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MOBILE OPPORTUNITIES:
Poverty and Telephony Access in Latin America and the Caribbean

Background paper

Pro Poor Mobile Capabilities: Service Offering in Latin America and the Caribbean

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PRO POOR MOBILE CAPABILITIES: SERVICE OFFERING IN LATIN AMERICA AND THE CARIBBEAN

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Pro Poor Mobile Capabilities: Service Offering in Latin America and the Caribbean

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Abstract

This paper establishes the background for analytical and empirical examinations of mobile opportunities and service capabilities in Latin America and the Caribbean (LAC). The analytical and empirical studies will form the basis of a regional assessment and, ultimately, to recommendations for meaningful pro-poor policy, regulatory and project interventions in the region.

The paper recognizes that mobile services ultimately enable end-user applications and that insight into these applications is critical to understanding their existing and potential importance in traditionally marginalized communities.

It recognizes that these uses are in turn key to assessing developmental impact and to making meaningful pro-poor recommendations.

The background paper provides a taxonomic review of terms such as the more general “applications” and the more specific “ICT applications”. It also provides a taxonomy on services. The relationship between applications and services is made in general though emphasis is placed on the link between ICT applications and their enabling mobile services. The categorization of services and applications will be used to guide the development of a questionnaire to be applied to Mobile Usage field studies in eight Latin American and Caribbean countries in 2007. The paper recommends a handful of specific questions to be included in the field instrument.

As a backdrop for analytical work which will follow the proposed mobile field studies, the background paper includes a discussion of the potential of mobile services to impact poverty as well as some familiar case studies which illustrate different contextual examples. As a backdrop to recommendations for interventions, a brief overview of LAC mobile service offerings and service providers is provided and relevant knowledge gaps in the region are identified. A research strategy to fill these gaps is proposed.

1 Introduction – From Applications to Services

The availability of affordable wireless telecommunications services, most particularly mobile, has enabled traditionally marginalized groups and individuals to communicate as never before. Though the patterns of usage vary widely across different demographic groupings, it is universally accepted that the physical access to, and familiarity with, communications appliances and services offers real possibilities for social and economic development.

Of particular interest to the developmental impact of telecommunications are the end uses to which they are put. Such “applications”, as they are called, represent the bridge between the traditions of Communications and Information Technologies, ICTs. The first section of this background paper classifies these end user applications and then describes the underlying telecommunications services which facilitate them. Particular emphasis is placed on mobile services which have attracted a great deal of pro-poor attention.

1.1 ICT Applications

An application can generally be thought of as “the thing applied,” (Webster 1913, 1828). A ***computer*** application generally refers to a “software program that carries out some useful task,” (Newton 2003). An example of a computer application is a word processing programme. Information and Communications Technology (***ICT***) applications additionally feature the conveyance of information to an end user, the ICT consumer, via electronic communications.

In addition to the notion of a single, task-oriented entity (computer programme), ICT applications have popularly come to carry strong connotations of end-user perception and utility. Indeed, the open collaborative dictionary project, Wiktionary, reinforces the user-centred nature of applications through their definition: “…a set of software that the end-user ***perceives*** as a ***single entity***, as a tool for a ***well-defined purpose***.”

The foregoing definitions are central to the dialog on existing and potential impact of ICTs on development as they bring to focus the tasks to which consumers put ICTs and the perception that these consumers hold about the capabilities of ICTs in their personal contexts.

Studies relating to the impact of ICTs on poverty must take account of the many parameters across which ICT applications are categorized. This categorization represents a useful framework within which a regional inventory of ICT applications can be formulated and also represents a useful means of analyzing the potential of ICTs to impact development in general and poverty in particular.

A natural categorization of ICT applications may be made along the lines of purpose. Such purpose may, in principle, be realized through a variety of means, including non-technological means. This categorization parameter is therefore intrinsically technology-neutral and includes, for example:

- Personal communications
- Dissemination of information
- Access to information
- Access to services
- Payment for products or services
- Receipt of payments for products or services
- Personal productivity
- Collaboration
- Knowledge management
- Knowledge sharing
- Personal computing
- Information processing

Applications may alternatively be, and are often, categorized according to their thematic focus, for example:

- Government
- Governance

- Banking
- Health
- Business
- Agriculture
- Education
- Entertainment
- Travel
- Employment
- Environment
- Weather
- Science

Quite apart from the purpose to which ICT applications are generally put and the relevant thematic area to which they are applied, these applications may also be usefully categorized according to a variety of technical parameters. These in turn include requirements such as relate to:

- Information type (e.g. conversational / real-time, interactive, streaming etc.)
- Communication mode (e.g. full duplex, half duplex etc.)
- Mobility (e.g. in-door, pedestrian, vehicular)
- Connectivity (e.g. tethered, untethered, Internet access etc)
- Level of human intervention (e.g. high, moderate, low)
- Technical features (e.g. bandwidth, delay etc.) and underlying service requirements.

Mallalieu and Rocke (2005) provide an account of related technical parameters.

1.2 Underlying Services

End users often implement applications using a mix of hardware, typically self-owned, and facilities offered by commercial service providers. An example of such an application is voice communications. This application is implemented

by an end user who often uses his or her personal hardware along with a voice communications facility available from a service provider. In this case, the end-user application is voice and the facility is referred to as a voice ***service***. Yet, there is no single taxonomy of applications and services. There exist variations in definitions and, though generally applications and their enabling services are distinct, in some cases such as voice communications, there is little that distinguishes[1].

The formal distinction between services and applications has been made by many international organizations including the International Telecommunication Union (ITU). For example in Y.101-2000 Global Information Infrastructure terminology (ITU 2000, 1), the ITU defines an application as a "structured set of capabilities, which provide value-added functionality supported by one or more services" and a service as a "structured set of capabilities intended to support applications."

Within standards organizations services and applications are sometimes variously defined to reflect different generations of technology as well as various thematic focal points. For example, many contemporary definitions have evolved around multimedia which features strongly in Third Generation (3G) mobile and Next Generation Network (NGN) technologies. In ITU-T F.700 Framework Recommendation for multimedia services (ITU 2000, 2), the ITU defines an application as a "set of activities performed to respond to the needs of the users in a given situation for purposes such as business, education, personal communication or entertainment. It implies software and hardware utilization, could be performed in a fully or partially automatic way and could be accessed locally or remotely. In the last case, it requests use of telecommunication services." This recommendation defines a telecommunication service as a "set of telecommunication capabilities that

[1] To compound matters, the distinction between services and applications is sometimes blurred as there exist variation in usage across the industry. Applications, for example, are sometimes referred to as "CPE-based services" while the end-user capabilities derived directly from service providers are sometimes referred to as "network-based services".

works in a complementary and cooperative way in order to let users perform applications."

So it is, that despite the subtle definitional differences in use today, broadly speaking, telecommunications services refer to the end-user capabilities derived directly from service providers. End-user applications are ultimately enabled through these services. In as much as applications are particularly user-centric, services are particularly provider-centric.

Services have evolved over the years and their categorization may be made along chronological lines. Traditionally, these services pivoted around the provision of physical as well as logical connections over which service consumers would exchange information that they themselves generated. Services which fall into this category are still widely available and are commonly referred to as "basic telecommunications services".

Over the past few decades, "value-added services", which modify customer-provided information in some way, have emerged. Examples of such services include voice and electronic mail, electronic data exchange and online data transmission.

According to the traditions of basic as well as value added services, the UN's Manual on Statistics of International Trade in Services (UN 2002) clarifies the scope of telecommunications services as:

> "Telecommunication services encompass the transmission of sound, images, or other information by telephone, telex, telegram, radio and television cable and broadcasting, satellite, electronic mail, facsimile services, and so forth, including business network services, teleconferencing, and support services. It does not include the value of the information transported. Also included are cellular telephone services, Internet backbone services and on-line access services, including Internet access provision. Excluded are installation services for telephone networks equipment

(included in construction services), and database services and related computer services to access and manipulate data provided by database servers (included in computer and information services)."

Contemporary trends in telecommunications services, however, feature deeper levels of modification as well as the provision, processing and management of information directly by commercial service providers.

This study focuses attention on mobile service and is therefore most interested in those services, basic and value-added, which are implemented using mobile technologies. Of particular interest are the requirements of underlying mobile service to enable end-user applications. These service requirements, in turn, derive from the purpose, thematic focus and technical parameters of end-user applications implemented using ICTs, as discussed in Section 1.1.

1.3 Focusing on Mobile

Mobile services are those which are delivered over wireless access network infrastructure and support untethered user mobility over a substantial geographic range. Mobile services are usefully classified according to service requirements which ultimately derive from application features. For this purpose, services are typically classified as real time, interactive or streaming. Real time mobile services include conversational voice, videophone and interactive games. Interactive mobile services include voice messaging, Web browsing, email and e-commerce. Streaming services include audio and video streaming.

To illustrate the link between application features and service requirements, real time video, audio and speech applications require that the underlying mobile service provides a real time stream of data which provides guarantees on the bit rate, end to end delay and delay variation. As another example, non real time interactivity and file transfer applications require that the underlying mobile service provides message transport with the ability to differentiate between

various levels of Quality of Service. As a particular example, a mobile banking application may require mobile, asymmetric, bi-directional, point to point, connectionless service that does not require a particular guaranteed bit rate. See Mallalieu and Rocke (2005) for a detailed account.

Contemporary mobile services are delivered primarily, though not exclusively, through Third Generation (3G) mobile networks. These networks offer a range of voice, data and multimedia services and offer a useful reference point for categorizing service features. The Third Generation Partnership Project, 3GPP,'s Technical Specification Group provides guidelines on 3G services and service capabilities. These guidelines provide ranges of end-user performance expectations for various types of services. Tables 1, 2 and 3 of Appendix 1 illustrate the 3GPP guidelines for conversational / real-time services, those for interactive services and those for streaming services.

2 Pro-Poor Mobile Applications

In monetary terms, the World Bank defines the poverty line as US$2.00 per day and the extreme poor as those who survive on less than US$1.00 per day. The World Bank also recognizes a broader definition of poverty as a complex, multidimensional phenomenon viewed in terms of powerlessness, vulnerability and fear (WBG 2005). In this sense persons excluded from a variety of everyday networks, including telecommunications networks, are considered poor. According to the Human Development Report 2001 (UNDP 2001), such networks "are transforming the traditional map of development, expanding people's horizons and creating the potential to realize in a decade, progress that required generations in the past."

Indeed, telecommunications is widely accepted to be a key enabler of economic development while the overarching Information and Communications Technologies, ICTs, have attracted a great deal of attention as potential vehicles for poverty alleviation.

Much has been written about ICTs and poverty alleviation. Adeya's comprehensive review of ICTs and Poverty (2002) concludes that "ICTs have the potential to alleviate poverty and the problems faced by the poor, but the deployment of ICTs has to be treated with caution so that the ICT component does not deflect limited resources for other developmental concerns, such as the HIV/AIDS pandemic." Braga (1998) and Brown (2001) offer that ICTs will increase the gap "between the haves and have-nots in economic terms; if the poor are excluded" while Chowdhury (2000) argues that "the poor can't eat high speed internet access." Schon et al (1999) conclude that it is unlikely that the poor will transform themselves into producers of knowledge as IT reinforces for them the notion that they are at a knowledge deficit.

The literature on ICT and poverty alleviation provides a number of cautions. These include Adeya (2002:11) and Donner (2005a)'s caution against equating 'poor' and 'rural' and Schon et al. (1999)'s caution against excluding the peripheral areas of developed nations as poor communities.
Mobile service is the darling communications technology of traditionally unconnected communities, both poor and rural, primarily on account of its rapid and relatively inexpensive deployment capabilities compared to its fixed-line alternative. Its penetration has exceeded that of fixed-line service for many years in developing countries (ITU 2003). Research suggests that mobile penetration has a positive and significant impact on overall economic growth (Lewin and Sweet 2005, Waverman, Meischi and Fuss 2005) but the relationship between mobile applications and poverty alleviation is not clear.

Some studies, for instance Vodfaone 2005 on Africa and Lewin and Sweet 2005 on Latin America, assess the economic impact of mobile phones in terms of increased GDP, FDI and such. However, although increases in these factors are an indication of growth in the economic wealth of a country, they are not necessarily indicative of a reduction of poverty. In addition, such reports are arguably designed primarily to lobby governments for favourable policies for mobile network operators and not to necessarily strategise specifically about how mobile-enabled ICT applications can be used to alleviate poverty. Other reports (Grameen Village manual, Bayes, A et al.) specifically address how the

poor and traditionally marginalized members of society benefit from initiatives specifically designed for their benefit. Various reports also monitor the social impact of mobile telephony (including Frost & Sullivan 2006 on LAC). Donner (2005 a) adds to the research on the social and economic implications of the use of mobile phones in the developing world by a study of 31 small business owners in Rwanda.

2.1 Pro-Poor Mobile Telephony

The Village Phone programme, initiated, by the Grameen Foundation USA, is the icon of pro-poor telecommunications service provision. It has demonstrated a model for sustainable access to affordable telecommunications for the rural poor and a case study of entrepreneurial possibilities as depicted by the Village Phone Operators.

The successful impact of the Village Phone programme is evidenced by the gains made by all partners in the initiative, and the long-term success of the project is determined by an all-round profitable partnership. It has provided evidence that profitability and development can be complimentary goals. In the Grameen model, mobile providers are able to offer wholesale rates to Village Phone Operators due to high volume, and their cell phones are used more than 8 times as much, on average. The Village Phone Operator, by selling mobile services, makes more than 3 times the average income. Additionally, 98% of Village Phone Operators have repaid their loan in full. The Village Phone programme continues to grow and as of October 2005, the Greameen Bank had 150,000 village phone ladies, who treat the mobile phone as a business, and estimated that this would have increased to 200,000 by the end of that year.

In terms of the impact on income generation, a study commissioned by the Canadian International Development Agency (CIDA 2000) revealed significant positive social and economic impact, with Bangladeshi Village Phone Operators deriving on average 24% to as much as 40% of their household income. Additionally, the programme which was initiated in Bangladesh, has been subsequently rolled out to Uganda and Rwanda, indicating the utility and

desirability of communications technology across social strata, regardless of income. Critical to the propagation of the programme, The Village Phone Replication Manual was produced in 2005, and while recognizing the peculiarities of every implementation, the publication seeks to document the process and provide systematic guidance to those wishing to adopt the programme.

In another scenario, traditional transport has been adapted to connect India's poor. In India, a regional telecommunications company is using rickshaws to simultaneously increase business and help the poor (Biddlecombe 2006). Shyam Telecom operating in the state of Rajasthan has equipped a fleet of rickshaws with mobile phones. Here again, is evidenced the innovative extension of existing mobile infrastructure to benefit both the service provider and the poor. Drivers pedal these mobile payphones throughout the capital and countryside providing exclusive opportunity for disadvantaged rural community members to make a call or send SMS. The hand-peddled rickshaws are equipped with a battery, a billing machine and a printer. The rickshaw drivers are largely drawn from those at the margins of society, including the disabled and women. The telecommunications company does not charge for the initial set-up costs of 75,000 rupee (US$1,641) for the tricycle and equipment. The drivers profit 20% on every call, earning between 6,000 (US$131) to 9,000(US$197) rupees per month. The company reports that through these mobile payphones, some drivers are now able to be entirely self-reliant. Similar to the experience of the Village Phone programme, all parties benefit, as the driver receives a commission, consumers have easier access to communication and the telecommunication captures new markets and revenue.

However, as Donner notes not all mobile-based payphone businesses are backed by mobile network operators or NGOs. In the case of the impromtu mobile phone operators there are examples of "Umbrella Ladies" in Africa who sell calls on the side of the road and the informal resale of calls is also a frequent practice.

This evidence of the success of the mobile public phone reinforces the notional capacity of poor communities to understand and use state-of the art technology, and suggests a need for continued exploration and adoption of pro-poor mobile capabilities. Indeed, there are a wide variety of mobile-enabled applications which relate to many sectors including commerce, governance, health and even entertainment, which offer the potential to empower the poor in a variety of ways.

2.2 Pro-Poor m-Commerce

Mobile network operators are continuously innovating to capitalize on the growing demand for mobility in virtually all corners of the world, and to generate alternative revenue streams by tapping into new markets. Given the growing number of mobile cellular subscribers in developing countries, mobile network providers that recognize the collective purchasing power of the poor are making strides towards affordable services and increased relevance to bottom of the pyramid users.

One of the recent mobile-enabled ICT applications is the application of mobile technology to the provision of financial services. This mobile-enabled commerce (m-Commerce) provides increased access to financial services and has the potential to draw those currently excluded into the formal banking system. And, given the growing size of national and international remittances, m-Commerce could have significant impact on the economic well-being of the poor by providing them with more efficient access to these funds.

The pervasiveness of pre-paid mobile telephony service has motivated the acquisition of a new skill set by those previously on the fringe of the ICT movement. A large number of prepaid users are now of necessity familiar with text and voice messaging in order to refill their credit balance, and this group would seem a natural target for a micro-payment feature. Even though they often have no relationship with a bank and do not use credit cards they still “have the ability to perform financial transactions as evidenced by their ability to purchase and activate prepaid card for a credit” (InfoDev 2006). Yet, although

there are millions of m-Commerce users in the world, notably in the Philippines, this potential has not been recognized in many markets, as the subtle change in technology usage brought about by mobile has not been fully recognized (InfoDev 2006).

The largest m-Commerce market is found in the Philippines where there are over 3.5 million users on the two major networks. Telecom Trends International (2004) estimates that globally, 94.9 million users generated US$6.86 billion in m-Commerce revenue in 2003, and estimates that there will be 1.67 billion users by 2008, generating over US$554.37 billion. Nagi Jaffery, President of Telecom Trenda International offers a three-fold driving force behind the growth in m-Commerce – “rollout of packet-data networks, availability of enhanced data devices, and development of rich content for m-commerce applications” (Telecom Trends International 2004). The study projected that digital content would retain a large percentage of total sales, while point-of-sale and interactive-type transactions would continue to increase.

All of the versions of m-Commerce examined in an InfoDev 2006 study by the Information for Development Program, in partnership with the International Finance Corporation (IFC) and the GSM Association, involved a special GSM-specific SIM-based menu, from which users select the desired transaction, including:

- Cash deposits and withdrawals
- Third parties deposits into a user account
- Retail purchases at selected outlets
- Over-the-air prepaid top-ups using cash already in the account
- Cash transfer between user’s accounts
- Airtime credits transfer between users
- Bill payments, including micro-finance applications of loan payments and advancements.

The InfoDev study (2006) offers that the key success factors to the implementation of m-Commerce "included the ability to load prepaid airtime credits as well as the ability to transfer both cash and airtime credits between customers. Coupled with these were the low rates charged by the operator for such pre-paid top-ups or credit transfers." In other words, the study showed that the mobile application in itself was not sufficient condition for success, however seemingly intuitive the benefits, rather the poor needed to see how tangible benefits would be derived for them. This is shown by the increase in m-Commerce usage when the smallest unit of pre-paid credit purchasable dropped to a level that fit the economic arrangements of the poor.

The InfoDev (2006) study points out that service providers recognized that if properly implemented all stakeholders involved could benefit from m-Commerce, as "networks would experience higher SMS usage and higher ARPU, the banking industry gained access to an otherwise difficult if not inaccessible market segment. Added to that were the transaction revenue and interest on the generated cash float" (InfoDev 2006) This cash float can be used to improve the country's economic situation. "The identifiable customer advantages included the availability of useful features, including cash deposits and withdrawals and ease of prepaid reloads and credit transfers between users" (InfoDev 2006).

The research team (InfoDev 2006) identified various areas for further research including the capability of current m-Commerce systems to work on networks other than GSM (such as US-CDMA), the need for further technical standards, the issues raised by multiple users sharing a common mobile phone (albeit with different SIM cards) and fraud prevention.

2.3 Pro-Poor m-Governance

Electronic government (e-Government) broadly encompasses "the use of ICTs by government to enhance the range and quality of government information and services provided to clients in an efficient, cost effective and convenient manner, while making government processes more accountable, responsive

and transparent" (Sudan 2005). A study undertaken by Heeks (2003a, 2003b) indicates that government initiatives in developing or transitional countries have had mixed results, but have overwhelmingly resulted in failure, with a breakdown of 35% total failures, 50% partial failures and only 15% successes. Heeks (2003a) elaborates on the various criteria as follows:

- *"Total failure*: the initiative was never implemented or was implemented but immediately abandoned.
- *Partial failure*: major goals for the initiative were not attained and/or there were significant undesirable outcomes.
- *Success*: most stakeholder groups attained their major goals and did not experience significant undesirable outcomes."

Several factors contributing to barriers in e-Governement adaptation have been identified by Ghyasi and Kushchu (2004) including:

- lack of electricity, communication lines
- computer workstations
- fluency in English (which is the main language for web page content)
- cost
- low levels of education and literacy (although it must be recognized that literacy levels differ across LAC)
- poor technology infrastructure
- wide gap of disposable income

Also contributing to the lack of success with e-Government ventures is a lack of people readiness, defined as the ability "to access *and* use Information Communication Technology (ICT) and Internet regularly" which preempts the implementation of many e-government applications and ensures their failure if implemented (Ghyasi and Kushchu 2004). To these should be added the necessity for enabling government policies. Governments clearly have an important role to play in telecommunications policy, which should be linked to development policy, information content and the effective use of mobile to enhance communication with citizens.

Sudan (2005) cautions against the tendency of developing countries adopting e-Government "to focus on a few showcase applications that visibly demonstrate success and spur increased use of ICTs in individual departments." In summary, he suggests the following issues are crucial to long-term success:

- a "whole government approach" which is balance and not over centralized, as a narrow sectoral approach can often lead to waste and unnecessary duplication.
- the development of appropriate framework for standardising data, as data clean-up can be a long and costly exercise.
- centralised coordination is also necessary to ensure that various departments do not embark on duplicate projects
- an overarching architecture is needed to guide the development and management of applications
- a central coordinating agency provided with the necessary institutional mechanisms to allow it to impose standards and influence budgets and procurement methods.

Developments in mobile telephony technologies from simple SMS to the more complex, Internet enabled mobile phones have created a new channel for governments to improve inter-departmental communication as well as communication with citizens and the private sector. m-Government is a complement to e-Government (Lallana 2004, Ghyasi and Kushchu 2004), "the strategy and its implementation involving the utilization of all kinds of wireless and mobile technology, services, applications and devices for improving benefits to the parties involved in e-Government including citizens, businesses and all government units" (Kushchu 2003). The recommendations for successful e-Government applications offered by Sudan (2005) can also be applied to mobile government (m-Government) applications.

For some authors (including Kushchu and Kuscu 2003) m-Government is inevitable as governments will have to adjust to the increasing prevalence of mobile phones and mobile internet connections that are driving a demand for

access to information anywhere and anytime. Capacity limits constrain some m-government applications as, for example, over SMS such applications are limited to a modest number of characters that can be transferred compared to email. Such considerations limit m-government services delivered over legacy networks to simple applications, in particular those that are time sensitive and immediate notification is required.

Concerns of ICTs and development regarding how government funds should be used, especially in developing countries where there is intense competition for scarce government resources, are even more pronounced with both e-government and m-government, as government funds are directly involved. The financial constraints faced by many governments of developing countries means that resources have to be judiciously applied. This is especially the case given the astounding failure rate of e-Government projects in developing and transitioning countries (Heeks 2003a, Heeks 2003b). Misappropriation of government funding would actually be a negative for poverty reduction goals. And, would lend substance to fears that scare resources were being spent on technology, rather than on basic infrastructure (Driscoll 2001).

In any event, the introduction of e-Government of itself is a challenge. Sudan (2005) discusses the evolutionary approach to initiating e-Government, citing the four-phase model developed by the Gartner Group and the five-stage typology of the UN Global e-Governance Report. The progressive phases of the four-phase Gartner group model are establishing a presence, interaction, transaction and transformation, with each successive phase involving increasing cost and complexity.

The UN Global e-Governance Report's five stage typology consists of emerging presence, enhanced presence, interactive presence, transactional presence and networked presence (as noted in Sudan 2005). These evolutionary methods assume a linear and progressive approach to the development of e-Government. But, as Sunada (2005) notes evolutionary models are inadequate to capture the complexities of e-government.

Ghyasi and Kushchu (2004) recommend a 3 phase approach for implementing m-Government, starting with outreach to citizens in times of crisis, to more interactive applications to allow greater citizen participation in government activities, and finally arriving at highly interactively applications that support financial transactions. Again the best potential lies in indigenous development to ensure relevant content.

2.4 Pro-Poor m-Health

The health sector is benefiting from the development of mobile phone software that can be used in the fight against and to increase awareness about the HIV/AIDS virus and potential health pandemics such as avian flu.

The GSM Association Development Fund in conjunction with Voxiva Inc. have partnered to develop an application intended to allow health workers in the field to submit critical health data to authorities in real time. They can use their phones to reports on disease outbreaks, drug inventory levels, status of patients, and other vital health information. Notably, the software provides for a two-way communication process enabling the health workers to also receive faster feedback on laboratory results, treatment guidelines or quarantine requirements (*GSM Association Press Release* October 17, 2006). The ability to view, analyse and respond to vital data immediately will contribute significantly to addressing the issues of inadequate HIV surveillance and lack of data on the disease. The untethered nature of mobile phones and their pervasiveness, especially in developing countries, make them an efficient method of information dissemination and collation.

The first pilot project of the software, in Rwanda, has been supported by that country's largest mobile phone operator MTN, and software testing has been completed in the Eastern Province. Health workers enter the data into their mobile phones and send it via a GPRS connection to a central database, or as a text message, in the absence of a GPRS connection. The tests which were carried out in collaboration with Rwanda's National Institute of Statistics, used the mobile phone to capture health information normally written on a piece of

paper. Since Java programming language is used, the application is able to run on a wide range of phones.

2.5 Pro-Poor m-Gaming

Mobile gaming is an important means of attracting the attention of traditionally unconnected populations. There are many positive pro-poor applications, for example, it has been innovatively used to fight against HIV/AIDS. Launched on World AIDS Day, December 1, 2005, under the banner “Freedom HIV/AIDS, ZMQ, a Delhi-based e-learning and gaming software company, released a suite of mobile games aimed at spreading awareness about HIV/AIDS, using the latest technologies, by capturing the attention of the millions of people, from all strata of society, who access mobile phones. As the European Commissioner for Information Society and Media noted during her interaction with the development team, “Mobile phones are a wonderful tool for communication and entertainment. 3G mobiles will add new applications, including education. Using mobile devices to raise awareness on HIV/AIDS is a very good example of intelligent use of mobile telephony”.

Importantly, the software developer, ZMQ, has recognized the need for context-sensitive, content relevant software applications (include citings/sources from ICT who speak on this) and one of the games is based on cricket, the most popular sport in India. There is a high probability that the popularity of this particular game would be extended to the other Commonwealth nations, which would include much of the Anglophone Caribbean. The games do however vary, and seek to target the psyche of different users (Pattanayak 2006). The games have also been deployed on both black and white and high-end coloured devices, indicating knowledge of the customer base and a desire to capture the widest segment possible.

3 Mobile in Latin America and the Caribbean

A sense of the mobile presence in Latin America and the Caribbean may be derived from the numbers and scale of providers; the services available by these providers as well as from the penetration of mobile services and the applications ultimately used by LAC consumers.

3.1 LAC Mobile Providers and Services

The major cellular mobile providers in Latin America are America Movil, Telefonica SA and Telecom Italia while the major providers in the Caribbean are Cable and Wireless and Digicel. A number of other providers offer services in the region. Appendix 2 presents an inventory of mobile operators by LAC country as of August 2006.

GSM leads the cellular market in Latin America and the Caribbean, with service offerings in all countries in the region and 124.9 million subscribers, corresponding to 53.1% of the mobile market share by the end of 2005 (Bibolini 2006) and an estimated 70% of the mobile market share by the end of 2006 (3G.co.uk 2006 a). TDMA and CDMA service is also available, with 50.7 million and 59.4 million subscribers respectively by the end of 2005 (Bibiloni 2006). The TDMA market share is falling while the CDMA market share is on the rise. Currently, CDMA2000 boasts 70.4 million LAC users, or 26 % of the regional mobile market share (3G.co.uk 2006 b). Appendix 3 presents the baseline technologies available in each LAC country by provider.

Though they account for lower revenues than voice services, virtually all LAC mobile providers offer mobile data services. Mobile data services available in various LAC countries include General Packet Radio Services, GPRS (on a GSM platform); Blackberry (on a GPRS platform), EVolution-Data Optimized, EV-DO (on a CDMA platform); and Short Message Service, SMS, (on all cellular platforms).

As GSM enjoys the greatest penetration in LAC, data services are primarily available over GPRS and EDGE. The 3G technologies of UMTS and HSDPA, built on GSM platforms with devices which are backward compatible with their EDGE predecessors, have this year been introduced in Chile and Puerto Rico. These technologies enable a rich variety of high speed wireless data applications such as high-speed Web browsing, multimedia mobile email, live TV and 3D games.

Despite GSM's greater penetration in the region, CDMA-based 3G services were introduced into LAC before those of GSM and the uptake continues to rise. There are an estimated 4 million LAC subscribers to CDMA2000 1X and 1xEV-DO services (3G.co.uk 2006 b). These services facilitate telephony, multimedia and other broadband wireless data applications.

Independent of the underlying platform (GSM or CDMA), 3G cellular services enable wireless conversational, real time, interactive and streaming applications as discussed in Section 1.3 and described in Appendix 1.

3.2 Mobile Penetration in LAC

The average Latin American or Caribbean citizen recognizes that mobile telephony has taken the region by storm. Liberalization and the introduction of pre-paid service have revolutionized the market and placed phones in the hands of the traditionally marginalized. It is typical to see domestic helpers, manual laborers, school children and the elderly manipulating the many features of their handsets with fluency.

Indeed, over 40% of all Latin American and Caribbean residents are mobile phone users, as shown in Table 1 which provides a breakdown of mobile penetration in LAC, by country, for 2005. These figures place Jamaica, at that time, ahead of the pack with 88.8% of all 2005 telephone service users subscribing to cellular mobile. By the end of 2005, Jamaica's mobile penetration rate was variously reported as 93% (Bibolini 2006) and 102% (ITU 2006). These figures compare to jurisdictions such as Cuba with an estimated 13.7%

of all 2005 telephone service users subscribing to cellular mobile and a 2005 penetration rate of 1% (Bibolini 2006 and ITU 2006). Currently, mobile subscribers out number fixed line subscribers in all of the region's countries other than Cuba.

Table 1: **2005 Cellular Subscriber Data for Latin America and the Caribbean (ITU 2006)**

	Mobile Subscribers per 100 Inhabitants (2005)	Mobile Subscribers as % of Total Phone Subscribers (2005)
Antigua & Barbuda	70.13	58.7
Argentina	57.27	71.5
Aruba	89.44	
Bahamas	58.68	57.1
Barbados	73.85	59.6
Belize	34.48	73.7
Bermuda	79.03	
Bolivia	26.37	78.9
Brazil	46.25	67
Chile	67.79	75.5
Colombia	47.81	73.7
Costa Rica	25.45	44.2
Cuba	1.19	13.7
Dominica	58.68	66.6
Dominican Rep.	40.68	80.2
Ecuador	47.22	78.6
El Salvador	35.05	71.3
French Guiana	53.55	
Grenada	42.05	57
Guadeloupe	71.04	
Guatemala	25.02	73.7
Guyana	33.29	69.4
Haiti	4.87	74.1
Honduras	17.79	72.2
Jamaica	101.85	88.8
Martinique	74.78	
Mexico	44.34	70.9
Neth. Antilles	90.09	
Nicaragua	19.69	83.5
Panama	41.88	75.4
Paraguay	30.64	85.5
Peru	19.96	71.3
Puerto Rico	68.82	70.7
St. Kitts and Nevis	20	28.6
St. Lucia	62	
St. Vincent	59.34	75.8
Suriname	51.85	74.2
Trinidad & Tobago	61.26	71.2
Uruguay	18.51	37.5
Venezuela	46.71	77.6
Virgin Islands (US)	57.84	47.5
LAC	**48.21**	**66.9**

3.3 Pro-Poor Mobile in LAC

LAC accounts for a substantial portion of the world's poor. By World Bank monetary standards (WBG 2005), 128 million people in LAC, almost one-quarter of the world's population, are poor while 50 million of these, one-tenth of the world's population, are classified as living in extreme poverty.

Lewin and Sweet (2005) found that in middle-income countries[2] such as those in Latin America, a 10% increase in mobile penetration boosts GDP growth by 0.3% per year. On the other hand Waverman, Meischi and Fuss (2005:11) estimated that the same 10% rise in mobile penetration in a developing country could stimulate economic growth in the country by a rate of 0.59 % per year, "and this impact may be twice as large in developing countries compared to developed countries".

ITU figures (ITU 2005) indicate that, overall, mobile communications has seen comparatively modest growth in Latin America and the Caribbean (LAC) over the past five years, with a regional Compound Annual Growth Rate of 30.4%[3] over the period 2000 - 2005. This compares with overall regional averages of 52.8% for Africa, 28.7% for Asia, 67.3% for Europe and 62.5% for Oceania. Absolute figures as well as percentages are shown in Table 2.

Recorded data relating to the overall percentage of cellular subscribers to total telephone subscribers in LAC is higher than averaged growth rates across the region, according to the ITU's 2005 figure of 66.9%[4] (ITU 2005). This compares with overall regional averages of 82.2% in Africa, 28.7% in Asia, 18.3% in Europe and 17% in Oceania.

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[2] Middle Income Countries as defined by the World Bank are those with incomes between US$3,036 and US$9,385 per capita.
[3] Figure derived from ITU 2005 WTI Americas data excluding The U.S. and Canada (ITU 2005).
[4] Figure derived from ITU 2005 WTI Americas data excluding The U.S. and Canada (ITU 2005).

Table 2: **2005 LAC Cellular Subscriber Growth Profile (Source: ITU 2006)**

	Mobile Subscribers(2000) in 1,000s	**Mobile Subscribers(2005)** in 1,000s	**Mobile Subscribers CAGR (%) (2000-05)**
Antigua & Barbuda	22	54	25.2
Argentina	6,487.90	22,100.00	27.8
Aruba	15	98.4	60
Bahamas	31.5	186	55.9
Barbados	28.5	200.1	62.8
Belize	16.8	93.1	40.8
Bermuda	13	49	39.3
Bolivia	582.6	2,421.40	33
Brazil	23,188.20	86,210.00	30
Chile	3,401.50	10,569.60	25.5
Colombia	2,256.80	21,800.00	57.4
Costa Rica	211.6	1,101.00	39.1
Cuba	6.5	134.5	83.1
Dominica	1.2	41.8	143
Dominican Rep.	705.4	3,623.30	38.7
Ecuador	482.2	6,246.30	66.9
El Salvador	743.6	2,411.80	26.5
French Guiana	39.8	98	25.2
Grenada	4.3	43.3	78.2
Guadeloupe	169.8	314.7	16.7
Guatemala	856.8	3,168.30	38.7
Guyana	39.8	250	44.4
Haiti	55	400	64.2
Honduras	155.3	1,281.50	52.5
Jamaica	367	2,700.00	49.1
Martinique	162.1	295.4	16.2
Mexico	14,077.90	47,462.10	27.5
Neth. Antilles		200	
Nicaragua	90.3	1,119.40	65.4
Panama	410.4	1,351.90	26.9
Paraguay	820.8	1,887.00	18.1
Peru	1,273.90	5,583.40	34.4
Puerto Rico	926.4	2,682.00	30.4
St. Kitts and Nevis	1.2	10	69.9
St. Lucia	2.5	93	147
St. Vincent	2.4	70.6	97.3
Suriname	41	232.8	41.5
Trinidad & Tobago	161.9	800	37.7
Uruguay	410.8	600	9.9
Venezuela	5,447.20	12,495.70	18.1
Virgin Islands (US)	35	64.2	16.4
LAC			**30.4**

Lewin and Sweet (2005) note that not withstanding the significant investment in Latin American mobile infrastructure, which increases the efficiency of the economy in general, mobile take up in Latin American countries is below

expectations for countries with similar GDP per capita. Speculative reasons offered for this lag, include the mix of technologies used, political instability, industry specific taxes and import duties on network equipment, interconnect arrangements, the level of license and spectrum fees (Lewin and Sweet 2005).

Indeed, the LAC region comprises substantial geographic as well as cultural and ethnic diversity. Even within the Caribbean sub-region, there are, for example, deeply forested and isolated areas in Guyana whereas in the small island of Barbados, the terrain is flat, infrastructure is extensive and the notion of isolation is quite different. The applications currently in use and those that have potential to take root are correspondingly diverse across the Caribbean and more so across the entire Latin American and Caribbean region. The broad variations in penetration rates across the region (Table 1) reinforce that there are substantial difference between LAC countries in the way that mobile phones are owned, used and valued.

Nevertheless, several user-led innovations have emerged with the advent and development of mobile telephony. For example, beeping, flashing and intentional missed calls are used to convey pre-established messages. “[T]his social convention has emerged which allows messages of various sorts to be set across the network at no additional cost to either participant” (Donner 2005c). While the beep normally indicates a request for the other party to call back, it may also have other pre-negotiated meanings, that are both situation and relationship contextual. Micro-negotiation “beeps don’t merely reflect social and cultural structures, they reinforce and reshape them” (Donner 2005c). In Jamaica many use their mobile phones as a way to secure contacts who could possibly be used as financial sources later on (Horst and Miller 2005). This user-led innovation is facilitated by the mobile phone’s address book feature which allows names and numbers to be stored and easily retrieved.

A wide range of mobile data services are used in LAC. GPRS, Blackberry and EV-DO are popular among many LAC business users, whereas SMS (“texting”) has exploded in popularity with the young and its affordability has won the attention of all age groups. Many users know the exact cost of text messages

versus phones calls, and prefer the much cheaper text message (SMS), even for important matters. With appropriate roaming agreements, these measures can also be used to reach people overseas, facilitating social contact and economic arrangements such as remittances.

While the mobile Internet has taken the developed world by storm, for the most part, the LAC region has viewed it with a mix of curiosity and excitement. A 2002 ECLAC assessment (ECLAC 2002) identified the major reasons for going online in LAC as: obtaining general information services, entertainment, instant messaging or e-mailing. Jain (c2006) recommends that given the inevitable migration delay in moving from fixed Web applications to those specifically designed for the mobile Web, developing countries need to innovate and create indigenous mobile Web applications.

Many jurisdictions within the region have committed, through a variety of means including national policies and projects, to advance both the use of the Internet and the broad access to mobile technology. Many national policies promote e-learning, e-Business/ e-Commerce, e-Health, e-Culture and e-Media. As the rollout costs of wireless technologies is lower than those for fixed line systems and as, in LAC, the penetration rates are higher for mobile than they are for fixed line service, there is interest in mobile-enabled versions of these applications. There is also a great deal of national commitment to implementing policies and regulations that "…favour competition and encourage the speediest possible rollout of mobile telephony" as proposed by Waverman, Meschi and Fuss (2005).

A key focal area of interest is m-government whose practicality benefits (over e-government) from the high levels of mobile penetration that exceed that of fixed line penetration in LAC. The delivery of m-government services is of interest for lower costs, increased effectiveness, wider dissemination of government information and services and increased channels for public interaction.

The potential benefits of m-Commerce are significant in LAC for instance, where in 2005, an estimated US$56.6 billion in remittances was sent from the

US by immigrants and migrant workers, up by approximately 17% from the previous year (IBD 2006[5]). In Latin America, the Brazil mobile network operator Vivo (Telefónica Móviles) has teamed up with Banco Brasil and m-Commerce application developers Eversytems. Appendix 4 provides a synopsis of some projects undertaken in the Caribbean and Central America (Heeks 2003b).

In considering the emergence of m-Government in LAC, the model for convergence of advanced mobile data applications in developing countries proposed by Jain bears consideration (Jain c2006). In a position paper on the mobile Web in developing countries Jain (c2006) explores how countries move from fixed Web applications to mobile Web applications. Factors contributing to growth of mobile data applications include low penetration of fixed phone lines, personal computers and Internet access. But, several challenges to Web usage in developing countries should be considered. These include basic issues of cost, connectivity and coverage. Note, that these concerns are also shared by other authors, regarding the development of e-Government applications (for instance Ghyasi and Kushchu 2004). Also beyond such challenges (with voice service) are issues of low literacy levels that preclude the exclusive use of and reliance on SMS messages (notably a challenge for mobile government, especially where the applications rely solely or at least heavily on SMS). This points to a need for MMS in combination with SMS. In addition, the diversity across the region in terms of disparity of wealth, technology advancement, and diversity of languages within and amongst LAC countries, albeit to varying levels for each country, all suggest a need for customized approaches to m-Government.

Jain (c2006) argues that replicating country-specific success in developing mobile web applications will be difficult due to the manner in which advanced mobile data[6] applications emerge and develop in developing countries. The author proposes that for industrialized countries, although applications were

[5] This background paper cites figures provided by the IDB's Multilateral Investment Fund.
[6] The author defines advanced data applications as those that are not telephony-oriented (e.g. VoIP) and are not in wide usage at present (e.g. SMS, ringtone download). Thus examples would include MMS, search, mail, online calendar, video, games, social networking, and maps (Jain c2006).

also migrated from the fixed Web, in the main they specifically developed applications with the mobile Web in mind. On the other hand, for developing countries, most of the applications are transferred mainly from industrialized countries. This does not completely discount natively developed applications, as there are examples, but if SMS based applications are excluded then the penetration rate drops dramatically (Jain c2006). There is also the issue of the migration delay resulting from factors such as “lack of broadband availability, relatively expensive data pricing, lack of proliferation of multimedia PCs, etc.” The conclusion therefore, is that developing countries need to innovate native Web applications rather trying to migrate those applications developed by industrialized countries.

LAC countries grapple with a wide variety of pressing economic, social and development issues, which variously motivate the prioritization of other focal points for ICT-enabled and mobile-enabled services and applications. One priority is the prevalence and spread of the HIV/AIDS virus. After Sub-Sahran Africa, the Caribbean has the highest HIV prevalence in the world, with 1.6% of the adult population infected. At the end of 2005, there were 1.6 million people living with HIV in Latin America. In the Caribbean, more than 27,000 people died of AIDS, approximately 37,000 were infected with HIV, in 2005 alone (UNADIS 2006). Pembrey (n.d) offers that inadequate HIV surveillance and lack of data are the primary reasons why HIV prevalence and AIDS cases are considered widely underestimated in the Caribbean. The region therefore stands to benefit from the pilot project carried out in Rwanda to develop a mobile phone software application to fight against HIV/AIDS.

Much of the region is also vulnerable to natural disasters such as volcanic eruptions, earth quakes and hurricanes and also suffers from high levels of crime. These vulnerabilities, which affect the poor disproportionately higher than other economic groups represent centres of interest for pro-poor ICT and mobile intervention.

There is considerable interest in harmonization of policies and practices relating to ICTs in general across the Latin American and Caribbean region. The

development of harmonized indicators and the gathering of comparable data across the region have received a great deal of interest. Mobile technology presents valuable opportunities for the efficient and effective gathering, and transmission of field data.

Nevertheless, to date, only few mobile-enabled initiatives have taken root and less have been documented in LAC. Research on the use, value and ownership of mobile phones in LAC would provide a crucial insight into the viability of various mobile-enabled applications in the region.

4 Knowledge Gaps

It is imperative that recommendations for meaningful pro-poor policy, regulatory and project interventions be based on regional data. However, there is, as Waverman, Meischi and Fuss (2005) note, a paucity of data in developing countries. Indeed, "[d]espite a worldwide boom in mobile phone ownership, studies of social and economic implications of mobile telephone use in the developing world are rare" (Donner 2005d). Much of the well-documented case materials on mobile and poverty alleviation that are available focus on Africa and Asia. Little data is available for LAC.

The literature indicates that many mobile initiatives in Asia and Africa are driven by mobile network providers. This suggests the need for further research into the driving-forces of pro-poor mobile capabilities in LAC.

It would be useful to document LAC cases and benchmark them against international reference points. Baseline data is also important to facilitate an understanding of the regional barriers to the adoption of mobile-enabled ICT applications in LAC and to the various parameters which influence end-user uptake of applications. Additionally, a regional inventory of existing mobile-enabled ICT innovations and applications is of particular interest. These various data inputs are necessary to guide the development of recommendations for regional policy, regulatory, technical and project interventions.

Many service providers have taken the initiative to acquire data relating to mobile usage. Studies such as Vodafone's, previously discussed, make important contributions to our collective understanding of the impact of mobile phones. However studies commissioned by service providers are vulnerable to conflict of interest claims. Even data from authoritative sources such as the ITU is not definitive as national respondents vary in their understanding of the indicators and their commitment to integrity. It is important that LAC strengthen its capacity for independent and reliable research both at the institutional as well as at the inter-institutional levels.

5 Research Objects and Strategy

The proposed research seeks to add to the regional literature and empirical data stock regarding service availabilities, application possibilities and the manner in which mobile phones are owned, valued and used in LAC. This will provide insight to enable analysis of trends in innovation of mobile-enabled ICT applications in the region, as well as ways in which existing mobile infrastructure may be used to optimal benefit.

5.1 Objectives

The broad thematic objectives of the 2007 research cycle are to gather, document and contemplate empirical data, from select LAC countries, that will contribute to, and enrich, the debate of pro-poor ICT policies in the region. Particular objectives are to:

- Develop an inventory of available regional mobile services (providers) and applications (users).
- Analyze the pro-poor mobile capabilities in the region
- Document regional mobile-enabled ICT case studies
- Develop a conceptual framework of mobile technologies, services and applications in a manner that is accessible to regulation and policy domains
- Develop an inventory of regional innovation capacity
- Develop a conceptual framework for a virtual mobile innovation centre

Non-thematic objectives of the work programme are to:

- Explore opportunities to develop local capacity in the area of cross-disciplinary empirical studies
- Engage in cooperative research with other DIRSI researchers

5.2 Scope

The significant variation in mobile penetration rates within LAC, discussed in this paper, suggest a corresponding diversity in infrastructure, service, economic and social circumstances across the region. LAC also features tremendous diversity in demographics, language, geography, topography and culture. Comprehensive regional research is therefore a major undertaking entailing representative studies across the many parameters of diversity. As the region spans an enormous geographic area comprising more than forty countries, many themselves comprising a number of islands and many others comprising large municipalities, a thorough regional study is an even more daunting undertaking.

Recognizing the practical limitations of a comprehensive LAC study, research of a limited scope is proposed for 2007. In particular, it is proposed that the 2007 empirical and analytical research focus on the following selected countries within the English speaking Caribbean:

- Northern Caribbean - Jamaica
- Southern Caribbean - Trinidad and Tobago

5.3 Methodology

The 2007 research will employ both analytical and empirical studies. The analytical component of the research will draw on Section 1 of this background paper, as well as the outputs of the 2005 research cycle (the Percolator Model) and the 2007 field work, to establish important technical inputs into the contemplation of avenues for the alleviation of poverty through mobile technologies. It will represent support for DIRSI research on pro-poor mobile

models, strategies and measurements. This work will draw heavily on desk research and point the way for continued research.

5.4 Field Instrument

Field work will gather demand-side data. Target groups will comprise bottom of the pyramid users and non-users. The particular instrument proposed for the empirical study is a quantitative questionnaire which closely follows the categorization of applications and services developed previously in this background paper.

To minimize interpretative spread and respondent fatigue, it is proposed that the survey instruments be developed in a nominal multiple choice format with each response to include no more than 5 closed answers as well as the option for further comment or clarification. Sample questions are as follows:

Demographics and Geographics

- Education level
- Gender
- Age
- Economic groupings
- Location (rural, suburban, urban, forest, jungle)

Value of mobile phone

- Do you value your mobile phone more because no other method of communication is available to you?
- Other forms of communication available?
    - Road (car, buses, etc)
    - Do you own a landline?

        If no: Do you have access to a neighbour's landline?
- Do you own your own mobile phone?
    - If yes…
        - prepaid?
        - Postpaid?

- Do you have more than one service provider?
- Who is your service provider?
- If more than one service provider, why?
    - Cheaper to make calls to similar provider?
    - Coverage?
    - Cheaper handset?
- Do you use fixed line telecentres?
    - If yes, are they in your neighbourhood?

Purpose

1. Executing government transactions
2. Banking
3. Health
4. Business
5. Agriculture
6. Education
7. Entertainment
8. Travel
9. Employment
10. Environment
11. Weather
12. Science
13. Other (please specify)

Ranking by importance and (separately) by frequency, purpose for business:

- Increased sales and profits (business)
- Increased efficiency (business)
- Save time / increase productivity
- Job search
- Make appointments
- Savings in travel costs
- Dissemination of information
- Access to information
- Access to services

- Payment for products or services
- Receipt of payments for products or services
- Collaboration
- Knowledge management
- Knowledge sharing
- Personal computing
- Information processing
- Other, please specify

Ranking by importance and (separately) by frequency, purpose for personal use:

- Easier to communicate with friends and family
- Save time
- Savings in travel costs
- Dissemination of information
- Access to information
- Access to services
- Payment for products or services
- Personal productivity
- Collaboration
- Other, please specify

Sharing of mobile phone

- If you do own a mobile phone would you be willing to allow others to use it?
    - Free of cost or fee?
    - All others/ only friends?

Barriers to access and use

- Do you have electricity at home?
- Is mobile coverage available in your neighbourhood?

Measurement of calls and SMS (text messages)

- How often do you use your mobile for the following? (never; often: >= 1 time per day; seldom: 1 time per month).

- Outgoing voice calls
- Incoming voice calls
- Outgoing text messages
- Incoming text messages

6 Summary

This background paper recognizes that impact studies of mobile technologies must take account of the end-user applications to which mobile services are put. It has therefore set forth the fundamental notions of applications and services and provided a taxonomic framework that can be used to analyze user needs / demands vis a vis provider supply. It has established a sense of the service offerings available in Latin America and the Caribbean and provided a brief inventory of service providers across the region.

The desk research identifies key knowledge gaps, chief amongst which relate to data on the use of mobile services and associated applications among the poor in Latin America and the Caribbean. In the absence of much regional data, the background paper presents a brief survey of the use of mobile in various countries around the world to provide a sense of its potential. It also makes general observations on the use of mobile in the region and reviews various perspectives on mobile in LAC.

The findings of the background paper have confirmed the need for field research on the use of mobile by poor communities in LAC. The paper is a useful starting point to contemplate relevant analytical work that can draw on the outputs of field data to make recommendations on innovations in mobile services and applications as well as enabling policy, regulatory and project interventions in Latin America and the Caribbean.

7 Appendix 1 3GPP End-user Performance Expectations

Table A1(a): **End-user Performance Expectations - Conversational / Real-time Services (3GPP 2006)**[7]

Medium	Application	Degree of symmetry	Data rate	Key performance parameters and target values		
				End-to-end One-way Delay	Delay Variation within a call	Information loss (Frame Error Rate)
Audio	Conversatio-nal voice	Two-way	4-25 kb/s	<150 msec preferred <400 msec limit Note 1	< 1 msec	< 3% FER
Video	Videophone	Two-way	32-384 kb/s	< 150 msec preferred <400 msec limit Lip-synch : < 100 msec		< 1% FER
Data	Telemetry - two-way control	Two-way	<28.8 kb/s	< 250 msec	N.A	Zero
Data	realtime games	Two-way	< 60 kb/s Note 2	< 75 msec preferred	N.A	< 3% FER preferred, < 5% FER limit Note 2
Data	Telnet	Two-way (asymmetric)	< 1 kB	< 250 msec	N.A	Zero

[7] Notes: The overall one way delay in the mobile network (from UE to PLMN border) is approximately 100msec. These values are considered the most demanding ones with respect to delay requirements (e.g. supporting First Person Shooter games). Other types of games may require higher or lower data rates and more or less information loss but can tolerate longer end-to-end delay

Table A1(b)**N End-user Performance Expectations - Interactive Services (3GPP 2006)**

Medium	Application	Degree of symmetry	Data rate	Key performance parameters and target values		
				One-way Delay	Delay Variation	Information loss
Audio	Voice messaging	Primarily one-way	4-13 kb/s	< 1 sec for playback < 2 sec for record	< 1 msec	< 3% FER
Data	Web-browsing - HTML	Primarily one-way		< 4 sec /page	N.A	Zero
Data	Transaction services – high priority e.g. e-commerce, ATM	Two-way		< 4 sec	N.A	Zero
Data	E-mail (server access)	Primarily One-way		< 4 sec	N.A	Zero

Table A1(c): **End-user Performance Expectations - Streaming Services**

Medium	**Application**	**Degree of symme-try**	**Data rate**	**Key performance parameters and target values**		
				Start-up Delay	Transpor t delay Variation	Packet loss at session layer
Audio	Speech, mixed speech and music, medium and high quality music	Primarily one-way	5-128 kb/s	< 10 sec	< 2sec	< 1% Packet loss ratio
Video	Movie clips, surveillance, real-time video	Primarily one-way	20-384 kb/s	< 10 sec	<2 sec	< 2% Packet loss ratio
Data	Bulk data transfer/retrieval, layout and synchronisation information	Primarily one-way	< 384 kb/s	< 10 sec	N.A	Zero
Data	Still image	Primarily one-way		< 10 sec	N.A	Zero

8 Appendix 2 Mobile Operators in Latin America and the Caribbean

Country	Operators
Antigua and Barbuda	APUA, bmobile[8], Digicel
Argentina	Movistar, CTI Movil, Personal, NEXTEL
Aruba	Digicel, SETAR
Bahamas	BTC
Barbados	Bmobile, Digicel, Sunbeach
Belize	Digicel, Smart
Bermuda	M3, Digicel
Bolivia	Entel, Tigo, Nuevatel
Brazil	Vivo, TIM, Claro, Oi, Telemig Cellular/Amazonia Cellular, Brasil Telecom, NEXTEL, CTBC
Chile	movistar, Entel, Claro
Columbia	Comcel, movistar, Tigo
Costa Rica	Groupo Ice
Cuba	Cubacel, C-COM
Dominica	Digicel
Dominican Republic	Orange, Verizon Dominican
Ecuador	Porta, movistar, Alegra
El Salvador	Claro, Tigo, movistar, Digicel, RED
French Guyana	Digicel
Grenada	bmobile, Digicel, Cingular Wireless
Guadeloupe	Bouygues Telecom Caraïbe, Orange Caraïbe
Guatemala	Claro, Tigo, movistar
Guyana	CelStar, Cellink Plus, Digicel
Haiti	Comcel, Digicel
Honduras	Tigo, Claro, HONDUTEL
Jamaica	Digicel, bmobile, MiPhone
Martinique	Bouygues Telecom Caraïbe, Orange Caraïbe
Mexico	Telcel, movistar, Iusacell / Unefón, NEXTEL
Nicaragua	Claro, movistar
Panama	Cable & Wireless, movistar
Paraguay	Tigo, Personal (Núcleo SA), CTI Móvil, VOX
Peru	movistar, Claro, NEXTEL
Puerto Rico	Verizon Wireless, Cingular, Centennial, Suncom, MoviStar, Sprint
St. Kitts and Nevis	Digicel
St. Lucia	Digicel
St. Vincent & the Grenadines	Digicel
Suriname	Telesur, Digicel, Intelsur
Trinidad and Tobago	bmobile, Digicel, Laqtel
Uraguay	Ancel, movistar, CTI Móvil
Venezuela	movistar, Movilnet, Digitel

[8] bMobile is Cable and Wireless' branding for their mobile service

9 Appendix 3 Baseline Mobile Technologies Employed by Operators in LAC

Country	Operator	Mobile Technology
Antigua and Barbuda	APUA	GSM
	bmobile[9]	GSM
	Digicel	GSM
Argentina	movistar	GSM, CDMA
	CTI Movil	EDGE, GPRS, GSM,
	Personal	GSM
	NEXTEL	iDEN
Aruba	Digicel	GSM
	SETAR	GSM
Bahamas	BTC	GSM
Barbados	bmobile	GSM
	Digicel	GSM
	Sunbeach	CDMA
Belize	Digicel	GSM
	Smart	CDMA
Bermuda	M3	GSM
	Digicel	GSM, CDMA
Bolivia	Entel	GSM
	Tigo	GSM
	Nuevatel	GSM
Brazil	Vivo	CDMA, TDMA, GSM
	TIM	GSM, TDMA
	Claro	EDGE, GPRS, GSM, TDMA
	Oi	GSM
	Telemig Cellular/Amazonia Cellular	GSM, TDMA
	Brasil Telecom	GSM
	NEXTEL	iDEN
	CTBC	GSM, TDMA
Chile	movistar	GSM, CDMA, TDMA
	Entel	GSM
	Claro	GSM, CDMA
Columbia	Comcel	EDGE, GPRS, GSM, TDMA
	movistar	GSM, CDMA, TDMA
	Ola To be rebranded Tigo in 1Q07	GSM
Costa Rica	Groupo Ice	GSM
Cuba	Cubacel	AMPS, GSM
	C-COM	GSM

[9] bMobile is Cable and Wireless' branding for their mobile service

Dominica	Digicel	GSM
Dominican Republic	Orange	GSM
	Verizon Dominican	GSM
Ecuador	Porta	EDGE, GPRS, GSM, TDMA
	movistar	GSM, CDMA, TDMA
	Alegra	CDMA2000 1x, CDMA
El Salvador	Claro	GSM
	Tigo	GSM, TDMA
	movistar	GSM, CDMA
	Digicel	GSM
	RED	iDEN
French Guyana	Digicel	GSM
Grenada	bmobile	GSM
	Digicel	GSM
	Cingular Wireless	GSM
Guadeloupe	Bouygues Telecom Caraïbe	GSM
	Orange Caraïbe	GSM
Guatemala	Claro	GPRS, GSM, CDMA
	Tigo	EDGE, GPRS, GSM, TDMA
	movistar	GPRS, GSM, CDMA 1x EV-DO
Guyana	CelStar	GSM
	Cellink Plus	GSM
	Digicel	GSM
Haiti	Comcel	GSM
	Digicel	GSM
Honduras	Tigo	GSM
	Claro	GPRS, GSM
	HONDUTEL	GSM
Jamaica	Digicel	GPRS, GSM
	bmobile	GPRS, GSM
	MiPhone	CDMA
Martinique	Bouygues Telecom Caraïbe	GSM
	Orange Caraïbe	GSM
Mexico	Telcel	EDGE, GPRS, GSM, TDMA
	movistar	GSM, CDMA
	Iusacell pending merger with Unefón	CDMA
	NEXTEL	iDEN
	Unefón pending merger with Iusacell	CDMA
Nicaragua	Claro	GPRS, GSM
	movistar	GSM, CDMA
Panama	Cable & Wireless	GSM
	movistar	GSM, CDMA

Paraguay	Tigo	GSM, TDMA
	Personal (Núcleo SA)	GSM, TDMA
	CTI Móvil	GSM
	VOX	GSM
Peru	movistar	CDMA, TDMA
	Claro	EDGE, GPRS, GSM
	NEXTEL	iDEN
Puerto Rico	Verizon Wireless	CDMA
	Cingular	GSM
	Centennial	CDMA
	Suncom	GSM
	MoviStar	CDMA
	Sprint	CDMA
St. Kitts and Nevis	Digicel	GPRS, GSM
St. Lucia	Digicel	GPRS, GSM
St. Vincent & the Grenadines	Digicel	GPRS, GSM
Suriname	Telesur	GSM
	Digicel	GSM
	Intelsur	GSM
Trinidad and Tobago	bmobile	TDMA, GSM
	Digicel	GSM
	Laqtel	CDMA
Uraguay	Ancel	GSM
	movistar	GSM
	CTI Móvil	GPRS, GSM
Venezuela	movistar	CDMA
	Movilnet	CDMA, TDMA
	Digitel	GSM

10 Appendix 4 Example Projects undertaken in the Caribbean and Central America

Location & Year	Type of eGov System	Success or Failure	Description of Outcome
Caribbean 2002	Operational support system – automated radio play and billing system; state radio station	Success	System assists with selection and playing of commercials and music; creates automated logs and billing for commercials; and generates statistical reports as intended; system is incompatible with subsequently-installed government-wide accounting system, required duplicate billing.
Caribbean 2002	Decision support system – budget preparation system, Ministry of Finance	Partial Failure	Has enabled budget to be delivered in a timely manner and is seen as a success by developers and politicians; but seen as inadequate by users: updating of figures is not automated and, after three years of development work, cash management component is still unused because it fails to meet local needs; system also over-ran budget by 50%/US$10m.
Caribbean 2002	Basic data system – handling customs data; Customs department	Success	Cut time for customs processing, reduced cost, increased revenue and generates trade statistics used in policy formulation; clerical staff who were redeployed or lost overtime because of the system are unhappy, as are staff who lost opportunities for private income gain.
Caribbean 2002	Management information system – student performance reporting system; state high school	Partial Failure	IT component of system works as intended, so those who commissioned the system see it as successful, but system has failed to address a key purpose of getting more students and parents to be aware of, and take action on, their performance: c.half of students are unaware of their performance rating, especially for gradings on effort and behaviour.
Caribbean 2002	Basic data system – planning application tracking system; Planning Department	Partial Failure	System has reduced time to retrieve information to answer queries from over half-an-hour to c.5 minutes, allows equitable distribution of staff workloads, and reports on employee performance; but goal was to get information in roughly one minute, and some file data is not regularly updated, causing important inaccuracies in the system.

Caribbean 2002	Functional information system – health accounting and budget; Ministry of Health	Partial Failure	Accounts payable component works, accounts receivable component does not work fully; middle-level staff do get most information they need; senior managers feel it has failed to meet their reporting and statistical needs; problems have arisen partly due to use of foreign consultant who, because of short time frame, was unable to meet local staff to get specification of needs.
Caribbean 2002	Document management system – file tracking system; Registry, Ministry of Finance	Partial Failure	Technically does all it should: holds scanned, indexed images of all relevant documentation; but intended for use by all MoF officers yet used by only a tiny handful outside the Registry itself: great majority of staff send all requests via Registry. IS developers see system as a success and blame Ministry staff for problems.
Caribbean 2002	Management information system – human resource management; Ministry of Planning	Partial Failure	Does not provide all of the services it was supposed to; for example, it produces salary schedules but not job classification schedules or calculations of leave entitlement; also suffers from technical problems.
Caribbean 2002	Decision support system – debt management system; Ministry of Finance	Partial Failure	Allows accurate projections for debt servicing and evaluation of reserves and borrowings; but two of five main reports have to be undertaken manually, and cannot deal with fact that debt is issued in foreign currency.
Caribbean 2002	Basic data system – online national register; Registrars Department	Total Failure	System is unused except by a very small percentage of potential clients. Has failed to improve response times or free up staff time.
Caribbean 2002	Management information system – expenditure monitoring and control; Ministry of Finance	Partial Failure	Budget/audit reports are produced on time and used by managers; but format of reports is more limited than in manual system; some key elements of budget are 'off-system' and have to be incorporated manually; system has been very high cost; there are delays in producing reports.
Caribbean 2002	Decision support system – budget preparation system, Ministry of Finance	Partial Failure	Has reduced time for calculations, and produces some useful information for budget decisions; is claimed as a success by vendor and politicians. But, time spent generating information has actually increased over manual system, partly due to poor interface design, partly due to lack of staff training.

Caribbean 2001	Basic data system – planning application tracking system, Planning Department	Success	Tracks applications as required, though some users still sceptical of its utility.
Central America 2001	Functional information system – budgeting and accounting; municipal government	Partial Failure	System works at an operational level, recording budget lines and expenditure and producing reports, but has been of little value in supporting decision making because staff lack budgeting skills and because budgeting is a heavily-politicised, centrally-controlled process.
Central America 2000	Management information system – community investment project management system, Central Fund Organisation	Success	Judged successful by donor, by central government, and by most communities. Has enabled improved targeting of poor communities; rapid reorientation in times of national emergency; and ongoing fund monitoring. But, has failed to achieve additional objectives of improved inter-ministerial coordination, or of community involvement.

(*Source: Heeks 2003b*)

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