presence of a long retail chain, is hard to predict. Ultimately it should lead to declining tariffs but could also lead to a conflict with retailers and agents as well as products merging.

In the short term, given that policy, legislation and marketing is in place, there will be a massive increase in the number of m-banking subscribers in East Africa. Figures from Kenya (mostly thanks to M-Pesa) are already quite impressive. Probably, there will also be an exponential increase in transaction volumes given that more cash-in and cash-out facilities are created and that users do more phone to phone payments (virtual money). Also, the political and economic integration in East Africa sets a very good base for regional financial integration. With the possibilities of regional transactions using services like Zap and M-Pesa, it appears that the day with a possibility of using uniform mobile money across countries is within the horizon.

> *"Imagine a future where you are able to coordinate Sudan, Kenya, Zambia, Uganda and Tanzania and you are able to easily use your money in all these markets. That's the future that we are looking forward to. That's a future that should be very real in a very short period from today. This is the future that the 'wonderful world' promised and we can see it happen"*
>
> (Kawuma 2009).

m-Governance

Traditional channels and means of communication such as press, radio and TV are sometimes used to promote good governance. With the introduction of interactive mobile applications and services, new dimensions, foras and possibilities open up. Mobile phones provide a new platform through which communities can access government information and services, using text, data, and audio browsing techniques.

m-Governance can be described as the delivery of governance related services via mobile communication devices, i.e. a tool and method that facilitates citizen to citizen, citizen to government and government to citizen interactions that can be leveraged to strengthen democracy and good governance.

There is big potential in using mobile phones for governance service delivery, increased participation, holding governments accountable and promoting transparency. We have witnessed mobile phones help create an informative, connected, innovative, and converging society all over the world. Due to technological advancements, it is today much harder to suppress human rights abuses as anyone with a mobile phone can record, SMS and MMS news of events even as they are happening. There is a wide range of potential governance related services which can be delivered and communicated via mobile phones, including services relating to:

- government news/information updates
- law enforcement/safety
- elections
- disaster and crises management
- education and awareness
- data collection
- monitoring

- mobilisation
- employment
- agriculture
- health
- education

Mobile payment systems like M-Pesa and ZAP opens up for even greater opportunities and possibilities for transactions and bill/loan/fine payments for a variety of public services like transport and school fees. Mobile phones are also used in citizen-based journalism and social media forums and makes it possible, in theory, for anyone to participate in the reporting of news events. The phone is used to write articles, to film and photo news material, and lastly to send the material via GPRS. A modern web enabled phone can do it all, but even a cheaper mobile with SMS and a camera can do a lot.

Bulk SMS for good governance

Government news updates, public awareness and emergency alerts are usually sent out in bulk. In cases of natural disaster as well as man-made crises like riots, election violence and land slides etc., mobile phones have often remained the only viable way to reach people. According to Christine Mugimba at Uganda Communications Commission (UCC), operators are usually obliged in the interest of public safety to operate their networks in such a manner as to alleviate a state of emergency as well as provide access to emergency services free of charge. However, there is still need to define clear operational procedures in case of an emergency according to the Uganda laws of the country.

A recent example that highlight the complexity of using bulk SMS to communicate with the public was during the riots in Kampala in September 2009. Subscribers, mostly on the Zain network, received at least two text messages from the signature UGANDA, urging people to calm down. The messages, both sent on Saturday the 12th of September 2009, read:

> *"Dear Ugandans, be reassured Kampala is safe.All hooliganism and thuggery has been stopped.Enjoy your weekend"*
>
> *"Dear Ugandans, our city is safe. Do not be intimidated or alarmed by hooligans. Today is a normal working day. For God and my Country"*

A problem though was that the riots continued and Kampala city was not safe until Sunday.

Governments are now looking into mobile solutions for strengthening early warning systems and efforts are under way to establish more systematised community-based landslide warning systems in Kenya and Uganda.

Mobile use in elections

Mobile applications related to elections have been fairly well explored in East Africa. Bulk SMS has been used to advertise political parties and candidates in the run-up to the Ugandan elections 2006 and Kenyan elections in 2007, and was used to urge Ugandans to go and vote during the referendum 2005. In the run-up to the 2007 Kenya elections, the Electoral Commission of Kenya launched a voter registration service where voters could SMS the ID number to receive a verification of voter registration (Hellström 2009c). Mobile applications in election observation and monitoring have so far not been tried out systematically in East Africa but plans are under way to involve both accredited and trained observers as well as citizen reporting in the 2011 elections in Uganda. Elsewhere in Sub-Saharan Africa, mobile phones have proved very useful in election monitoring and for parallel vote tabulation where trained observers stationed at a representative sample of polling stations track and verify election results and send the results via coded SMS to a communication hub where data is aggregated and published.

Media houses usually works in a similar way with reporters and correspondents scattered all over the country equipped with a mobile phone to call in and report what they see. This happened in Kenya 2002 and 2007 for example, when the company Mobile Planet (www.mobileplanet.co.ke/) provided up-to-the-minute election results and news via SMS at a premium rate. As the results were tallied, subscribers were sent updates via SMS. There are also examples where mobile phones are used for citizen-based monitoring or crowdsourcing. Crowdsourcing involves outsourcing a specific task to a large group of people and allows regular citizens to report election irregularities, violence etc. via SMS or voice to a centralised server. A good example of crowdsourcing and how mobile phones provide a good complement to government lead governance by adding the dimension of quick participation and action regarding certain issues is Ushahidi. Ushahidi was developed and used for post-election monitoring in Kenya 2007/8 and the Ushahidi platform has since been used all over the world for a number of good governance related interventions (see Box 6).

Box 6: Ushahidi

During the Kenyan post-election crisis 2007–2008, the website Ushahidi (www.ushahidi.com/) was created by a group of young, creative and connected, Kenyan developers. The basic idea was to create a crowdsourcing platform to which citizen via the web and SMS could report incidents of violence. The original Ushahidi tool was written in a few days but in 2008, Ushahidi won the NetSquared Mashup Challenge making it possible to further develop the concept.

"As early as May of 2008, we shared our code with a group in South Africa that used it to map incidents of xenophobic violence. This rudimentary deployment made us realize the need to rebuild the framework from the ground up. [...] In October the alpha version of Ushahidi was completed and promptly deployed to the DR Congo for testing. In its alpha form, Ushahidi was tested and deployed with 11 different organizations directly, including the International Center for Transitional Justice (ICTJ), Peace Heroes and the Kenyan National Commission on Human Rights. Externally, there were 4 major alpha deployments, including Al Jazeera during the War on Gaza, Vote Report India (to monitor the recent local elections) and Pak Voices (to map incidents of violence in Pakistan)" (Ushahidi 2010).

The newly established iHub in Kenya serves as Ushahidi's central hub for East African operations, service its in-depth testing and deployments in the region, and provide a space to host Ushahidi events. Much of the open source platform was built by volunteer developers and designers in Kenya and the many installations of Ushahidi are run by volunteers who organise themselves and start translating and verifying SMS, Twitter feeds and mails. Reports are sent in on a many-to-many-basis where victims and witnesses supply on-the-ground data in order to map and report. Citizens, journalists and aid workers then use the data to target the response.

Limitations in using mobile solutions in governance

There are many limitations in using mobile phones and SMS in good governance work. Some of the more profound are electricity issues, the limited format of SMS, illiteracy. SMS spamming is threatening the trust and confidence in using the technology for good governance purposes. A challenge that is a bit more sector specific has to do with the mobile industry itself. The sector is highly competitive and privatised with profit as the primary focus. If a non profit service is launched it is usually being implemented as part of corporate social responsibility (CSR) programs in the entertainment, sports, housing, health, education and environment sectors, i.e. sectors with maximum reach out, good for marketing purposes and with few political hurdles. Good governance on the other hand is a public good. How does one attain a balance between the two? Today there are few innovative business plans that brings the two worlds together and therefore social and governance applications end up low on the priority scale of operators. Further, public service is a long term commitment, there are no quick fixes which a pilot can fix.

In governance related applications, anonymity and privacy is often key. Scarce electricity and shared handset practice might be problematic for some users. When the phone is at the charging station or switched off to save batteries it is not possible to send or receive urgent and time sensitive information. Some users do not like SMS for the simple reason that they can not control the phone while it is at the charging station. Shared handsets constitute a similar challenge. Since many families only have one handset that is held by the head the family, normally the man, it is hard to reach the member of the family who the service is targeting. Sensitive and private information is further challenging since the intended receiver may not want other family members to know about the communication. A related issue, tapped phones, are further discussed below.

Christine Mugimba from UCC pointed out yet another sector specific challenge. According to her, SMS applications have proven good for basic service utilities such as water, electricity and basic health services. SMS however are mostly an urban phenomena and services such as water, electricity and similar are not to be found in most rural areas in Uganda. Applications need to address the needs and what is the best tool to address this need differs. Traditional radio announcement might be the best and easiest way to reach out while mobile applications might be suitable when interaction is required.

Issues and challenges

There are a number of identified challenges in developing, implementing and sustaining mobile applications for social and economical development. Challenges are many and relate to use, technology, and regulations etc..

The most profound issues from a user perspective are:

- electricity issues – access to power for phone charging, low energy products needed and skills to use these technologies
- affordability – total cost of ownership, i.e. cost of device, airtime, charging, etc., is too high
- surrounding supporting systems – trouble shooting, capacity building, user uptake, customer care
- ICT illiteracy, i.e. lack of training and skills development
- language barriers and high illiteracy levels (non-literate and semi-literate users and plenty of local languages)
- consumer rights and their enforcement as well as understanding of customer obligations are all still largely under-developed
- privacy issues and registration of SIM cards
- gender issues, men/women ownership and control of handset
- different networks, and various tariffs causes confusion
- lack of trust in the technology and spam SMS undermine the potential
- security – high rate of phone theft

From a developers point of view:

- Product development – how to turn ideas into sustainable products?
- Sustainability and funding – many projects tend to die as development partners or other initiators move. How to make the mobile component sustainable? Who should pay for the service and traffic? Innovative business models and billing plans for service delivery needed, especially in light of declining ARPU and low disposable income.
- The flow of revenue is not transparent and operators usually take a very high share of the overall profit. This affects the content development market negatively with lower incentive for developers to provide better content.
- Scaling-up applications and solutions – projects tend to stagnate or die out at the pilot stage.
- Infrastructure – limited network coverage, actual network quality, unreliable SMS due to increasing traffic loads creating network bottlenecks and crippling SMS service, non existant GPRS and G3 service. Documentation of network coverage and quality is not authoritative.
- Fragmentation – the mobile sector is still fragmented at many levels; from handsets to networks.
- Handset limitations, preference for simple, low-end phones with small screen size.
- Content – creation, management and relevance.
- Lack of training and skills development.
- Policy environment regulatory issues and dis-harmonization across East African borders.
- Lack of documentation – what worked, what did not? Impact studies are scarce.
- Lack of coordination and collaboration among stakeholders across different sectors as well as across borders is practically non-existent.

Some of the challenges are explained in more detail below.

Electricity

A main barrier to phone use, especially in rural areas, is access to reliable electricity. The majority of citizens in East Africa lack access to reliable and clean energy supplies, making it difficult and costly for people to charge their phones. According to Uganda's most recent census in 2002, only 8% of the households had access to electricity (UBOS 2003). However, having access does not equal use, as people might have access but still cannot afford it or have other priorities.

A common scenario when calling someone is that the phone is switched off or no one is picking up. Limited access to electricity is one explanation. A NGO in Kasese District in Uganda explained that since many people live outside the national grid, or simply cannot afford electricity at home, they have to charge their phones at charging stations or at a friend's place or sometimes even send the phone with a bus to a trading centre once a week for charging. This means that people often leave their phone unattended for a few hours per week while it is charging. Further, people with limited access to electricity often switch the mobile off to save batteries. Farmers usually leave their phones at home when going out in the fields. Therefore, urgent and time sensitive correspondence might face problems (Hellström 2009b).

There are a number of solutions available, and the trend of using renewable energy to charge mobile phones is starting. Motorola tried to provide free solar-powered charging kiosks to female entrepreneurs in Uganda, who used them to sell airtime, but the project did not last long. Some companies are looking into motion-harvesting technology but it seems solar is the best option since there has been a clear drop

in solar panel prices. And in the end it is the cost that will ultimately determine whether innovative, environmentally friendly solutions will be successful or not. Operators in the region in partnership with Chinese handset manufacturer ZTE, are subsidising handsets with a small solar panel on the back.

Registration

In East Africa you can buy a SIM card at every street corner, or in any village put it in the phone and make a phone call. The easy access to SIM cards partly explains the phenomenal growth of the telecommunications industry in the region: there is no hurdle for the customer to acquire a phone number and if there is no coverage for a particular network in an area or there is a new promotion going on, customers can just buy a new SIM card.

However, this liberal market and absence of controls on subscription also opens up for scams and threats. With an anonymous number, phone and airtime, anyone can send a SMS to anyone else without fear of being exposed. Today it is impossible to moderate the content and it is therefore up to the end user to scrutinize and critically review the source. For example, during the post-election violence in Kenya 2007, mobiles were used as a disinformation tool and unidentified SMS were among the means used to encourage Kenyans to participate in tribal attacks.

Governments in East Africa are now pressuring operators to begin registering SIM cards and subscriptions in order to connect a person to the SIM, as a way of tracking criminal and terrorist activity. Also, with mobile money transaction services spreading in the region, SIM cards will to a large extent be registered anyway, following the operators need to Know Your Customer in order to identify the client and ascertain relevant information to be able to do financial business with them. Registration can lead to a reduction of scams and threats but can also be seen as a first step to control, monitor and further monopolise mobile communication.

Privacy

Another issue is that of privacy. How can privacy be secured in situations where data needs to be verified or when sensitive opinion polls are conducted? For example, if a whistle blowing application is developed, privacy and user protection is key otherwise no one will use the system. Internet is different; it is fairly easy to hide your identity. With mobile phone networks it is harder to accomplish since the network *"record a phone's hardware signature and SIM. As governments begin registering SIM cards as a way of tracking criminal and terrorist activity, anonymous publishing or reporting via mobile phones grows far more difficult"* (Zuckerman 2009). Phones are being tapped and networks are centrally monitored and to some extend controlled. Workarounds must therefore be figured out for sensitive communication: some sort of encryption tool or a service like StealthText (see www.staellium.com/, only works in UK) that allows you to send a SMS that will delete itself from the recipient's mobile phone as soon as the person has read it.

There is also a high rate of phone theft in East Africa. Many subscribers do not know or care about protecting their phones other than from scratches and water. Mobile phones become more than just a communication gadget and now stores data and information, ranging from contacts, passwords, bank account details, and other valuable personal information. However, very few password protect and encrypt their phones. Losing it might become a nightmare as identity theft, blackmailing, abuse and threats are on the rise. There are a few products on the market in East Africa that enables the owner to track the geographical location of the mobile phone in the event that it gets stolen like the Kenyan solution Ujanja (www.ujanja.co.ke/). Slightly more advanced products provide remote file retrieval via GPRS (see www.maverickmobile.in/ for example).

Affordability

Affordability remains one of the biggest challenges relating to access and use of mobile communication. Many people cannot afford the cost of airtime and sometimes, in extreme cases they have to prioritize between buying airtime and food. Access, demand and use are mostly dependent on the economic situation. Why is it still relatively expensive to use mobile phones in Africa? Operators would argue that it is due to high initial investment costs as well as costs associated with the roll out phase, usually called capital expenditure, CAPEX. It is debatable if this argument is convincing when you look at the profits some of the network operators are making today. Other costs that affect the end user are production costs, costs associated with the running of the network for example running the base stations, paying salaries and maintenance. These costs are called operational expenditure, OPEX. And then there is Value Added Tax, VAT, on mobile phones. In Kenya it was decided to remove it. This move was welcomed by the government in Uganda who now wants to harmonis this across the region. *"I say so because if we do not respond accordingly, those who live near the border will just cross to Tanzania or Kenya and pick up phones from there and we lose the taxes"* said Aggrey Awori, the ICT minister in Uganda, in response to Kenya's initiative (Mugabe 2009).

Finally, although prepaid service plans and low denomination airtime vouchers make it possible for the poor to afford and thereby access mobiles, it is also the most expensive mobile deal on the market, since the retail chain that distributes it is making it more expensive than it ought to be. Operators are trying to address this and try to simplify the value chain by introducing different top-up options. This is vital to prevent churn and keeping users active. Prepaid is also causing other problems in that it keeps the billing platform very busy which effects the whole network, e.g. topping up slows down the network.

All this indicates that the whole structure of the mobile market is not really pro-poor. Ironically it is more expensive to own a mobile phone in the rural, poorer areas in East Africa because it is usually off-grid and one has to pay to charge the phone and repairs are expensive. There are even cases and places where one must pay more than the face value of the airtime card to pay for the added distribution costs (Hellström 2009a).

An economic study by World Resources Institute (WRI, a Washington-based environmental and international development think tank), and the International Finance Corporation (IFC, the private sector arm of the World Bank Group), show that even very poor households invested a significant amount of money on ICT. They state that the business models play a big part in ICT spending: *"Prepaid mobile telephony in small units and Internet access by the quarter hour in cybercafes for example, have helped to create affordability"* (WRI and FCI 2007 p. 46). The study also show that in most countries measured, *"ICT spending per household increases roughly in proportion to income"* and sometimes faster than spending in any other category, including health, education and housing (WRI and FCI 2007 p. 47).

Data from ResearchICTAfrica's Household e-Access and e-Usage Survey from 2007–2008, shows that in East Africa, people seem to spend more or less half of their disposable income on mobile communications and people below the poverty line is either gaining nor saving money owning a phone (Chabossou et. al 2009). The findings are summarised in Table 16 below.

Table 16: Mobile expenditure in East Africa

	Kenya	Rwanda	Tanzania	Uganda
Monthly mobile expenditure of monthly income, All	17%	10%	15%	11%
Bottom 75% in terms of individual income	27%	17%	22%	18%
Top 25% in terms of individual income	8%	9%	12%	7%
Monthly mobile expenditure of monthly disposable income, All	53%	66%	29%	49%
Bottom 75% in terms of disposable income	64%	65%	41%	67%
Top 25% in terms of disposable income	40%	66%	21%	39%

Source: ResearchICTAfrica Household e-Access and e-Usage Survey from 2007–2008 (Chabossou et. al 2009)

In emerging markets, purchases of goods and services are often made in small amounts when the need arises. Operators follow suit and offer per-second billing where they charge in small time slots so that a subscriber can make use of seconds. Per-second billing is only cheap if you stay brief but operators know that once the initial demand is created, innovative design of tariffs and packages will allow even more people to participate and bring the revenue up. Per-second billing open up the door for different kinds of people from different economic groups; people with an irregular cash flow and/or people who cannot afford to tie up sums.

Owning a mobile handset is still a luxury for a majority of the citizens in East Africa. Many therefore rely on public payphones, informal resellers and family or friends to make or receive messages and calls. A reduction in handset price would further stimulate the market, especially among the poorest 75% of the population who often perceives the cost of the phone as a major entry barrier. In order to tackle this problem, some handset manufacturers are trying to push down prices.

There are a number of initiatives where cheap handsets are being developed around the world aimed at the huge market of poorer communities. For example, Nokia's entry-level phones like Nokia 1280 cost about US$25; ZTE offers models that are closer to US$20. In early 2010, Vodafone announced *"its most affordable ultra low cost handsets to date",* targeting emerging markets. Manufactured by Chinese vendor TCL, the two phones will retail unsubsidised at below US$15 and US$20 respectively (Vodafone 2010). Then there are a number of projects that have generated headlines around the world: the US$14 "El Vergatario" in Venezuela and the US$20 screen-free "Peoples' Phone" in India. Also the Chinese company A-Link Technologies, who are assembling cheap mobile phones in Rwanda, are trying hard to push the prices down. Smartphones are getting cheaper too: Synchronica for example, backed up with Korean technology, produces a US$100 smartphone specifically targeting countries in emerging markets (see www.message-phone.com/).

Despite fairly low prices for new handsets, the demand for second-hand mobile phones is strong in the region. The second-hand market is big and the repairing culture strong. A used Nokia 3210 can be sold for as little as US$4.

Another strategy to reduce the price on handsets is to subsidize them. This is what happened in Rwanda in 2008 when the government launched an initiative to subsidize the cost of mobile phones in rural areas. The implementation was run by MTN Rwanda in association with the Rwanda Development Bank (BRD).

Affordability is a key issue, and with the cost of telecoms in East Africa remaining among the highest in the world in relative terms, this open the door for new innovations and low-cost operators.

Existing services are also considered expensive and the cost of most value added services (VAS) is high. This is mainly because of the fact that the VAS market is lead by entertainment which has a high perceived value. Operators would rather support a VAS that will generate revenue than a VAS that will only generate traffic.

Yet another strategy to lower the prices is to develop totally new models for affordable communications access. Smile Communication in Uganda has tested a model based on a Voice over Internet Protocol (VoIP) WiMAX platform where customers do not need to own a handset but will be given a phone number for free, which they can use to call and receive messages. The company operates through agents, who provide mobile handsets in street kiosks, stalls and payphones and customers access their own account and details through a secure personal identification number (PIN). Calls are charged per-second deducted from prepaid airtime cards. However, the system has some limitations. Unless the receiver of a call owns their own handset, the user must be logged on to a Smile phone at a pre-arranged time to answer the call. Otherwise the incoming caller will need to leave a voice message. Smile has also acquired operational licenses in Tanzania, Nigeria and the Democratic Republic of Congo.

Average Revenue Per User

The average revenue per user (ARPU) is the total revenue divided by the number of subscribers. ARPU have lately experienced widespread declines because of increased penetration into lower income segments that usually exhibit modest consumptions patters. The operator MTN constitutes a good example in Table 17. Some operators see a slowdown in consumer spending among existing subscribers and/or are experiencing declining growth, partly because first-time subscribers are becoming fewer. Many seem to feel pressure due to multiple SIM behaviour and rotational churn. This means that the value of existing subscribers has become critical and retaining valuable subscribers is now imperative to the future success of an operator. East African operators are therefore trying to find ways to prevent churn and increase the revenue through loyalty enhancement, usually by selling value added services (such as entertainment) and thereby increase ARPU. This is mostly done in close partnerships with a third party content services provider.

Table 17: Quarterly % change, Dec 2008–Mar 2009

	Subscriber numbers	ARPU
Rwanda	15%	–33%
Uganda	13%	–19%

Source: MTN 2009

Another way for operators to compensate for the declining voice ARPU is through increased data traffic. With an internet penetration in the region between 1% and 9% (ITU 2009a), there is a significant opportunity for mobile operators to become ISPs and offer data services to its subscribers.

The operator are looking for innovative applications that brings up the ARPU, while development oriented developers are trying to create applications that create an extra value and economic growth for the end-user. This equation is not to easy to solve.

Customer service and consumer rights

Customer service in East Africa is generally non-existent. This might change with time as competition increases and when/if number portability is introduced. Number portability enable the users to switch their operator without having to change their mobile phone number and thereby avoid the risk to loose contact with business associates, friends, family, etc..It is also considered a key factor in enhancing competition as quality of service is likely to improve and costs will continue to fall. While regulators try to make it a reality, there is a resistance from the bigger players who feel threaten by smaller players and new entrants.

However, as for now customer service is moderate to say the least. Long waiting times, jammed toll free numbers, insufficient and incorrect replies etc. Typical issues include billing complaints like airtime never loaded or unclear tariffs. Poor quality of service include undelivered SMS, poor voice quality and dropped calls; high failure rates of hardware such as on promotional mobile phones. Unsolicited messages is another commonly received complaint. It is in situations like these operators like Safaricom, Zain, MTN and Vodacom get the nicknames Suffaricom, $afcom, Sufferingcon, Zait, Pain , Most Troubled Network and Voodocon.

When providing low-increment services in a prepaid environment, back-office, billing and customer service must work extremely well. *"It is not good business if a $2 transaction billed incorrectly leads to a $10 customer service call."* (Cellular-news 2010a). Further, few customers know about their rights and obligations resulting in a situation where end-users do not get value for money from operators and service provid-

ers. Consumer rights are usually a form of government regulation and consumer education as a prerequisite for consumer protection. As the mobile industry is turning the ordinary citizen into a consumer, who gets more and more dependent on the network and available services, it becomes extremely important that the end-users know their rights and that there is some sort of body which protects the interests of consumers, alternatively consumers can unite and put pressure on the operator when the service is bad.

Spam

There are high volumes of spam in the VAS market in East Africa with Rwanda being the exception as it has legislation against it. A SMS spam in this case is an uninvited message urging the consumer to take advantage of some service.

Normally, a subscription or a premium SMS service, is when a user order a specific content in advance and is charged accordingly upon receiving the requested content, following a reverse SMS billing model. What often happens is that a user receive premium SMS even though she never subscribed to the service. It can be the daily horoscope, a game quiz or sex tips or similar. To stop those messages the user must send a request to the particular premium number she have received it from. To often the messages keep on coming.

Also when running health or political outreach and publicity campaigns, it is important to get "buy-in" from the target population. Otherwise the SMS campaign will be seen as spam exercise, causing irritation. To avoid this, a subscriber database of mobile phone numbers must be built.

Some sort of spam filter, an abuse reporting system or a functioning legislation is needed. In Uganda, the newly created WASPA-U is in the process to develop a code of ethics by which VAS providers will operate to ensure better service. The director of SMS Media in Uganda, Simon Kaheru, explains on the I-Network mailing list:

> *The SMS business has grown at a pace in Uganda that has not been matched by much regulation or control, and we as providers have realised the need to exercise self-control at the very least for the long-term sustainability of the sector. Our Code of Ethics primarily and squarely addresses the issue of Spam as well as other aspects [...]* (Kaheru 2010).

Human capacity development

A major challenge that the telecommunication sector face is that there are too few, qualified graduates. It should be the responsibility of universities and training institutions to meet the demands but starting up new courses and develop syllabuses takes time and means a high maintenance infrastructure cost. The ideal would be if operators could step in and create good partnerships. Unfortunately, the operators are not doing too much to solve the problem. With the profits generated, the operators with its vast experience in the sector could help to build special academies and training institutions. It should also be in the interest of governments to invest in education. Operators, being a major tax player (license fees, VAT on services, corporate tax, income tax of employees etc.) will be even better off if the human capacity base is broader. A likely scenario is that the top positions will be filled by people from abroad while lower scale jobs goes to East Africans.

Scaling up

Many of the applications that could benefit the poor most are still in their infancy in the region. There are many pilots but there are still few successes at scale. Scale is important for impact reasons and sustainability issues since scale reduces the unit cost and make the whole programme more cost effective and more efficient. Applications do not work in isolation, the more services available, the more active end-users and transactions, the better the mobile ecosystem of stakeholders will be. This is a mutually re-enforcing process.

In order to avoid the "forever pilot syndrome" that most ICT4D projects battle, it is important to design with scale in mind and to be familiar with all the costs involved when implementing a project. Having scale in mind is of extra importance when designing applications meant for national, public service – there is a need to get away from pilots and projects and rather promote a service delivery approach.

So, despite of all the progress in mobile applications, there is a lack of scale. Analysing mobile applications for social and economic development, a number of success factors have been identified (see Hellström 2009b):

- do the homework and avoid re-inventing the wheel
- end-user driven and look at needs
- fit into already existing patterns – learn from M-Pesa
- consider open standards/content and build a user community
- focus on usability and design with the end user in mind – applications addressing poorer segment of the society should work on existing phones to ensure access
- interface richness should correspond to the task at hand – there is no need for extravagance to display simple information
- involve right stakeholders, forge strong partnerships and use local capacity
- collaborate with other organisations doing similar interventions
- documentation is a key element throughout the project and to share lessons learned, successes as well as failures, benefit all

In the implementation phase:

- set measurable goals
- have a viable business model and/or predictable funding flows
- involve end-users in content creation where applicable
- use technology that align with the needs of the program it is designed to support – try to keep it simple
- implement a decentralised solution rather than centralised
- cross network instead of working only with one operator when possible, however, close partnership with operators seems to be crucial for most applications
- educate the end-user
- have a proper marketing to get a critical mass of users
- let it take time – as a reference, the M-Pesa pilot was not successful at all in the beginning and two years after launch it was still not proving to be profitable

Needs

It is vital to start with the drivers and needs of the end-user but to figure out how to meet the need of a mobile solution is tricky. Also, needs assessments are often biased by what various development experts think people need (healthcare, education, social empowerment), while what end-users really desire, need and want usually is something totally different (entertainment such as music and games). This mismatch in the definition of needs must be thought of and addressed at an early stage. There is also the issue of who is funding and paying the bill – each funder has their own priorities and agendas.

Every setting and market is uniquely different and complex and a one-size-fits-all approach might not work. There are commonalities though, elements can be reused but the final product often needs to be contextualised and localised. By involving right stakeholders and using local capacity the problem is partly solved. Also, by involving local capacity developers and implementers get access to local knowledge and content crucial for most interventions. A challenge here is that this knowledge very rarely is structured and might be hard to conceptualise.

In their application development process, AppLab in Uganda have the following approach (Cantor 2009):

- Assess information needs
- Analyse economic and information flows
- Identify how information is accessed
- Define sources of information
- Rapid prototyping and piloting
- Scale the winners

When developing their health and agriculture services that later was launched under the umbrella Google SMS, AppLab used an interesting approach. Ken Banks, founder of kiwanja.net with initiatives like FrontlineSMS, who consulted for AppLab at that time, recalls:

> *"One of the most interesting and exciting phases of the AppLab work was the rapid prototyping – getting out into the field (or the matatu [bus] stations, to be precise) and offering people the opportunity to text in agriculture- or health-based questions. Any questions. What seemed to them like a smart, fully-automated system was in fact a handful of health and agriculture students sitting at computers in the MTN/AppLab offices, manually reading incoming questions and formulating 160-character answers. Suffice to say, the data gathered over a few days gave the strongest indication yet of the need and perception of such a service to potential users. The value of this kind of work cannot be understated."* (Banks 2009)

Sustainability

Use depends on relevant services but also on lower prices for basic infrastructure and access. The lack of financial and operating models of mobile applications with potential for sustainable, rapid and large-scale growth is a major barrier to move from pilot towards full scale. A sound business model should both maximize the contributions and value of the various stakeholders involved while addressing the needs of the poor. It should generate enough profit to fund continued innovation and updating of content.

Some ways to ensure sustainability is to develop a Robin Hood like strategy where services are divided into a good/best offers. Best offer might include more information and better interface – but costs more. The generated profit could then subsidise the good offer. Another area not fully explored in East Africa is advertising based models. Even though a SMS is limited to 160 characters there is often room

for something more, which in this case could be a message from a private company etc.. Even voice applications could be sustained with similar solutions. Other areas worth exploring, depending on what type of application in mind, is mobile money transaction systems which opens up for pay as you go billing platforms.

In sectors where there are no clear profits to be gained, like in health, other solutions need to be looked into. Text To Change have been successful in running an incentive based system where participants receive free airtime as a way to sustain theproject and reach results. This solutions requires a good partnership with the operator.

Many pilots run as part of a company's corporate social responsibility (CSR) programme. It could be a good source for initial funding but very few CSR interventions are sustainable:the pilot is simply a part of the company's marketing plan once the press release been published and circulated the interest cease. However, if handled correctly it is possible to reach out to a critical mass of users, show impact and prove the concept and thereby increase the chance of getting continuous support.

Sustainability needs to be designed into the end product from start and the simpler the merrier. Low complexity of business model and the technical solution has proven to be a success factor. There are many costs during implementation phase too. Tactical Technology Collective have put together a checklist of possible costs when implementing a project involving mobile phones. See Table 18.

Table 18: Budgeting checklist

Set-up Costs	Human resources costs (salaries, etc..)	Planning
		Market research
		Project coordination
		Technology preparation
		Content development
		Other campaign preparation
		Contracted service provider or consultant fees
Technology	Hardware	Phones and SIM (or PDAs)
		Personal computers
		Servers
		Modems (Internet, phone network such as GSM, 3G, etc.)
		Other equipment (GIS, media recorders, UPS, cables, etc.)
	Software or online-services (either license or subscription fees)	Operating systems
		Publishing
		Messaging (applications, short codes, etc.)
		Project and campaign management
		Office applications (spreadsheets, image editing, etc.)
		Information safety (back-up tool, virus scanner, firewall etc.)
		Application integration
		Web-site hosting
	Communications	Mobile network connectivity (voice, data)
		Internet connectivity
	Other	Additional security measures
		Training (course fees, etc.)
		Administrative costs

Running and Maintenance Costs	Human resources costs (salaries, etc.)	Project coordination
		Campaign implementation
		Content development
		Other campaign tasks
		Financial and HR management
		Technology and information management
		Contracted service provider or consultant fees
	Marketing costs	Content development and design
		Materials
		Media Advertising
	Technology	Hardware
		Replacement and maintenance of purchased equipment
		Communications
	Software or online-service	Technology support
	Other	Additional security measures
		Insurance fees
		Training (course fees, etc.)
		Administrative costs

Source: Tactical Technology Collective 2008

Marketing

Good marketing begins and ends with a good product and service. Very few, independent mobile applications for development have a budget to roll out on a national scale. For a service provider it is therefore much easier and cheaper to go for third party deals and split the revenue with an operator. Kigen Kandie from the content and application developer Mobile Planet in Kenya (www.mobileplanet.co.ke) stated in an interview that you need a very strong marketing budget to run your own thing without the operator. He estimated a cost of US$50–100 000 to roll out something nationwide for one month. It cost Starfish US$2 million to promote its services on radio and TV during a nine months period, running six adds an hour on the radio (the urbanites went crazy according to Starfish). The idea was to raise awareness on how to use the value added service, i.e. step by step how to send SMS. Other companies have praised Starfish for their educational adds as it has helped them to run their services too.

What most existing implementations need to do is to segment the market, and then run micro-segmented marketing campaigns focusing on small target segments. This will hopefully lead to more relevant marketing messages and offers while minimising communication cost. If carried out correctly, micro-segmented marketing campaigns are highly effective and cost-efficient.

Marketing can also be seen as a capacity building exercise. One of Text To Change key lessons learned from their pilot in Mbarara, Uganda, is that an extensive marketing campaign using radio, bill boarding and newspapers, should precede an SMS program in order for end-users to pick up the message. Many services and programs would also benefit from sending out an introductory message explaining key commands, purpose of the service and how to stop the service.

Conclusion and recommendations

When mobile phones started to spread and become popular they were always compared to fixed line telephony. Today we see similar comparisons with internet – internet users versus mobile phone users – and discussions whether mobile phones or computers are the most appropriate tool to fight poverty. It is argued that since mobile phones have the greatest penetration, the aggregate impact is highest for mobile phones compared to other technologies. However, comparisons like this are not that fruitful since technologies are merging and so is the telecommunication sector with other sectors with mobile networks and solutions as the merging force. Mobile phones cannibalise everything and it will be the communication device used for internet surfing, mailing, money transactions, taking pictures, listening to radio and music, and watching video clips and television etc.. In the end though, it is not a question about the technology itself but what you do with it that matters. McNamara states:

> *In thinking about m-agriculture projects in particular, the focus should be on mobility, not mobiles. The broader reach of the mobile footprint into rural areas, and the growing range of "anytime, anywhere" services that this makes possible, is what is important, not the specific form of the electronic device through which people access those services. Indeed, what we call mobile phones are increasingly becoming multi-function mobile appliances, and many of their functions are converging with increasingly portable and affordable laptop computers. Given these trends, which will only intensify in the next several years as innovation in devices and services continue, the still-popular debate about whether to prioritize computers or mobile phones in ICT-for-development interventions seems increasingly sterile (McNamara 2009).*

Innovative use of mobile technology promotes growth and helps make markets more efficient, reduce transaction costs and increase productivity. Mobile solutions help in creating a more informed citizenship. We are witnessing a small revolution regarding new applications and services added to the mobile phone and a qualified guess is that we will see an incredible burst of new uses of the phones – especially when East African users are moving from traditional voice/SMS usage to data and IP (from 2G to 3G and 4G mobile standards). Simple technologies will still play an important role for many years to come though since smartphones like Android handsets and iPhone's only have a small distribution in developing countries compared to basic mobile phones.

The way people communicate is changing and from a technological point of view we see new trends regarding messaging: convergence between different messaging standards where end users can exchange email, SMS, MMS and instant messages between the mobile, other mobile devices and the Internet more or less seamless. When people are using IP enabled phones, instant messaging will become more popular and to some extend replace SMS. MMS will grow in popularity when camera phone penetration increases and with that, prices drop. Voice SMS and IVR are growing strongly too and might be a new killer application in rural, illiterate areas.

What will be the next big thing in terms of new applications and services? The possibilities are endless given the simple fact that the mobile phones are so accessible and ever present. Looking at applications, often less is more where the simplest device and solution might be just what is needed to address a particular problem. To understand the need in each particular setting is key – then identify appropriate, simple solutions. Otherwise practitioners and implementers create a situation where there are too many solutions looking for problems and this constitutes a problem in itself.

Some high potential application areas include (see Cantor 2009):

- financial services – after successful implementations of mobile money services in Kenya, Tanzania, Uganda and most recently in Rwanda, m-banking is set to grow. As it grows, there will be an integration of m-transactions systems into existing applications and services and m-commerce in general will thereby take off rapidly and widespread.
- governance – improved public service delivery by integrating services with m-transactions and by developing menu based information portals. Organisations and government should set up call centres and platforms for increased interaction with and between citizens.
- employment – further develop innovative applications and tools that connect job seekers to opportunities.
- education – most mobile based learning applications are still in their infancy but possibilities are huge for distance learning, supporting access to and creation of relevant content, integrating Geographic Information System (GIS) for real field tasks and projects etc..
- transportation coordination – using mobile phones to increase mobility, efficiency and profitability by linking people with various transportation solutions.

What is needed?

In order to to encourage economic growth and social development in East Africa, the interplay between the four elements access, affordability, appliance innovation and applications needs to be strengthen. Each element needs to be developed too. The interplay between and the development of the four elements is driven by various stakeholders.

Access:

- Further promote private sector investment and competition in mobile services since competition leads to increased penetration and ultimately better service and tariffs for the end user. The introduction of number portability will further promote competition leading to improved quality of service and declining costs.
- Many applications and services never reach out to the masses due to poor marketing and difficult to remember USSD and SMS short codes. Using a single point of entry for all services, like *100# to access a menu system or a SMS application that aggregates relevant services, are to viable solutions.
- Include use and deployment of mobile solutions in national poverty reduction strategies since mobile technology is a catalyst for social inclusion and could be a source of income, provide employment opportunities, provide valuable agricultural, market, health information and make the "unbanked" banked.

Affordability:

- Mobile phone ownership and usage must become more affordable. In order to lower the total cost of ownership, pressure should be put on operators for cheaper or free SMS; governments should consider to lower mobile-specific taxes, and handset manufacturers should be encouraged to develop and distribute low-cost handsets. There is strong demand for technologies and services that do the same for less money, rather than more for the same price. The details regarding interconnection fees, especially the actual cost, needs to be determined. This will be tricky because interconnection fees are both a cost and a source of revenue for the operators.

- In a sea of ever changing tariffs, promotions and competitions, it is almost impossible for the end-user to know what is the best deal. Pricing information is difficult to find in the public domain. The regulator should monitor call tariffs and regularly published them in the media with all charges fully disclosed and with instructions on how to join, use and exit etc.. The regulator should also be able to disapprove any offer from operators that will cause network congestion or poor performance of the network.
- Implement and develop new innovative business models tailored to local conditions. As most operators have been concentrating on urban areas, the challenge is to reach remote, potential consumers in a cost-effective way. As subscriber base goes up, ARPU is going down there is time for a new pro-poor strategy to reach out.

Appliance innovation and application development:

- Further promote collaboration and find the right fora for this, e.g. focused workshops, discussion lists, blogs, wikis, etc.. For example, in product development, when turning ideas into products, it would be good for developers to interact with other developers from other markets who have already done it. Exposure may lead to implementations.
- Understandable and easy to find documentation is needed to determine lessons learned, technology used, successes and failures etc.. This would mostly benefit developers but also policy makers, investors, practitioners and researchers. Further research on the socio-economic impact of mobile applications and use in East Africa is needed too.
- Support the implementation of development platforms that are capable of managing major differences between handsets and operation systems automatically. A premium SMS gateway and mobile portal for mobile solutions for social and economic development should be created too. This would drastically reduce the number of barriers for independent developers. The platform should further promote these SMS-based solutions as well as other mobile solutions, help in marketing and operate as a localised application portal, similar to Android Market (www.android.com/market/) and App-Store but with focus on locally relevant solutions.
- Commitment from the market and donors to support a long-term funding plan and sustain local entities to ensure ongoing innovation and availability of services.

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Appendix 1: Interviews, meetings and people consulted

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Selection of conferences and workshops attended during the consultancy

April 1–2, 2008. Nairobi, Kenya. "The African Banking Technology Conference – Sharing Knowledge and Best Practicies in Banking Across Africa". Conference organised by Aitec.

April 16–17, 2008. Uppsala, Sweden. "Big Brother and Empowered Sisters: The Role of New Communication Technologies in Democratic Processes". Conference organised by the Collegium for Development Studies at Uppsala University, in collaboration with Sida's ICT4D Secretariat, and Division for Democratic Governance.
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October 13–15, 2008. Johannesburg, South Africa. "MobileActive08 Summit – Unlocking the Potential of Mobile Technology for Social Impact". Organised by The Southern African NGO Network (SANGONeT) and MobileActive.org.
http://www.mobileactive08.org/

November 5–6, 2008. Kampala, Uganda. "M4D in East Africa" Organised by Makerere University, UPGRAID and Knowledge Consulting.
http://m4d.kcl.co.ug/

December 11–12, 2008. Karlstad, Sweden. "Collaboration in East Africa: Project Planning" in conjunction with the "1st International Conference on 'M4D': Mobile communication technology For Development". Centre for HumanIT at Karlstad University.
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April 1–2, 2009. Maputo, Mozambique. "Africa Perspective on the Role of Mobile Technologies in Fostering Social and Economic Development".
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September 16, 2009. Washington DC, US. "Mobile Innovations for Social and Economic Transformation – From Pilots to Scaled-up Implementation". The workshop was prepared by the World Bank Global ICT Department in collaboration with infoDev, IFC, EduTech, WBI, HNP Learning,and CGAP.
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October 20, 2009. Stockholm, Sweden. "E-health – promise or pitfall for developing better health?". Organised by Karolinska Institutet.

Appendix 2: List of key m-applications for development

Appendix 2 show the availability of relevant social applications and information services in the East African market. Most of the m-applications listed can be characterised as consumption applications (end-user relevant) while other are more for orientation purposes. Services like BungeSMS, M-Pesa and Google SMS are for direct consumption and more relevant for mobile end-users. Ushahidi and FrontlineSMS are not for direct consumption but rather describe a tool that can be used and implemented for a specific service. To list all these implementations, e.g. every single instance where FrontlineSMS has been used in East Africa, would be next to impossible.

Some applications can fit under many different categories.

Sector	Application area	Location	Project	What?
Agriculture	Commodity Prices and Market Information	Kenya	DrumNet	Transaction platform linking small holder farmers to markets, finance and information. DrumNet partners with buyers and sellers (farmers) of produce. Stockists of farm inputs, farmer intermediary organisations, banks to provide finance. Run by Pride Africa since 2003. www.drumnet.org, ina@drumnet.org
		Kenya	SMS Sokoni	SMS Sokoni is a service that enables farmers to receive market prices in various market centres around Kenya via SMS. Run by Kenya Agricultural Commodity Exchange (KACE), which is a private initiative launched in 1997. Their aim is to link sellers and buyers of agricultural commodities and provide relevant and timely marketing information and intelligence. Works in partnership with Safaricom through their Get It 411 services. www.kacekenya.com/ www.safaricom.co.ke/index.php?id=322
		Kenya, Tanzania	Livestock Information Network and Knowledge System (LINKS)	Provides livestock prices on most major markets in Ethiopia, Kenya and Tanzania via SMS, email, WorldSpace radio and web. LINKS is also a market data collection tool where livestock prices and volumes are collected by market monitors. Average prices by animal kind, breed, class and grade is then calculated along with the total volumes of livestock by animal kind. The data is coded and sent into the database system using SMS or web. The project is led at the Texas AM University. http://links.tamu.edu/
		Kenya, Tanzania, Uganda	RATIN SMS	Commodity prices from various terminal markets within East Africa visa SMS. Currently, the service is only available in Kenya, Uganda and Tanzania but will soon be available in Rwanda and Burundi too. Type in the commodity of interest followed by the terminal market or country, specify the currency and units of measure, e.g. MAIZE NAIROBI KSH KG. Send SMS to 8000 in Kenya, 7197 in Uganda, and 15711 in Tanzania. Premium charged. www.ratin.net/

Sector	Application area	Location	Project	What?
		Rwanda	eSoko Project	A platform used to collect and distribute agricultural market price information using SMS and web. The system is built by software company BusyLab in Ghana. It allows farmers to access prices of agricultural commodities vis SMS, web and in the near future via IVR (voice). In Rwanda eSoko Project is being implemented in 2010 by the eRwanda Project and Ministry of Agriculture. 3500 mobile phones will be distributed to farmers through cooperatives and at least one cooperative in every district will benefit from the project. www.esoko.com/, wilson.muyenzi@rita.rw
		Uganda	Google Trader (Google SMS)	A user-generated trading bulletin that through SMS posting and notifications matches buyers and sellers of agricultural produce and commodities as well as other products. Shortcode 6007, premium charged. Developed in partnership with MTN Uganda and AppLab. www.google.co.ug/mobile/sms/
		Uganda	CKW Search	A series of forms, presented in Java, guides the user through a menu to search for agronomic techniques for banana and coffee production. Content provided by Uganda's National Agricultural Research Organisation, Uganda Coffee Development Authority, and the International Institute for Tropical Agriculture (IITA). www.grameenfoundation.applab.org
		Uganda	Input Supplier Directory	An SMS-based keyword search service that gives the location and contact details of shops offering specific agricultural inputs, such as seeds, pesticides and fertilizer. Content provided by Uganda National Agro-input Dealer Association (UNADA). www.grameenfoundation.applab.org
		Uganda	Agricultural Market Information System (AMIS)/Acacia II	It was implemented in 2004 in western Uganda by African Highland Initiative funded by IDRC through establishing ICT-centres, telecentres and village information centres where mobile phones were used for data collection and information dissemination. Project is now handed over to the National Agricultural Advisory Services (NAADS), which is a program of the Government of Uganda put in place to increase the efficiency and effectiveness of agricultural extension service. www.naads.or.ug/, k.masuki@cgiar.org
		Uganda	FOODNET	FoodNet was launched in 1999. It covers harvest and market research information in East and Central Africa. In Uganda farmers can get prices via SMS by typing any one of the commodities BEEF, FISH, MILK, CATTLE, PORK, HONEY, HIDES, SKINS, PIGS, GOATS, EGGS and send to 198 on MTN or 755 on Zain. In partnership with Livestock Market Information Service. www.foodnet.cgiar.org/

Sector	Application area	Location	Project	What?
		Uganda	INFOTRADE Mobile	Up-to-date agricultural prices via SMS. Type price commodity market, e.g. "price beans jijna" and send to 8555. Answer will be "Dried beans, Yellow Jinja: retail = 1500, wholesale = 1400". INFOTRADE was set up in July 2008 in a partnership venture between FIT Uganda Ltd and ASPS Danida aimed at implementing agricultural market information services in Uganda. www.infotradeuganda.com/
	Education & Awareness Good cultivation practices, improved crop varieties, pest and disease management, pest and disease management etc..	Kenya	National Agriculture Information Service (NAFIS).	Interactive voice-based service that converts text to voice providing agricultural information in English and Kiswahili. Intended to serve farmers' needs in rural areas. Run by National Agriculture and Livestock Extension Programme (NALEP) of the Ministry of Agriculture and Ministry of Livestock development. In collaboration with Teknobyte (Kenya), Speechnet Ltd, Popote Wireless, Agriculture Information Resource Centre (AIRC), University of Nairobi. Service accessible by calling 020-47NAFIS or 020-4762347 www.nafis.go.ke/ www.teknobyte.co.ke/
		Tanzania	Farm Radio International/Freedom Fone	Farm Radio International is a Canadian-based, not-for-profit organisation working with about 300 radio broadcasters in 39 African countries to fight poverty and food insecurity. They partnered with Freedom Fone to established 5 listening communities attached to 5 community radio stations in varied locations in Tanzania. www.farmradio.org/www.freedomfone.org/
		Uganda, Rwanda	MPAIS (Marketplace for Information and Services)	MPAIS is a demand driven information and service platform that brings together demand and supply of information and services. Uses SMS to provide information to farmers and extension workers. Alive since 2005. www.mpaisuganda.com
		Uganda	Farmer's Friend (Google SMS)	A searchable database of locally relevant, organic tips and agricultural advice, plus a three day and seasonal weather forecast. Launched 2009 using shortcode 6001. Developed in partnership with MTN Uganda, AppLab and BROSDI. www.google.co.ug/mobile/sms/
		Uganda	CELAC	CELAC is a project of BROSDI (Busoga Rural Open Source and Development Initiative) that collects and exchange local agriculture content using ICT and knowledge-sharing methods to enhance poverty reduction and food security. Agriculture information collected at knowledge sharing forums is repackaged and sent once a week to farmers via SMS. Sometimes the message is read out in the village horn. The project also use mobile phones for voice conferencing (loudspeakers connected to the phone) between farmers to share information and discuss agricultural problems. When a farmer group wants a meeting they beep a BROSDI member who then phones back. The method enables direct communication and also saves on travel costs and time. Project started in 2005. www.celac.or.ug, brosdi@infocom.co.ug

Sector	Application area	Location	Project	What?
Health		Uganda	Question Box	Question Box is an Open Mind initiative and the version implemented in Uganda is run by Apprica. Question Box is a free telephone hotline service, in local languages, where callers are connected to a call centre where an operator with access to internet and a database who can look up the question and provide the information requested. Question Box also have a network of agents in the field who have mobile phones and ask the question on behalf of the individual. The agents get compensated with free airtime. Working with the Grameen Foundation in Uganda and Uganda's National Agricultural Research Organisation, they plan to expand the service further and also include a SMS based service. www.questionbox.org/
	Other	Uganda	Flower SMS	International Trade Centre (ITC) in cooperation the Uganda Flower Exporter Association (UFEA) with technical support from CIT at Makerere University, help flower exporters closely monitor the temperature of their products at different steps in the supply chain. Temperature measurements will be taken at various spots and sent via SMS to a database. Help flower exporters yo track down the hot spots in their supply chain. www.intracen.org/
	Education & Awareness Mobile phones in support of public health and behavioural change campaigns.	Kenya	Games4Life	The projects envisages mobile phone games that educate and entertain audiences on topical issues. The games allow the youth to interact with verified HIV messaging that they may not be comfortable asking their parents for. Implemented by Mobile4Good, in partnership with Safaricom, the Star Program (Dutch based social investors HIVOS and KPN), ZMQ for technical know-how, and Mobile Planet for testing and connectivity to the networks. Two games are designed for Java enabled phones, AIDS Penalty Shoot Out and AIDS Fighter Pilot. The third game is a SMS based quiz. The Java games are charged Kshs 50 for every game downloaded and the SMS games will be charged at Kshs 5 for every SMS received. Charging for the games ensures sustainability of the initiative. www.mobile4good.biz/services.html
		Kenya	Health Tips	A service offered by Mobile4Good that is designed to provide subscribers with useful tips on various pertinent health issues. Kshs 7 per SMS. www.mobile4good.biz/services.html
		Kenya	MyQuestion	A service by Mobile4Good, which has been developed to allow customers to anonymously ask HIV/AIDS and Breast Cancer related questions and receive answers. Kshs 7 per question and per answer. www.mobile4good.biz/services.html

Sector	Application area	Location	Project	What?
		Kenya	VCT Online	The programme urge Kenyans to get HIV tested and have their status added to a confidential database that partners can query before having sex. The system sends both persons an SMS telling them if their status is similar or different. To join and get their HIV status into the VCT Online database, users must buy a physical or e-Mteja card, send an SMS with the card number and a password, and submit a blood sample to participating lab. The test results are then added to the database by SMS together with the date when the test was done. The data is held valid for three months after which retesting is required. The system was set up with help from the Kenya Institute for Capacity Development and Research Limited (KICDR). www.vctonline.org/
		Uganda + more	Text To Change	Text to Change is a non-profit organisation which is devoted to improve health education and medicine adherence via mobile devices. They design complete programs and develop their own software, hardware and can control a program from the drawing board until the data analyses. Main product is an interactive and incentive based SMS multiple choice quiz. www.texttochange.com/
		Uganda	Health Tips (Google SMS)	Provides sexual and reproductive health information. Free service accessible through shortcode 6001 on MTN. In partnership with Marie Stopes Uganda and Straight Talk Foundation. www.google.co.ug/mobile/sms/
		Uganda	Clinic Finder (Google SMS)	Helps locate nearby health clinics and their services. Free service accessible through shortcode 6001 on MTN. www.google.co.ug/mobile/sms/
		Rwanda	NACC Hotline	A free national hotline for information on HIV prevention, care and support services provided by National AIDS Control Commission (NAAC). The hotline works from 7am to 8pm on 3334 and 3335. www.cnls.gov.rw/hotline.php
	Data Collection and Health Record Access Applications using mobile devices to collect and/or access real-time patient data	Kenya	ChildCount+	ChildCount+ is a mHealth platform developed by the Earth Institute in collaboration with the UNICEF Innovation Group for the Millennium Villages Project. ChildCount+ uses SMS to facilitate and coordinate the activities of field based health care providers, usually community health care workers. Through SMS and the RapidResponse platform, users are able to register patients and send in health reports to a central web dashboard that allows a health team to closely monitor the health of their community. The application help facilitate communication between the members of the health system and an automated alert system helps reduce gaps in treatment. www.rapidsms.org/about/projects/childcount www.childcount.org

Sector	Application area	Location	Project	What?
		Kenya	Weltel	Weltel is a Kenya-based application that uses SMS to support the clinical management of patients in resource-limited settings. Using SMS in improving patient adherence and response to highly-active antiretroviral therapy (HAART). A weekly SMS is sent out the patient: "Mambo", Swahili for "how are you", to which the patients can respond "Sawa", OK, to show they are fine, or "Shida", which means problem, to show they need attention. Weltel operate at two sites in Nairobi and a site in Kajiado District. Partnership between the Universities of Manitoba and Nairobi funded by US Centers for Disease Control and Prevention (CDC), International Development Research Centre (IDRC) and U.S. President's Emergency Plan for AIDS Relief (PEPFAR). www.weltel.org
		Kenya, Uganda	EpiSurveyor	Open source mobile data collection system that enables users to easily create a handheld data entry form, collect data on a mobile device, and then transfer the data back to a server or laptop for analysis. Mostly used in health, for example by Ministry of Health officials in Kenya to collect data about vaccine programmes. Run by Datadyne and Ministry of Health since 2003 www.datadyne.org
		Rwanda, Tanzania	Phones for Health	Support for community health workers in various health interventions. It uses computers and mobiles to establish a national electronic reporting system that eases delivery of public health care at the village level. Implemented by Voxiva, GSMA Development Fund, the U.S. President's Emergency Plan for AIDS Relief (PEPFAR), Accenture Development Partnerships, Motorola and MTN. Ministry of Health Rwana and Ministry of Health Tanzania involved. www.pepfar.gov/c21414.htm
		Rwanda	TRACnet	Gathering clinic level information on infectious diseases through mobile phones. Virtually all facilities providing ART to HIV patients submit monthly reports using mobile phones. View analyse and map the data in realtime to make more informed decisions. Implemented by TRAC (Treatment and Research AIDS Center, an institution of the Ministry of Health of Rwanda), Voxiva and the US Center for Disease Control and Prevention (CDC). Started in 2003. www.tracrwanda.org.rw www.tracnet.rw (login required) tracinfo@tracrwanda.org
		Tanzania	CommCare	CommCare, short for Community Care, is a support tool for data collection and decision support used by community health workers. The application aid household visit tracking, visit support and data collection, follow ups, record keeping, health protocols, day planning and data exploration. It is run by D-tree International together with OpenROSA and Dimitri since 2008. www.d-tree.org/

Sector	Application area	Location	Project	What?
		Tanzania	IMCI Tanzania	e-IMCI (Integrated Management of Childhood Illness) protocols used by community health workers. Developed by D-tree together with Ifakara Health Research and Development Centre. www.d-tree.org/
		Uganda + more	OpenXdata (previously EpiHandy)	Community-developed, open source data collection tool for management and dissemination of information. Handle any type of forms based data collection and management using mobile devices and web forms (online or offline). Free to use and can run on both high- and low-end mobile devices and mobile phones (J2ME and sending data using, Bluetooth, GPRS or SMS). In Uganda, developed by Department of Innovations and Software Development (DISD) at Makerere University in collaboration with many partners from all over the World. http://openxdata.org/
		Uganda	Uganda Health Information Network (UHIN)	Use of handheld computers and wireless access points by health workers to access health information and collect health data. Implemented 2004. www.healthnet.or.ug
		Uganda	MIDAS (Mobile Information Datacollection Analysis System)	Simple SMS data collection by answering designed questions by the developer as provied by the client, i.e. creating health data from villages to Ministry of Health through answering questions designed by the ministry via SMS. Developed by COMTEL Integrators Africa LTD in 2008. www.comtelafrica.com
		Uganda, Rwanda + more	OpenMRS Mobile	Collection of patient data using Java enabled mobile phones and submitting it into OpenMRS. www.openmrs.org
	Monitoring/ Medication Compliance Maintain care giver appointments or ensure medication regime adherence via one-way or two-way communications	Tanzania	HIV/AIDS Tanzania	Care and treatment to HIV/AIDS patients through a set of clinical protocols. D-tree International in cooperation with Center for Disease Control, IntraHealth International and Columbia University. This application is extended by a tuberculosis (TB) module. www.d-tree.org/
	Disease/ Epidemic Outbreake Tracking Send and receive data on disease incidence, outbreaks and public health emergencies	Rwanda	HealthWatch	A disease surveillance solution run by Voxiva. HealthWatch is an integrated surveillance platform used by the public health agency to support integrated disease surveillance, syndromic surveillance, and coordinated response. www.voxiva.com/

Sector	Application area	Location	Project	What?
Banking/financial	Health/Administrative Systems	Kenya	Bloodbank SMS	BloodBank SMS was developed to improve the communication between local district hospitals and Kenya's centralized blood banks. The system enables medical workers at the local district hospitals to provide information about their remaining blood stock directly to their centralized blood bank. http://eprom.mit.edu/bloodbank/
		Rwanda	HealthNet	Voxiva's HealthNet is a health program management solution for diseases such as HIV/AIDS. Include a drug inventory management system. www.voxiva.com/
	Analysis, Diagnosis, & Consultation Phone as point-of-care device.	Tanzania	IMCI, HIV/AIDS, TB, Diabetes, CommCare, Malaria, Reproductive Health	Runs a number of projects all based on a decision support system for health workers to check patients condition before going to see doctors. A system of protocols, that are delivered from mobile phones, allows community health workers to deliver high-quality and effective care where there is no doctor. The mobile phones take the health worker step by step through the diagnosis and treatment options for a range of illnesses. Implemented by D-tree International together with OpenROSA, Ministry of Health among others. www.d-tree.org/
	Money transfer	Kenya	Zain Zap	Send and receive money, top up airtime, withdraw from bank accounts, pay KPLC bills, pay for shopping. Flat fee of Ksh 10. www.ke.zain.com/en/zap/index.html
		Kenya	Safaricom M-Pesa	Send and receive money, international transfers (UK-Kenya), top up airtime, pay bills. More info by dialling Safaricom customer support on 234. Fees depending on size of transaction. Application owned by Safaricom Cooperates with a range of different partner like agents in the UK, Western Union, Provident Capital and KenTV. www.safaricom.co.ke/index.php?id=745 m-pesa@safaricom.co.ke
		Kenya	yuCash by Obopay	Yu (Essar Telecom Kenya) teamed up with Obopay and Nokia to launch a money transfer services called yuCash to be carried out under the Obopay platform using Equity Bank as banking partner. With a country-wide network of agents, yuCash by Obopay offer the following to registered users; deposit cash, send money, withdraw cash, buy yu airtime, check the balance and transaction history. In addition to theses standard services yuCash offer a feature that enables the recipient of the money to initiate the transaction and request the sender to send a certain amount of money. The sender only has to confirm and have sufficient funds to send and the transaction gets concluded. A short message with the transaction can be sent as well as invitations to yuCash to friends and other contacts www.yu.co.ke/

Sector	Application area	Location	Project	What?
		Kenya	Eazzy 24/7, "Benki Yangu Mkononi"	Equity account holders can credit and transfer cash into other Equity accounts, pay their utility bills, purchase airtime, request bank statements and perform 13 other banking tasks over the mobile phones. Run by Equity Bank and CGAP since 2008. www.equitybank.co.ke/
		Rwanda	MTN Mobile Money	Send money to anyone in Rwanda, withdraw cash at any authorized MTN Mobile Money Agent, buy MTN airtime. www.mtn.co.rw/index/bvoice-services-mobilemoney
		Rwanda	Rwandatel Mobile Payments (Forthcoming)	Rwandatel will launch the service in partnership with Access Bank Rwanda. www.rwandatel.rw/?Forthcoming-Services
		Tanzania	Zain Zap	Send money from bank account to ZAP account or vice versa. Receive and send money, cash in/cash out, top up airtime, pay utility bills, pay for the goods and services. Flat fee of Tsh 150/=. Many extra services exist, like fuel payment service that allow Zap customers to pay for fuel at Oilcom fuel stations. www.tz.zain.com/
		Tanzania	E-Fulusi Mobipawa	Solution for all operators, ie operator independent. Developed in 2007. www.efulusi.co.tz/?p=products&s=mobipawa www.mobipawa.co.tz
		Tanzania	Vodacom M-Pesa	Deposit and withdraw money and send money to any mobile subscriber in Tanzania. Buy prepaid airtime, manage the account. Vodacom and the electricity generator Tanesco have also made it possible for customers to pre-pay for their electricity. Vodacom is also facilitating the payment of school fees. www.vodacom.co.tz/docs/docredir.asp?docid=3492
		Tanzania	Zantel ZPesa	Deposit money, withdraw money, send money. Buy prepaid airtime, manage the account. In cooperation with e-Fulusi. Short code 15097. If additional services are introduced the account is automatically updated. Services are overseen by Bank of Tanzania and licensed by the TCRA. The account is safeguarded by a secret word and a password. Money can only be deposit and withdrawn through an authorized ZPesa Agent. Money transfer can either be account to account or account to non account. www.zantel.co.tz/zpesa.html
		Uganda	MTN Mobile Money	Available for MTN subscribers. Allows you to send money to any mobile phone user and withdraw cash at any authorised MTN Mobile Money agent. Subscribers can also buy airtime. www.mtn.co.ug/MTN-Products/MTN-Mobile-Money.aspx
		Uganda	Zain Zap	Fee for every transactions, free to join. In partnership with Standard Chartered Bank Uganda. www.ug.zain.com/en/zap/index.html

Sector	Application area	Location	Project	What?
		Uganda	M-Sente	Run by Uganda Telecom with infrastructure from MAP International and DFCU Bank as the banking partner. USSD based system that allow users to deposit, transfer, and withdraw funds. Users can also buy airtime and pay school fees. M-Sente rates are fixed at 500 UGX for any amount sent whereas receiving depends on the bulk. Maximum transfer value is set to 2 million UGX (USD 1000). www.kaingroup.net/utl/ www.dfcugroup.com/ www.businesscalltoaction.org/
		Uganda	Simba Cash	Simba Cash is an instant money transfer service which operates under Simba Forex Bureau run by Simba Telecom. This service uses Simba Telecom's retail outlet to provide instant money transfer services around the country. Currently, the service has been rolled out to 17 Simba Telecom shops in Uganda. www.simbatelecom.com/
	Airtime transfers	Kenya	Orange Transfer	Orange #123# portal, subscribers can transfer between Kshs 50 and Kshs 2,000. www.orange.co.ke/
		Kenya	Okoa Jahazi	Safaricom's credit advance service where subscribers can request 50 Kshs for an additional cost of 5 Kshs. www.safaricom.co.ke/index.php?id=925
		Kenya	Eneza	Electronic Top Up offered by Yu. Top up any amount from Kshs 10 to Kshs 99,999 straight to the phone without scratch cards. www.yu.co.ke/
		Rwanda	MTN Me2U	Me2U is an airtime-sharing service which enables the user to top up mobile phones of other customers directly through the phone. *772*number*amount# OK (Amount: 500, 1,000 or 2,000 Rwf – up to 3 a day) www.mtn.co.rw/index/pvoice-services-me2u
		Rwanda	Rwandatel Gift for You	*220*amount*number# OK. www.rwandatel.rw/?Gift-For-You
		Rwanda	Transfer balance, Give me balance	Share balance by dialling *132*[phone number]*[FRW]#. Ask for balance by dialling *133*[phone number]*[FRW]#. www.tigo.co.rw/
		Tanzania	Zain Me2U	Airtime can be sent in any denomination between Tshs 200 to Tshs 50,000/= www.tz.zain.com/en/phone-services/Me2U/index.html
		Uganda	Orange Easy Share	Tansfer any amount between 10 /- and 100,000 /- per day. *143*number*amount#. 40 Ushs/transaction. www.orange.ug/mobile-plans/easy-share.php
		Uganda	Zain Me2U	The normal sms rate applies. www.ug.zain.com/en/phone-services/me2u/index.html
		Uganda	Warid Balance Share	*166*amount*number# or dial 166 toll free. http://waridtel.co.ug/balanceshare.php
		Uganda	MTN Me2U	Any amount between 1/- and 50,000/-. Give(space) number(space)amount, normal SMS rates apply. www.mtn.co.ug/Value-Added-Service/Value-Added-Service-%281%29/MTN-Me2U.aspx

Sector	Application area	Location	Project	What?
Governance	Bill payments and other	Kenya	Jamii Bora	Faulu Kenya is a microfinance institution with branches all over Kenya. Members repay loans using mobile application. The devices are connected to both Zain and Safaricom. www.jamiibora.org/
		Kenya	Bill payment, E-bill and SMS Alert	Bill Payment through the mobile phone if you are a registered Cooperative Bank customer and have registered the KPLC account number with the bank. E-bill is a electronic bill querying service for account balance and bill due date via SMS. SMS Alert sends disconnection alerts, power outage alerts, bill reminders two days prior to the due date. Type the first part of the account number and send to 5551. Service offered by Kenya Power & Lighting Company Ltd (KPLC) and Adtel. www.ad-tel.com www.kplc.co.ke
		Kenya	Mosoko	Mobile version of craigslits which is local classifieds and forums, which are community moderated and free. Developed by the Mosoko team whose objective is to create a cell phone application which will provide market information to Kenyans about available jobs and available goods. wiki.nrcc.noklab.com/Mosoko
		Kenya	SMSoko	SMSoko is an SMS/Web based market-place that enables buyers and sellers of anything to interact and transact. Developed by Symbiotic. http://zunguka.com/elite.frontpagers/smsoko.sss
		Rwanda	Cellpower	Prepaid electricity scratch cards service using the proven airtime scratch card model. Entrepreneurs purchase the prepaid electricity cards in bulk and then sell them throughout Rwanda. Run by SMS Media in partnership with Reco-Rwasco (former Electrogaz) since 2006. jgasanja@smsmedia.com
		Rwanda	pivotaccess.com	Allows you to buy prepaid electricity tokens over the web or with the mobile phone. www.pivotaccess.com/
		Uganda	UTL Info Service	Foreign Exchange Rates by sending keyword FX to 434. www.utmobile.ug/myfone/services/
	Government News, Information, Updates	Kenya	Road Safety	Allows commuters to report public vehicles contravening traffic regulations run by Transport Licensing Board of Kenya. The dedicated SMS hotline is 2333.
		Kenya	e-Service Delivery Project	Information on progress of identity card (text 2031) and status of passport (text 2032). The government will expand this service to cover other key areas of service delivery such as Lands and Health. Run by Ministry of Migration and Directorate of e-Gov. www.e-government.go.ke/

Sector	Application area	Location	Project	What?
		Kenya	Emergency/ notification	In Kenya, post election 2007, threats and misinformation was floating around using SMS. The government authorities intervened with the help of mobile operators and sent out a mass SMS stating "The Ministry of Internal Security urges you to please desist from sending or forwarding any SMS that may cause public unrest. This could lead to your prosecution". This is an anecdotal example but yet interesting: the state and the operators working together in the event of crises.
		Kenya	Election results	Mobile Planet provided up-to-the-minute election results by text message in 2002 and 2007 Kenyan elections. As the results were tallied, subscribers were sent updates via SMS. www.mobileplanet.co.ke/
		Kenya	Voter registration	In the run-up to the 2007 Kenya elections, the Electoral Commission of Kenya (ECK) launched a voter registration service where you could SMS the register by sending your ID number to receive verification of voter registration. They later tried to sell the application.
		Uganda	Voter reminder	The Electoral Commission (EC) sent out 500,000 SMS to remind potential voters for an upcoming referendum in 2005. SMS Media's bulk SMS tool was used.
	Law Enforcement/Safety	Kenya, Tanzania, Uganda	Lake Victoria Project	Enhance mobile coverage on Lake Victoria for better communication. Saves lives on the lake in call of accidents. Run by ZAIN and Ericsson. www.gsmworld.com/
		Kenya, Tanzania, Uganda	Misc. short codes	Even though designed for voice they are worth mentioning: regional numbers are 112 for emergency/ police/SOS, 114 for fire and 115 for ambulance. In Kenya and Tanzania there are some designated short codes for 'Crime Stoppers' (111) and 'Anti-corruption' (113). In Tanzania, if you call 113 you will come to the Prevention of Corruption Bureau (PCB). In Uganda, one can leave anonymous complaints on a special hotline (347387) to the Inspector General of the Government (IGG) "for rapid response to complaints" (IGG, 2009). Kenya Anti-Corruption Commission (KACC) have a similar system in place.
		Kenya	Zain 911	Zain 911 Rapid Response Service is a Zain Kenya initiative in conjunction with security firms KK Security and EARS. The hotline connects to the emergency response teams from KK Security that are located all over Nairobi and respond to any emergency situation like residential robberies, roadside emergencies including fuel delivery and ambulance services. Trouble-spot SMS alerts are sent out too to subscribers. Service is available to all Zain subscribers in the greater Nairobi area only. Other urban centres including Mombasa, Kisumu and Eldoret will be covered by end of 2010. Monthly rate is KES.2,500/-. www.ke.zain.com

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		Tanzania	Albino hotline	Police handed out free mobile phones to 350 Tanzanians with albinism. "Each phone comes with a "hot line" to the police. Albinos text in their location if they suspect they are being tracked by gangsters determined to kill them and harvest their body parts." (The Economist, 2009). Vodacom offered free top-up vouchers, while both Vodacom and Zain offered equipment to the police to record incoming SMS messages. Also anecdotal but worth mentioning. Many albinos have been killed in the last few years (especially in Tanzania and Burundi but also in Kenya and Uganda) supply witch doctors with organs, teeth, limbs and hair.
		Tanzania	Public Alert System	Tanzanian police implemented an SMS alert system to allow for anonymous reports on crimes, wrongdoing by police officers, or request emergency services. Run by E-Fulusi and Tanzania Police. No longer active. http://police.efulusi.co.tz/
		Uganda	Emergency, Police & SOS	Option of contacting the police through SMS to report emergencies. Available to Warid Telecom subscribers. SMS to 112 or 999.
	Citizens-to-Government	Kenya	BungeSMS	Empowers citizens to influence local governance in their constituency through the use of SMS and web. It intends to strengthen citizen-to-government (bottom-up) communication in governance. An SMS to a Member of Parliament (MP) is sent to a designated number and routed to the BungeSMS website. On the BungeSMS website, it is mapped onto Google Maps using the Ushahidi platform. Run by Made In Kenya Network. Send SMS to 3454. www.bungesms.com
		Kenya	Budget Tracking Tool	The Budget Tracking Tool is a collaborative platform for grassroots communities to proactively engage in public resource management. It enables citizens to monitor and track both disbursments and utilisation of developments funds, projects funded by Constituencies Development Fund (CDF, www.cdf.go.ke/), Local Authority Transfer Fund (LATF, www.localgovernment.go.ke/), Women's Fund and Youth Fund. The tool can be accessed via web and by SMS by sending a text message to 7002, e.g. constituency#project (westlands#water). It can also be used for feedback in the format #constituencyname#projectname#comments. The tool has been developed by the Social Development Network and designed by Infonet. www.sodnet.org www.opengovernance.info
		Kenya	Martus	Martus is an online reporting tool for documenting human rights violations. It is open source, has tight security to protect the identities of individuals and organisations, it is encrypted on both the local drive and the remote server, and records are stored in a distributed system involving multiple servers. A SMS module for human rights reporting and feedback is developed in Kenya to further increase usage and access. www.martus.org/

Sector	Application area	Location	Project	What?
		Kenya	2888	An SMS service that allows Kenyans to send information, suggestions, complaints etc. via SMS to number 2888 to the Office of Public Communications. The aim is to increase the citizen-to-government communication and sensitize the government spokesperson to the priorities of Kenyans. The service will also help in tracking and apprehending corrupt officials and was used during the food crises in 2009 as a way to ease communication. Launched in June 2005. www.communication.go.ke/
		Uganda	Tracking School Attendance	Twaweza is collaborating with SNV Uganda on a project to facilitate monitoring of teacher and pupil attendance and absenteeism in primary schools by using an SMS based information system. The project will pilot an SMS based application that generates frequent and detailed overviews of teacher and pupil attendance in 100 primary schools, selected in 2 districts. The information will make the dynamics around teacher absenteeism transparent and will inform district and sub-district government officials for their appropriate short, medium and long term action, as well as non state actors at (sub) district level. http://twaweza.org/
		Tanzania	Daraja	Daraja is a Tanzanian NGO that aims to develop tools and encourage citizens to report waterpoint functionality in their areas. The information from citizens (via SMS or other mobile telephony) will go to a database that has water point mapping information of the area. Twaweza is providing support to Daraja to a) share information about water point functionality to the public in accessible formats, primarily through the media and b) enable citizens to update functionality information in real time via SMS, and c) analyse and publicize responsiveness of government to citizen notification. http://twaweza.org/
	Employment Services	Kenya	txteagle	A mobile crowd-sourcing application launched by txteagle and Safaricom. It enables people to earn and save small amounts of money by completing simple tasks on their phones for companies who pay them either in airtime or cash. Partnership between txteagle and Safaricom initiated 2009. http://txteagle.com/
		Kenya	Mobile Movement	A micro financing website that connects young entrepreneurs in the slums of Nairobi with the rest of the world using mobile technology. You can give the youth groups creative business ideas, microfinance a project, be a mentor or offer a community grant. Mobile Movement in partnership with UN-HABITAT and Environmental Youth Alliance (Canadian non-profit). www.mobilemovement.tv/

Sector	Application area	Location	Project	What?
		Kenya	Kazi560	A job information service that allows employers to post job listings and job seekers to get personalized text messages based on the kind of work they are looking for. It offers jobs in more than 78 categories from managers to drivers. Kshs 10 per SMS received. Run by Mobile4Good and OneWorld Kenya. www.kazi560.co.ke/
		Uganda	Job Platform	Employers are able to access the labor force and recruit instantly through a SMS service. All the job seekers need to do is type an SMS with credentials and availability and send it to a designated number for a cost of Ushs 1,000 per SMS (USD 0,5). Details will be listed in the following Wednesday's edition. Job providers can send their details at the cost of Ushs 3,000 per SMS (USD 1,5). Offered by one of Uganda's biggest daily, Daily Monitor, in collaboration with the value added service provider True African. www.monitor.co.ug
	Disaster and Crises Management	Kenya	Ushahidi	Crowdsourcing tool to exchange and distribute information via mobile and web about social and political crisis. The platform allows anyone to gather data via SMS, email or web and visualize it on Google map or timeline. Open source. Grew out of the post election violence in Kenya in 2008. www.ushahidi.com
		Kenya	Violence-Prevention Tool	Involved in supporting mobile monitoring and reporting of post election violence. Created a SMS Nerve Centre; a hub for real-time information about actual and planned attacks between rival ethnic and political groups. The messages were then sent to local Peace Committees for action and response. Initiated by Oxfam GB with help from PeaceNet. www.oxfam.org.uk/applications/blogs/kenyacrisis/2008/02/pushing_for_peace.html
	Other (news services)	Kenya	Community News	The community news service is distributed free to subscribers in Kibera, Kangemi, Kawangware, Mathare and Mukuru. It provides a channel for sending out information on events in the community, send out alerts in cases of fire outbreaks and mobilising residents to take part in environmental clean-up activities. www.mobile4good.biz/services.html
		Kenya, Tanzania	Voices of Africa	Voices of Africa Media Foundation is a Dutch non-profit organisation that trains young journalists in Africa to create news videos for the web using mobiles. www.voicesofafricamediafoundation.org/.
		Tanzania	VodaFLAVA	Starfish Ltd is a VAS but they also offer information on demand on weather, tides, ferry boats (Dar es Salaam, Pemba, Zanzibar), crops, stock exchange, national and international news headlines, exchange rates. Send the correct keyword as a SMS to 15500. www.vodacom.co.tz

Sector	Application area	Location	Project	What?
Learning and education		Uganda	Find Fuel	Mobile content platform designed for finding the nearest fuel station that has fuel. Basic phones and airtime to pump attendants across Kampala where given out for them to update the system on the status of fuel at the station. Used during the bad fuel shortage in 2008.
		Uganda	NSSF	SMS based system giving NSSF (National Social Security Fund provide social security services to employees in Uganda) clients access to individual contribution balances etc.. In partnership with Makerere University. www.nssfug.org
	Content	Tanzania	ICT BITES	The aim of the project ICT-Based In-Service Teacher Education for Secondary School Teacher in Tanzania (ICT BITES) is to improve performance of secondary school teachers by providing training on pedagogy and subject specific education. It exploits the interactive potential of ICT, using available infrastructure (mobile) and open courseware and other material. Open University of Tanzania partnering with Mid Sweden University. www.out.ac.tz http://sites.google.com/site/ictbites/ m-e-learning.blogspot.com
		Tanzania	BridgeIT	Bridgeit combines mobile phone and TV to deliver digital, multimedia materials to teachers and students. In practice, teachers use mobile phones to access a library of science, maths, and English videos. Once selected, videos are downloaded via gprs to the phone which then is connected to a TV in the classroom. Opens up for distance learning programs. Public-private partnership between Ministry of Education, International Youth Foundation, Nokia, Vodacom, Pearson and FAWE. www.moe.go.tz www.iyfnet.org/document.cfm/751 www.pearsonfoundation.org/pg5.1.html
	Examination Results	Kenya	Examination results	Kenya Certificate of Secondary Education (KCSE) national examination results and orders of merits can be accessed by candidates and parents through SMS. Type KCSE (Full Index Number) and send to 2228. Run by Kenya National Examinations Council and Ministry of Education. www.examscouncil.or.ke/ http://kcse.info/
		Kenya	SEMA Project	SEMA – SMS Education Management Application. Provides the Ministry of Education with technology to enable SMS based communication with primary school teaching hierarchy for; school empowerment program; EMIS (Education Management Information System); ongoing teacher training. Partnership between Ministry of Education and DFID. Launched 2005 and piloted in 10 district. Ended in 2008 but plans for countrywide implementation.

Sector	Application area	Location	Project	What?
		Rwanda	eNota Project	A mobile based system that will allow students (primary leaving and secondary leaving students) to access their national examination results via their mobile phones. Implemented by e-Rwanda, Ministry of Education and Rwanda National Examinations Council (RNEC). www.rnec.ac.rw/
		Uganda	ExamSMS	UNEB in conjunction with SMSMedia launched a registration and exam results SMS platform in December, 2009. Students, parents and guardians will be able to check their results via their mobile phones by typing a keyword e.g. PLE <space> Index No and send this to 6600. Each SMS sent will cost Ushs 500 and available on MTN, ZAIN, and UTL Networks. www.uneb.ac.ug/ www.smsmedia.ug/
		Uganda	PurcAI Mobile	Mobile application for teachers to record student marks using their cell phone. After processing these grades by the server, students, teachers and parents can access grades of their students using SMS. Not rolled out yet.
	Other	Kenya	SMS and Direct Email innovation	The Higher Education Loans Board (HELB), which is mandated to source funds and finance Kenyan students pursuing higher education, have a service where students send an SMS to a shortcode with their ID-number. The sent SMS will query a database and send back name, loan balance and a note thanking them for using the service. Technical partner is Adtel. www.helb.co.ke
Environment		Kenya	Save the Elephants	SIM card placed in the elephant's collar and the set up of a virtual "geofence" using a global positioning system that mirrores the conservatory's boundaries. Whenever the elephant approaches the virtual fence, the collar sends text messages to the rangers. Run by Save the Elephants in partnership with Safaricom. http://savetheelephants.org/tracking.html
Social networks		Kenya	Her560	Her560 is a lifestyle channel for women, providing information on health, diet, fitness, fashion, family, finance, etc.. One-off tips and subscriptions are available, all charged Kshs 7 per SMS. www.mobile4good.biz/services.html
		Kenya	Zunguka.com	Zunguka is an African mobile and web social network for GPRS enabled phones. It is a 7in1 product consisting of Sembuse (connect via short messaging, much cheaper than normal SMS, much like its counterpart MXit in South Africa), TumaSMS (personalised SMS platform), SMSoko (an SMS/Web based marketplace), KeleleMobile (mobile lifestyle solution), SaaZingine (mobile dating), Tarazaki (sync service to backup contacts and calendar events), KeleleTV (live video). Developed and run by Symbiotic. www.zunguka.com, zunguka@symbiotic.co.ke
		Uganda	Facebook/Twitter SMS service	Send 'tweetme' to 2299 on UTL to get instructions how sign up. www.utl.co.ug/utl.php?i=200

Sector	Application area	Location	Project	What?
Shared access and public access points		Uganda	Status.ug	A local mobile portal for Facebook. Makes it possible for users in East Africa to update their status via SMS. Sign up at Status.ug, enter mobile number, SMS to Status.ug phone number preceded by the word 'status' and update will be updated. http://apps.facebook.com/status_ugtek/
		Rwanda	MTN Tuvugane	Public phones for shared access, phones from BCS and Publicell. www.mtn.co.rw/index/tuvugane
		Uganda	Uganda Refugee Connectivity Project	The project connect refugee camps in northern (West Nile) Uganda to mobile networks to support family reunification, education, health care, economic activity and other needs. Run by GSMA Development Fund, in partnership with Ericsson, MTN Uganda, and the UNHCR. www.gsmworld.com/developmentfund/
		Uganda, Rwanda	MTN Village Phone	Based on the success of GrameenPhone in Bangladesh, MTN distributes phones to women entrepreneurs in rural villages who can purchase them through a microfinancing scheme. The mobile is then used to sell per-minute usage, SMS, virtual top-up to other villagers making a profit. Operators benefit from low-interest loans and lower rates while the loan is being paid off and MTN earns money from the use of their network. Dubbed Tel'imbere in Rwanda. Run by Grameen Foundation USA, MTN Uganda, MTN Rwanda. Technology depending on the setting: booster antenna in areas without a strong network: car battery charger in areas without electricity. www.mtnvillagephone.co.ug/ www.mtn.co.rw/index/mtn-village-phone
Other		World-wide	RapidSMS	RapidSMS is a free open source platform for dynamic data collection, logistics coordination and communication. www.rapidsms.org http://unicefinnovation.org/mobile-and-sms.php
		World-wide	FrontlineSMS	FrontlineSMS is a free open source software platform that enables large-scale, two-way text messaging using only a laptop, a GSM modem, and inexpensive mobile phones. Once installed, it acts as an SMS gateway that enables users to send and receive SMS and can be used for data collection, coordination or monitoring. Specifically designed for grassroots NGOs in the developing world, it has been used in over forty countries for a range of activities, including blood donor recruitment and assisting human rights workers, to promoting government accountability, keeping medical students informed about education options, providing security alerts to field workers, election monitoring, the capture and exchange of vegetable (and coffee) price information, the distribution of weather forecasts, the co-ordination of healthcare workers, the organising of political demonstrations, the carrying out of surveys and the reporting and monitoring of disease outbreaks. www.frontlinesms.com

Sector	Application area	Location	Project	What?
		World-wide	Freedom Fone	Freedom Fone is an information and communication tool, which marries the mobile phone with Interactive Voice Response (IVR), for citizen benefit. It provides information activists, service organisations and NGO's with widely usable telephony applications, to deliver vital information to communities who need it most. Freedom Fone is a project of The Kubatana Trust of Zimbabwe. www.freedomfone.org/
		World-wide	Microsoft OneApp	Microsoft OneApp is a software application designed for Java enabled phones. OneApp expands the capabilities of these handsets to deliver new applications and services. The exact set of mobile applications and services will vary by partner but could for example include a mobile wallet, Windows Live Messenger, popular games, and multiple feed readers for sports, news, finance, and more. At present, OneApp is only available in South Africa but plans are underway to launch in more countries within the next year www.microsoft.com/oneapp/
		World-wide	Mobile XL	The XLBrowser is a SMS based browser for java enabled phones that link to information and communication where internet, WAP and GPRS services are slow, limited, and unreliable. XLBrowser is a walled garden (content-wise) which means that it lets the provider lock the user into the content they wish. Might be a good bridge builder until gprs is ready available. www.mobile-xl.com/
		World-wide	Opera Mini	Opera Mini is a web browser designed primarily for mobile phones. It uses the Java ME platform and uses a compression technology to reduce data costs by up to 90%. It is offered free of charge, supported through a partnership between its developer, the Opera Software company, and the search engine company Google. www.opera.com/mobile/
		World-wide	0.facebook.com m.facebook.com	Facebook version for mobile interface. View news feed, update status, like or comment on posts, and send messages. 0.facebook.com is the stripped-down version of m-facebook.com (no pictures and media), offered free of charge by a limited number of operators. m.facebook.com is available on all mid-range phones regardless of network but standard data charge apply.
			MXit	MXit is a mobile instant messenger and social networking software application that allows the user to chat anywhere on earth from the web enabled mobile or PC. Connects to Yahoo, ICQ, Google Talk, AIM, or Windows Live Messenger contacts. www.mxitlifestyle.com

Appendix 3. Terms of Reference

Consultancy services
Preparation of a report on the use and possibilities of m-Applications in East Africa
Coordination of a workshop on m-Applications and study visits in Uganda

Background

The Swedish International Development and Cooperation Agency (Sida) supports the integration of Information and Communications Technology (ICT) in developing countries in order to improve communication, the exchange of information, and to facilitate economic development. Sida's policy is outlined in the document "Strategy and Action Plan for ICT in Development Cooperation" www.sida.se/sida/jsp/sida.jsp?d=118&a=3404&language=en_US.

During 2006 and 2007, a Sida commissioned project was carried out in the Philippines. The project intended to study the potential of m-Applications and its possible impact for development. Meetings, field visits and a workshop in Manila (co-organised with the Asian Development Bank) was organised and a report, *"The innovative use of mobile applications in the Philippines – lessons for Africa",* was published in September 2007.

The report position the Philippines as the leader in the use of mobile (SMS[1]-based) applications for access to a range of services from m-Banking to m-Education and m-Governance. The Philippines experience shows that it is possible to increase access to mobile phones, not only for the well off but also for the poorer segments of the society.

The report finds that the Philippines' success was due to a number of reasons such as; appropriate regulatory policies, a developed retail network, low cost ratio of SMS to voice, prevalence of a pre-payment system, and a critical mass of users. Many of these prerequisites exist in East Africa. The report also states that *"there is another factor that makes much of Sub-Saharan Africa, and especially East Africa, ripe for the expansion of simple mobile applications. The factor is a lack of internet bandwidth".* However, some barriers still remain, especially when it comes to m-Banking. Those are a proper legal framework regarding identification and competition between rival m-commerce suppliers. It is also uncertain whether or not the networks are reliable enough to support high volumes of SMS traffic.

The key questions are; what hinders the take off of m-Applications for development in East Africa and what role could donors play in this process?

Despite the fact that more than 70 percent of East Africans have access to mobile networks, that the number of users ever increases, and that the prices keep on dropping, the fact remains that the number of mobile services are still few and/or limited geographically. M-PESA in Kenya being an exception and does also constitute a proof that m-Banking works in East Africa. Access to financial and other services is limited in the region, especially in rural and remote areas. Consequently, many do not have access to banking services and are forced to make all payments in cash, which is less secure and flexible than electronic payment forms. A recent report commissioned by the Information for Development Program (infoDev) in association with the International Finance Corporation (IFC) and the GSM Association finds that the use of mobile communications in developing countries has the potential to bring a range of financial services to previously excluded groups and can address a major service gap in developing countries that is critical to social and economic development (InfoDev, 2006a).

[1] Short Message Service permits the sending of messages between mobile phones and/or other devices. SMS can also be used to interact with automated systems to order products and services, participate in contests, access information and/or conduct financial transactions.

Could it be the same with other services? The report outlined in this Terms of Reference will investigate if there are other mobile services and applications that may have a similar positive impact on marginalized groups. Sida is especially interested in the possibilities that the services provided by mobile telephony could contribute to efforts to alleviate poverty. Therefore, Sida is awarding a contract to further investigate the experience vis-à-vis the possibilities of mobile telephony in East Africa.

Scope of services

There are two main components to the assignment: 1) the planning of a workshop in Uganda, involving Sida's ICT4D Secretariat, to discuss and explore the current and future use of mobile applications for development in East Africa; and 2) fact finding and research to support publishing of a report detailing lessons learned/best practices and way forward of mobile applications for development in East Africa.

The workshop will be accomplished with a number of study visits for Sida/Embassy staff to further explore the developments and potential in mobile sector. The end goal is to identify which applications are most relevant in an East African context for the purpose of reaching and empowering the poor and contribute to poverty elimination. Ultimately these applications should be up-scaled and implemented in the form of public-private partnerships (PPP).

The assignment includes meetings with relevant mobile actors in the region such as government ministries/institutes/agencies, telecommunication companies (e.g. Ericsson, Nokia as well as local service providers), key business users of the services (e.g. banks offering m-Banking) and end-users (e.g. m-Banking services for people traditionally excluded from the formal banking sector and for expatriate remissions, market pricing for farmers, and other services from both private- and public-sector actors).

The consultant will coordinate a workshop for relevant stakeholders, including Sida staff, and produce a report on use of SMS and other simple applications in East Africa, especially regarding potential application for economic development and poverty reduction through empowerment. The report will include:

- An overview of the state of simple mobile applications in East Africa;
- A review of the development of mobile applications in the region as a tool for economic development and poverty reduction; and
- An analysis of the potential up-scaling and implementation of (mobile application) pilots in East Africa in order to spur economic development and empower the poor.

The *descriptive* part of the final report should provide information on the current state of m-Applications in East Africa and forecasted changes and developments in the near future. Names of key persons and other relevant institutional data (size, ownership etc.) should be listed in the reports. Key data should be gathered and sources should be listed.

The *analysis* should address the following:

- Major trends and initiatives in the region regarding the use of m-Applications;
- Main obstacles for increased use of m-Applications; and
- Main opportunities to increase the speed/integration of mobile telephony and services such as m-Banking and other relevant m-applications.

The analytical part could serve as a first step to actually up-scale and implement services and to identify major areas of interest regarding future integration of ICT in the Swedish development cooperation.

The analysis should include a discussion of advantages and risks of supporting mobile based implementation, mainly from the perspectives of poverty reduction.

Methodology

Preparation of the workshop and the report should be made in close cooperation with stakeholders in East Africa. Local sub-contractors should be used to facilitate contact with local actors and stakeholders as well as facilitate access to information. Close cooperation with both Sida and SPIDER[2] should be maintained to ensure relevance and contact with SPIDER's project, "Leveraging mobile platform technology to address the information and development needs of marginalized communities (rural and urban poor)." The goal of this project is to support development of three SMS and/or GPRS[3] applications that contribute to the development of marginalized communities by: 1) determining which applications are most relevant in the purpose of reaching the poor and assisting with poverty reduction; 2) developing these applications; and 3) implementing applications with the assistance of local providers in Africa.

Data for the report will be gathered via various field visits to organisations, companies and institutions in East Africa, as well as through the locally engaged consultant. Data should also be gathered through desk review.

[2] SPIDER – the Swedish Program for ICT in Developing Regions – is a centre for ICT in developing countries funded by Sida and hosted by the Royal Institute of Technology in Stockholm.

[3] General Packet Radio Services (GPRS) is a mobile data service for users of GSM and IS-136 mobile phones. GPRS data transfer is typically charged per megabyte of transferred data. GPRS can be utilized for services such as WAP access, SMS, MMS as well as for as email, web access and, most recently, low cost voice over IP.

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THE INNOVATIVE USE OF MOBILE APPLICATIONS IN EAST AFRICA

The notion of mobile communication and applications as a tool to alleviate poverty is becoming increasingly mainstreamed. The basic mobile phone is seen as a tool that supports bottom-up economic development. It is also seen as a way of empowering individuals by encouraging entrepreneurship and innovation as well as giving the poor a voice. Through mobile phones, farmers get access to market prices, young urban citizens can transfer money back to their home villages, health workers can give diagnoses and collect data, family and friends can easily connect and communicate, news can be spread and read in crisis situations, citizens can build opinion and mobilise. In just a few years, mobile phones have transformed East Africa, not just seen from a social and cultural point of view, but access to and use of mobile phones and applications is also shaking up the region's entire economic system.

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