UNLOCKING THE POTENTIAL OF CELL PHONES

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ISSUES

The rapid rise of mobile phone use in poor countries is well known as an exemplary case of a technology enabling bottom-up empowerment through information access, driven by small-margin business and end-user innovation. While many are not mobile phone owners themselves, few today face a several mile walk to access an often-disconnected landline phone for communication, which was a regular occurrence only ten years ago. But even as some marvel at the rapid changes brought about by mobile phone use, a second generation boom is already occurring, developing innovative applications for the now widespread mobile phone platform.

Building off this new connectivity, there are new programs aiming to provide public information access, data storage and accounting, and even mobile banking, mostly utilizing only the cheapest phone models. Whether for-profit or as charity, these applications are seen by many as the next step in leveraging the power of mobile phone diffusion to provide information access cheaply and efficiently to the world's poorest.

While some may see this new movement as over-exuberant, high-profile new programs are being driven by enthusiasts representing the technology industry, academic research groups, and international aid organizations. As a result, the future of mobile phone applications, as well as most technology in development, is relevant to business and trade policy, research investment, as well as traditional development aid programs.

BACKGROUND

Introduction

Extending the benefits of mobile phone use is now the focus for countless development projects. Although many technical projects target assisting aid workers or providing group tools for whole communities, mobile phones have uniquely become easily accessible and useful for individual users. The rapid spread of phone usage, generally unaligned with formal aid programs, has prompted support for "connectivity for it's own sake,"[1] the idea that giving people a tool to

1 Sey, Araba. "Mobile Communication and Development: A study of Mobile Phone Appropriation in Ghana" (PhD. Diss., University of Southern California, 2008), 13.

connect them to information should be a primary goal – and that less focus needs to be placed on exactly what users are accessing. The fact remains, however, that the power provided by a mobile phone can be expanded significantly by thinking about exactly what people are accessing and how to improve it. "Bottom billion" users have shown extreme ingenuity with their phones, discovering new benefits and finding new uses wildly unexpected by mobile phone designers. Building off this, there is reason to believe that changes and new programs can be implemented to further expand the benefits and uses of mobile phones.

Comparison to PC and Internet Based Solutions

Although the capabilities provided by a mobile phone are limited compared to the extensive functionality provided by a PC and the Internet, mobile phone applications fill a significant niche at a much lower cost than PC applications and with a guaranteed base of penetration. PC-based "interventions," such as community kiosks and the One Laptop Per Child project, require providing expensive hardware, a consistent power source, and an extensive, expensive Internet infrastructure. Increasing skepticism for these interventions are growing out of the difficulty of successfully deploying such programs.[2] However, through simple mobile phone applications, clever designers are managing to duplicate some of the benefits of PC-based Internet access without the heavy infrastructure costs associated with distributing PCs.

Mobile phone programs can address the need to consistently obtain valuable information. Mobile phone access has already provided great benefits by allowing users to connect to contacts from anywhere, allowing them to instantaneously access the knowledge of those in their community. One-to-one communication, though, limits an individual to information known by a contact that they already have. If a user wants to know what the weather is like in Kibera, he needs to know someone in Kibera. If a user wants to know what the weather will be like tomorrow in Kibera, he needs to know a weatherman, or someone who has read the news forecast in Kibera. Alternatively, a user with Internet access can openly access tomorrow's or next week's weather report without any contacts whatsoever. Mobile phone applications can bridge this gap. Attempting to allow open access to targeted, useful information known to have

2 Rajesh Veeraraghavan et al., "Warana Unwired: Replacing PCs with Mobile Phones in a Rural Sugarcane Cooperative" (paper presented at International Conference on Information & Communication Technologies for Development, Bangalore, India, December 15-16, 2007*)*, 4.
Lohr, Steve, "One Laptop Per Child Proves to be a Hard Sell," *International Herald Tribune,* September 23, 2007.

direct benefits (such as weather forecasts or market prices for specific crops) thus constitutes many of the new mobile phone applications being developed.

Another function often only imagined on a PC or website is the ability to utilize personalized applications or tools. In the United States, the average PC and Internet user interacts with dozens of online applications every day. These applications are everyday utilities allowing their users to streamline regular activities, many of them business related, such as financial data storage. There is no equivalent tool for a remote mobile phone user who simply lives without these tools altogether. While the mobile phone may not be able to match the computing power and usability of the PC, there have been several innovative programs in allowing the development of some interactive applications, most prominently in creating personal crop data and interactive sharing of business information.

Recognizing the Strengths of the Mobile Phone Platform

Still, it is important to recognize that the mobile phone is a very different tool than a PC, and not only has limitations compared to the PC, but also unique strengths. As a result, it is important to also look for creative new uses for the phone that are not simply mimicking functionality provided by computers in wealthy countries. A successful example of this type of thinking is visible in mobile banking projects, which look not only to online banking for inspiration, but also to mobile phone distribution networks and brick-and-mortar banking institutions for models of what to provide their users. As a result of these combined influences, the technologies running mobile banking projects are unrivaled in wealthy countries.

A Unique Opportunity

Mobile phone programs are still a rapidly growing area of Information and Communication Technology for Development (ICT for Development). There is significant success already behind the mobile phone movement, visible in it's penetration rate in poor countries as well as economic benefits that have been well demonstrated. Current activists are looking at the rapid expansion of mobile phone access not as a finished success but as a stepping stone for new growth. Although the new applications that are currently expanding utilize extremely simple interfaces and a very basic technology, they are still managing to mimic many of the capabilities of Internet and PC access, and even to provide completely new uses of mobile phones, tailored to their poor users. As a result, these new applications are poised to vastly expand the capabilities of an already successful, widely adopted tool.

The Successes of Mobile Phones Today

How Mobile Phones Have Reached the Masses

In 1999, connectivity, the ability to exchange information between distant locations through telecommunications, in Africa was dismal. While the developed world was experiencing soaring growth in communication accessibility with Internet access reaching businesses, homes, and schools, experts began to worry about the growing "digital divide" between rich and poor nations. Information was becoming the most important commodity for the 21st century, and yet African countries had only 1.7 fixed lines, 0.98 mobile phones, and 0.12 internet subscribers for every 100 individuals.[3] By 2006, however, the mobile phone had made a spectacular breakthrough. While fixed lines stagnated at only 3.1 per 100 people, and the internet still failed to reach the masses, having grown to only 1.2 subscriptions per 100 people, mobile phone penetration had improved to an astounding 22 per 100 individuals.[4] With almost one in four people owning a phone, it is hard to imagine someone who does not at least know someone with a phone. African countries are showing the most growth out of all developing nations, with South Africa and Nigeria at the top, followed by Algeria, Egypt, and Morocco.[5] In addition, Asian countries are making significant gains as well, with China and India leading Asia with their substantial populations.[6] Furthermore, users in developing nations outnumber those in wealthy countries, making up 58% of subscribers worldwide.[7] In sum, the developing world has become a connected world.

Mobile Phones from a Bottom-Up Perspective

Beyond its model status in the ICT for Development community, the mobile phone also stands as an excellent case study for bottom-up development. Phone based tools have certainly been deployed in top-down contexts to great benefit: aiding hospital assistants, providing a simple avenue for data submission for field workers, and providing tools for community and educational usage. Nonetheless, the most surprising attribute of mobile phone usage in developing countries has been it's availability to poor individuals, who choose to purchase the

3 Sey, 3.
4 *Ibid.*
5 United Nations Conference on Trade and Development. *Information Economy Report 2007-2008: Science and Technology for Development: the New Paradigm of ICT,* 2008, 23.
6 *Ibid,* 24.
7 *Ibid.*, 23.

phone deciding that the benefits of owning a phone justify the cost. Information access creates individual empowerment by allowing users to make more effective choices with a good understanding of options and solutions available to them.[8] In addition, just as bottom-up perspectives have developed mostly in recent years, moving away from a long history of "top-down" programs, ICT for Development had a predecessor in "development communication," which focused on television and radio.[9] Although the defining difference between ICT for Development and "development communication" is technological, shifting focus to mobile phones and the Internet, the ideological distinction that stems from this technological shift parallels the shift in development policy. This new technology moves the focus from shipping ideas out to allowing individuals to access information of their choice, as well as spread their own information to others.

Economic Impact

Beyond ideology, the economic impact at the "bottom of the pyramid" has been remarkable. One study demonstrated a positive correlation between mobile phone ownership and GDP, and further claimed that "a developing country that had an average of 10 more mobile phones per 100 population between 1996 and 2003 would have enjoyed per capita GDP growth that was 0.59 percent higher than an otherwise identical country."[10] The on-the ground underpinnings of this correlation are clear. In a survey over 14 African countries, 80% of small market enterprises surveyed used a mobile phone for business, and 95% of small market enterprises agreed that mobile phones were important or very important for their business operations.[11]

Mobile phone companies have also made steps to integrate interesting distribution policies allowing for extended micro-entrepreneurship, policies which allow them to efficiently organize their sales while including the poor in their profit chain. One original program, copied by mobile phone companies worldwide, is that of the shared phone; a mobile phone sold to one person who then re-sells phone use to neighbors.[12] This pattern is repeated from the iconic "phone ladies" of Bangladesh, to the "umbrella people" of Nigeria, to the "community phones"

8 Sey, 5-6.
9 *Ibid.*, 18.
10 Leonard Waverman et al., "The Impact of Telecoms on Economic Growth in Developing Countries," (paper presented at Telecommunications Policy Research Conference, 2005), 2.
11 United Nations Conference on Trade and Development, 30.
12 Sey, 140.

of South Africa.[13] Another, new development growing in Ghana is the re-sale of airtime, allowing the mobile phone networks to avoid printing airtime distribution vouchers. Under this program, a vendor may buy a "commercial" account and purchase pre-paid mobile phone minutes in bulk at a special, low rate, and then re-sell the airtime through a phone interface to their local customers.[14] As a result, the path of mobile expansion has become a path of economic growth and empowerment.

A Baseline for Future Success

Mobile phones provide a starting platform, which already demonstrates several of the qualities of a successful technical intervention. Because they are already well-deployed, any application for the mobile phone platform does not require large-scale distribution of expensive technology. Since mobile phones have already had an economic impact, future applications have a model of how the mobile phone can create positive change, and can work to improve or extend those benefits. Unlike many other experimental technologies, mobile phone applications are being designed in known territories, where models of success are visible from the start.

Methods for Application Design

Options and Limitations

As new ideas are emerging from many backgrounds, from software development to economic development, it is important for all parties to be aware of the framework within which they are designing their new interventions. Working with mobile phones is an extremely limited environment, which is often hard to imagine for those coming from a perspective of ubiquitous technology access. The shift in perspective, though, is necessary. While the latest high-tech devices are constantly being adopted in wealthy countries, only the cheapest phones are affordable to poor users in poor countries, meaning that working with existing tools is paramount[15]. However, this still leaves design choices that can be cleverly utilized depending on how the proposed program is deployed. Currently, there are two primary methods of building a mobile phone application, each with individual benefits and restrictions. These two prominent methods use either an SMS server, or a proactive SIM card. In addition to these methods ready

13 *Ibid.*

14 *Ibid.*, 147.

15 Nick Hughes and Susie Lonie, "M-PESA:Mobile Money for the 'Unbanked' Turning Cellphones into 24-Hour Tellers in Kenya." *Innovations*, Vol 2., no. 1-2 (2007): 4.

for design, there are many other platforms and methods which are under trial in research environments, but which currently lack the deployment and/or low cost of the first two methods.

Designing with an SMS Server

Applications based on an SMS (Short Message Service) server are widely used, and work entirely through text messaging. From the user's perspective, they can send and receive text messages to a specific phone number and can both submit and access data. For example, a weather application might be accessed by a user by sending a message to a specified phone number saying "weather tomorrow Accra", and then would receive back a message saying "Sunny skies, 30 degrees C." This implementation is extremely limited – long dialogues are not convenient and most programs involving SMS involve simple one-for-one information submission and retrieval. However, the necessary investment for such a system is quite low: the designers only need a mobile phone connected to a computer, and then to design their program to receive and respond to messages. Microsoft Research has even designed an interface called the "SMS Server Toolkit" to assist software developers in designing such a program.[16] Furthermore, there is nothing special to deploy to end users; they just need to be informed of the special number to message and how to contact it.

Designing with a Proactive SIM

The other major interface, using a proactive SIM, allows programs that can be a bit more complex than those simply functioning by exchanging text messages – these programs work through a series of menus and dialogues, and can display messages on the phone, send messages, set up calls and play sounds.[17] All of these allow interaction to be more complex than a simple one-for-one exchange of messages. Because these programs are installed on network-provided SIM cards (the card sold by the network provider and inserted into the user's phone when they register for network service), they are only available to programs endorsed and developed with network operators. This is not an entirely restrictive factor, though, as many telecoms are beginning to seek recognition as participants in development progress, with the UK's Vodafone going so far as to claim that "development today is understood to be unachievable without the engagement of the private sector."[18] Furthermore, because they require a special card,

16 Microsoft Research, *SMS Server Toolkit* , http://research.microsoft.com/enus/downloads/2bdeb3c6-9945-4804-a9bc-0d53704d35da/default.aspx , (accessed Feb. 13, 2009).

17 Global System for Mobile Communications, *SIM Application Toolkit,* http://www.ttfn.net/techno/smartcards/GSM11-14V5-2-0.pdf, (accessed Feb. 13, 2009), 12.

18 Hughes and Lonie, 3.

deployment is more complex than SMS server programs, which doesn't require any special additions to the standard phone.

Designing for the Future

While applications utilizing an SMS server or a proactive SIM card are the most feasible for current deployment, several future-looking research projects have started investigating mediums which would utilize higher-tech mobile phones. These theoretical designs may become more useful as technology improves and as prices for features from current high-end phones begin to drop. Many projects have been developed for "smart phones", internet-capable phones capable of running multiple applications.[19] Seeking the most useful features for the phones of tomorrow, researchers have identified built in cameras,[20] GPS service,[21] and cell-based Internet access[22] as existing features in higher-end phones, which hold strong potential for the low-cost phones of tomorrow. Another prospect that has excited many is "fixed mobile convergence", the integration of multiple communications such as internet, email, and phone service, all within one mobile device.[23] In some places this convergence is approaching more rapidly - in Latvia, 67% of households receive their internet access through a mobile phone.[24] Fixed-mobile convergence holds special promise for developing countries, where landline Internet access requires an almost unachievable level of infrastructure and satellite access is far too expensive for sustainable use. Still, all of these promises are looking far into the future. The most feasible projects today will involve the simplest technologies on the simplest phones, and it is necessary to creatively envision current applications to function within that restricted context.

Successful Projects Today

Types of Programs

Many applications indeed have risen to success by creatively working within the context of simple mobile phone design. All of these attempt to springboard off of existing mobile phone successes to hit large numbers of the poor and provide them economic benefit. Most provide

19 Veer et al., 1.

20 Tapan Parikh and Edward Lazowska. "Designing an Architecture for Delivering Mobile Information Services to the Rural Developing World," (paper presented at World Wide Web, Edinburgh, Scotland, May 23–26, 2006), 1.

21 Veer et al., 1.

22 United Nations Conference on Trade and Development, 24.

23 *Ibid.*

24 *Ibid.*

functionality that those in wealthy countries traditionally envision on a PC. Some simply work to expand information access, and others act as tools for personalized data use and interactivity. Mobile banking defies standard conceptions of PC type designs by providing banking features that rival traditional banking institutions.

Information Access

Accessing targeted information has proven particularly simple to implement using an SMS server. As a result, many programs have arisen to expand user access to information that is known to be extremely pertinent to users.

Information access is not simply an educational feature of technological access – it has crucial role in individual decision making and direct impact on economic success. The canonical study on this effect with regard to mobile phones came with a study of South Indian fishermen. Jenson showed that as mobile phone access came to fishermen, they gradually moved away from selling their fish only in their local market.[25] In addition, they began to sell almost all of their catch, rather than wasting much of it as they had before.[26] Furthermore, market prices in the region shifted quickly with the introduction of mobile phones, from rapid, unpredictable fluctuations to a more steady and consistent price line.[27] As a result, both phone users and non-users benefited from increased profits – with phone users increasing their profits almost twice as much as non-users.[28] These results demonstrate that as individuals have to access a wider range of market prices, they make better informed choices about when and where to sell their goods. As a result the market stabilizes an and all those involved involved benefit tremendously.

Expanding Available Information

Extended up-to-date information access is convenient to provide to individuals through mobile phones, and it has a direct impact on the lives of those effected. In pursuit of this convenient usage, several programs have been designed attempting to provide more extensive knowledge of pertinent data, especially sales and pricing data, to the poor involved in business activity. These programs have been driven both by commercial groups as well as non-profit organizations, and mostly focus on agricultural information and trade data. Examples include:

- A program in Maharashta, India providing both weather prediction as well as market

25 Jensen, Robert, "The Digital Provide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector", *The Quarterly Journal of Economics, V. 122, no. 2, (2007):* 17.
26 *Ibid.*, 18.
27 *Ibid.,* 21.
28 *Ibid.*, 39.

price data is under development by Reuters, the United Kingdom based news service. This should allow them to decide when to sow and harvest their crops, as well as where to sell them most efficiently.[29]

- A program in Senegal utilizes both a SMS-server and a cell-phone optimized web site for mobile phones with internet access to provide data on product prices at several local markets. The program, called Xammarsé, is being run commercially by a company named Manobi and has over 3,400 users among producers, middlemen, traders, and hotel keepers involved in the local trade network.[30]
- In Burkina Faso and Mali, a UNCTAD-supported program called "Trade at Hand" sends information on product prices in international markets to agricultural exporters via SMS, allowing them to negotiate better deals for their produce. Current plans are moving towards making the program self-sustainable.[31]

All three of these programs target the entrepreneurial poor: they are developed in both for-profit and non-profit contexts. They attempt to extend the protection provided from market inconsistency through information and control as seen among the Indian fishermen. Expanding the information distributed to both agricultural and weather information should give farmers better control over their planting cycles, protect them from weather anomalies, and enable farmers to make the most informed choices about how to manage their crops.

Interactivity and Assuming the Role of the PC

There are also many interactive programs which involve users submitting and receiving data relevant to them (and often, their businesses), and challenge many of the traditional ideas about what is necessary for a successful computer program. These programs mostly target the storage and sharing of agricultural data. Programs of this type can be implemented either using an SMS server interface or a proactive SIM interface. Because these programs store simple data through simple interfaces but are still useful, they directly challenge theories that a PC is necessary for the basic functionality taken for granted by those in wealthy countries.

The success of a mobile phone application in duplicating PC behavior is well visible through the "Warana Unwired" program. Researchers in this program visited a several year old PC Kiosk that had been placed in an agricultural collective to provide information services to

29 O'Connor, Ashling. "India's farmers switch faith to mobile phones." *TimesOnline.* July, 24, 2006.
30 United Nations Conference on Trade and Development, 249.
31 United Nations Conference on Trade and Development, 31.

small-scale farmers.[32] However, they were surprised to find the PC in disrepair, and that out of 9 intended uses for the PC, only one program was actually being used.[33] The researchers, after realizing that the storage and retrieval of personalized sugarcane data was the only feature that farmers were interested in, quickly realized that such a simple task could be accomplished with much simpler technology. The result was an SMS-server based program which successfully replaced all of the PC functionality and was even more popular with farmers than the previous system.[34] As a result of this popularity, although the initial pilot had only included 7 phones, by the time the researchers ended their study, the program had unexpectedly expanded to 61 phones, as friends of the kiosk owners had their phones added to the database.[35] Following the study, the cooperative kept the mobile phone service, which suited their needs and was much cheaper than the PC service.[36]

Many other programs target personalized agricultural information using mobile phones, even allowing farmers to interactively share data. In Uganda, the Collecting and Exchanging Local Agricultural Content (CELAC) allows farmers to share agricultural data, with several farmers submitting and receiving relevant data to one central database via SMS.[37] Another program in South Africa combines an information-access based approach to receive market data, with an interactive program allowing farmers to initiate trades away from a centralized market, all through a proactive-SIM interface provided by the cell provider, Vodacom.[38]

Through all of these programs, users have access not only to useful information, but personalized, customizable information tailored to each user. By utilizing the mobile phone as a two-way resource, for both information reception and submission to a central server, the program extends beyond passive reception and mirrors adaptability previously imaginable only with an individual PC, albeit on a much simpler scale.

Mobile Banking

A few programs have started to provide banking services through mobile phone

32 Veer et al., 1.
33 *Ibid*., 4.
34 *Ibid*., 1.
35 *Ibid*., 9.
36 *Ibid*., 10.
37 United Nations Committee on Trade and Development, 248.
38 *Ibid.*, 249.

applications, including Vodafone's high-profile Kenyan investment in "M-PESA", and South Africa's growing startup called "WIZZIT". Both programs have distinct methods of bringing banking to the poor, but each illustrates quite effectively the potential of innovative business building off of technology for social benefit. Not only do m-banking programs fulfill a well-known need, they break the mold of many existing applications, which seek only to mimic functionality available in wealthy countries. Mobile banking, as implemented, is better suited to the lifestyle of the poor than the wealthy. Furthermore, mobile banking programs break the mold of mimicking PC behaviors and instead look to brick-and-mortar banking procedures as their model for access. Finally, in an excellent extension for research, mobile banking programs are well studied by those driven by investment, and so the service providers are able to provide excellent data after only a few years of development. As a result of this planned investment and imaginative design, both programs have seen significant success.

Filling a Need

M-banking addresses a well-understood need of the developing world's poor: the lack of access to banking resources. With the success of micro-finance, providing financial services in general has a spotlight as one of the most necessary changes to developing world infrastructure for individuals to improve their economic status. In particular, financial services are known to be "fundamental to entrepreneurship,"[39] which sparks economic activity, job creation, and trade.[40] Furthermore, these new m-banking financial services have begun to provide assistance not just in saving money, but in transferring it as well – an issue that individuals in developed countries are often blind to because money transfer is so convenient in a stable, fluid market economy. In essence, although those in poor countries may have money to spend and transfer, the ability to actually spend or transfer it is the major "stumbling block" for any transaction to actually take place"[41]. Even with the financial "stumbling blocks" well understood, it is only recently that the mobile phone's position to affect this financial gap has been recognized. As it turns out, many of the unbanked poor still have mobile phone access – in South Africa and Botswana, one-third of those without a bank account own a mobile phone or have access to one.[42]

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39 Vodafone Group, *The Transformational Potential of M-Transactions*. Vodafone Policy Paper Series, No. 6 (2007): 2.

40 Hughes and Lonie, 3.

41 *Ibid.*, 3.

42 Gautam Ivatury and Mark Pickens, *Mobile Phone Banking and Low-Income Customers Evidence from South Africa* (2006), 5.

Usage Success

Understanding this context, M-PESA in Kenya, and WIZZIT in South Africa are addressing the financial needs of the cell-phone owning poor using in manners remarkably suited for poor countries. M-PESA launched as a trial in 2005, and fully launched in 2007.[43] The setup process is a simple registration at any Safaricom (the local network provider) agent's booth – these agents are already widespread and generally sell airtime and SIM cards to Safaricom users.[44] Once registered, users can deposit and withdraw cash at any agent's booth, with the payments facilitated by text messages to and from a central Safaricom server, allowing both user and agent to trust each other in the financial transaction. Furthermore, the customer can transfer funds to any phone number on any network – the recipient will simply receive a text message informing them to visit a Safaricom agent to pick up their transfer.[45] To provide security, the program comes with customer support, transaction tracking, and anti-money laundering measure.[46] WIZZIT, in South Africa, offers similar phone banking services, but is more integrated in the traditional banking system than M-PESA. WIZZIT gives it's users Maestro-branded debit cards, and has reciprocal agreements with several South African banks allowing it's users to use their ATMs and bank branches.[47] Furthermore, WIZZIT allows transfer payments for services and electricity through its banking system as well.[48]

Economic Connection

These programs have many observable successes. Between the launch of M-PESA in March 2007 and December 2007, 1.4 million customers registered for M-PESA, and over 7.4 billion Ksh ($92.9 million USD) were transferred using the service.[49] For WIZZIT, their services have clearly reached the target market: a survey of users shows that 43% of it's users are below the poverty line, and another 12% are between the poverty line and one and one half of the poverty line.[50] A WIZZIT account is one-third cheaper than an account at a normal bank[51] and has allowed users to actually conduct more transactions per month by their mobile phone than

43 Vodafone Policy Group, 6.
44 *Ibid.*
45 *Ibid.*
46 *Ibid.*
47 Ivatury and Pickens, 6.
48 *Ibid.*
49 Morawcyzynski, Olga, *Surviving in the 'dual system': How M-PESA is fostering urban-to-rural remittances in a Kenyan Slum,* University of Edinburgh (2008), 3.
50 Ivatury and Pickens, 9.
51 *Ibid.*, 5.

traditional banking customers typically do through all other channels.[52] Furthermore, the breadth of this extended use is remarkable. Users of M-PESA have been observed to use M-PESA as an overnight safe, to deposit money at one location and take it out at another after traveling through a dangerous neighborhood, to make business payments, to use M-PESA to purchase airtime for others, to purchase pre-paid mobile phone minutes after dark, and to transfer money to friends in town.[53]

A Development Specific Feature: Remittances

Beyond traditional banking functions, development-specific benefit has come in through urban to rural remittances. M-PESA's "Send Money Home" program is designed to facilitate money transfers between migrant workers and their families at home in rural villages.[54] In poor countries, it is extremely common for urban workers to exist in a "dual system," living between urban and rural arrangements, and frequently transferring money from their urban jobs to aid family members and even purchase property at home.[55] These remittances are often necessary for the survival of rural families,[56] and under some estimates, 13-21% of the income of recently migrated urban males is sent back to their home villages.[57] Before electronic transfers, users tended to transfer money through friends or relatives or with unlicensed bus drivers, but these transfers were perceived by senders as risky, and they state that losses were high.[58] As a result, the majority of respondents in one survey used M-PESA to "send money home" as they found it much more trustworthy than old services.[59]

A Model Program

Hence, the m-banking phenomenon has taken off especially in developing regions. It addresses particular needs of the poor, and utilizes an accessible network of mobile phone vendors creatively along with the mobile phone itself. Vodafone has attempted to be a model corporation, investing in developing regions, and through partnerships with the UN and funding from the UK government, it has made a solid step towards corporate participation in aid work, still driving toward a profit. Finally, because M-PESA and WIZZIT are well studied both

52 *Ibid.*, 8.
53 Hughes and Lonie, 14.
Morawczynski, 9.
54 Hughes and Lonie, 16.
55 Morawczynski, 2.
56 *Ibid.*
57 *Ibid.*, 5.
58 *Ibid.*, 6.
59 *Ibid.*, 8.

technically and from a social benefit standpoint, much understanding can be derived from the experience and applied toward future interventions. The entire area stands out as quite an exemplary case of how technical interventions can work and be successful.

Concluding Remarks: Challenges and Opportunities

Mobile phone applications are widely improving the capabilities of the cell-phone owning poor of the developing world. Because mobile phones are already widely adopted among the poorest of the poor, applications deployed for mobile phone use have a ready audience already in place. Recognizing the economic impact of greater information access and understanding, many applications are finding success simply by enhancing these simple capabilities inherent in mobile phone use. Furthermore, original developments in mobile banking demonstrate the potential of mobile phones to expand beyond readily known avenues for mobile phone design. Using simple tools and simple interfaces, these applications are creating remarkable results through programs designed in industrial, non-profit, and academic environments.

Still, the results of future mobile phone developments are not readily known. It is hard to predict what will appeal to users and have the most impact. The growth of mobile phone usage among the poor was a surprise to many, and it may be that the next successful technology will be equally surprising. Investment, deployment, and outreach all require significant effort. However, reflecting the history and current growth within mobile phone application design reveals exciting potential. The future of the mobile phone is intricately tied to the future of communication and information access for those in developing regions.

OPTIONS

The United States' development aid budgets support current development projects through, non-profit development organizations, academic research, and even industrial research and investment. With mobile phone application programs in such a position of prominence and high success, development policy will most certainly encounter cell-phone based initiatives. How development aid policy addresses these new applications will have significant control over what direction and form these programs take, and how intensely they are pursued. Such a development policy could adopt one or several of the following options: targeting mobile phones

only through greater ICT and development projects; supporting non-profit, partnering with network providers to develop and invest in deploying mobile phone technologies; supporting non-governmental organizations to deploy cell-phone based applications that are beneficial to the poor; granting academic institutions research funding to design new, low-cost phones and discover the most effective features and usage patterns.

- **Target mobile phones only through greater ICT and development projects.**

Information and Communication Technologies for Development is an expansive field, and certainly encompasses the entirety of mobile phone activity. Mobile phones are just one of many technologies targeting development; it may be that another technology only now in development or early deployment will turn out to be the next capabilities-enhancing tool to change the lives of the world's poor. Furthermore, because mobile phones interact with a series of technologies - computer servers, satellites, wireless antennas – all of these issues might be best studied together. However, it can also be said that out of all development technologies, mobile phones stand out markedly in terms of penetration at the individual user level, economic impact, and potential expansion Since this level success is unmatched so far by other technologies, and potential projects continue to grow, a policy singling out mobile phones from general ICT development policy might optimize upon the already well-known strengths of mobile phone deployment.

- **Partner with network providers to develop and invest in deploying mobile phone technologies.**

Both industrial and non-profit organizations participate in cell-phone based interventions in the developing world. Industrial efforts have been the recipients of government support in the past. Vodafone's intervention in Kenya through the M-PESA program was driven by a UK government “challenge fund”, offering government capital for investment in programs that had the potential to benefit individuals in developing countries. Because private mobile networks make up the majority of mobile phone infrastructure, it might make sense to support investment in their efforts to maximize the expansion of mobile phone technologies. On the other hand, companies investing in developing regions stand to make a significant profit in a new market and already have significant capital for investment, a slightly less compelling arrangement than

donating the funds to a non-profit group, which is more dependent on financial support.

- **Support non-profit, non-governmental organizations to deploy cell-phone based applications that are beneficial to the poor.**

Non-profit groups form a large network of the major aid going in to developing countries, and many have begun to experiment with mobile phone programs. Groups on the ground, such as Trade at Hand and CELAC, have deployed cellphone based programs to improve information access of agricultural knowledge and trade pricing, information critically relevant to the lives of poor farmers and entrepreneurs. Local knowledge provided by those on the ground in these groups can be indispensable for any aid project. However, because the major endeavors involving mobile successful that have been successful are driven by industrial efforts, it may prove to be a sub-optimal deployment of funds. In addition, since traditional aid groups are not involved in the distribution of mobile phones the way corporate projects often are, they may be more limited in their capabilities.

- **Grant academic institutions research funding to discover the most beneficial features available for mobile phones, evaluate usage patterns and effects of existing phones, and design systems improving functionality in low-income regions.**

Academic research drives much of the new attempts at technical interventions, and many academic studies involve limited pilot programs themselves. Several United States' universities have advanced research groups targeting this branch of research, including UC Berkeley's “Tier” group, and the University of Washington's “Change” group. The technical aspects of these interventions target both new uses of currently available mobile phone features, as well as high-end mobile phones that seem far detached from the real phones that users actually own in developing countries. Further focus can be turned to economic and ethnographic studies of the effects of mobile phones both for research in academia and for government-sponsored aid projects. These studies are the marker for what is and isn't working among projects that have been deployed, and what merits more extended deployment and investment. On the other hand, mobile phone studies for development do not fall easily into the field of study of any researcher, requiring both understanding of technical and social research, so it may be hard to target such studies. Furthermore, industrial and non-profit groups designing interventions on-the-ground

may have a better grasp on what the next steps should be for research and might be the better avenue to invest in future study.

RECCOMENDATIONS

Target Cell Phones Independently of Information Communication Technology Initiatives

Cell phones have had a unique impact upon the developing world. There are an astounding numbers of users across Africa, and east and southeast Asia, and the economic impact on these users has been demonstratively beneficial. This impact has enabled decidedly bottom-up developments, as users, through a tool they themselves have purchased and own, are constantly able to communicate with contacts regardless of location, and can make use of a new tool to facilitate many of the choices and actions they take every day. This impact is not just unique among technical interventions for development; it is a remarkable case by any standard of developmental impact. As a result, it makes sense to target mobile phones specifically as a platform for future development projects. Because organizations based in industry, academia, and the non-profit sector have all played roles in mobile phone based interventions, all three must be supported to make the most of the opportunity provided by mobile phones.

Invest in and Partner with Relevant Corporations

Industrial investment plays a massive role in mobile phone deployment and progress in all areas of the world. The backbone of the cell networks is provided, for the most part, by private network providers who manage both mobile service and the distribution of physical mobile phone devices, meaning that the network providers are crucial players in how cell phone usage develops over the next several years. Many providers have already accepted their role in the developmental features of mobile phone access, as seen in Vodafone's M-PESA. Other organizations involved in the distribution of applications and information also have roles to play, as demonstrated by the involvement of groups like the Reuters news agency and Microsoft Research. Although some may be skeptical of supporting profit-driven industrial efforts in the name of aid work, previous successes from mobile phone distribution, to information access, to mobile banking have all been extensively driven by corporate entities. So long as there is accountability for how American funds are spent and exactly what developmentally beneficial outcomes are resulting from that investment, which these corporations have thus far been ready to provide, partnership with industrial, profit-driven programs can remain a viable path for

improving lives through mobile phones.

Support Non-Profits and Encourage Corporate Partnerships

Non-profit aid groups are the key figures in most any program for development and should continue to be involved in mobile phone based strategies. Current programs already underway and proposed programs with the ability to create successful opportunities should receive support for their efforts. However, because for-profit groups have been driving much of the success thus far, non-profit and corporate partnerships should also be encouraged to optimize on the strengths of both groups.

Fund Research to Develop an Understanding of Future Options

Research and academia driven programs must also continue to be supported, both towards building the phones of the future by developing new technologies and towards deriving new understanding of what success looks like through social studies of mobile phone users. Because experimentation is the only way to discover new ideas and what works, it is crucial to maintain a steady stream of technical innovation. Only by evaluating experiments to see what does and does not work can an experimental idea develop into a successful technical intervention, so studies must focus on the usage and impact of technologies being deployed to the developing world. Providing a free field of study without overriding interests is exactly the environment provided by a government-funded academic institution, and can be a very successful environment for the creation of new ideas. Particularly if there are cooperative ventures with industry involved, it will be necessary to provide for an unbiased eye to evaluate current successes and what technologies to provide funding for in the future.

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