Development Informatics

Working Paper Series

The Development Informatics working paper series discusses the broad issues surrounding information, knowledge, information systems, and information and communication technologies in the process of socio-economic development

Paper No. 48

Understanding Mobile Phone Impact on Livelihoods in Developing Countries: *A New Research Framework*

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2012

NOTE:
A revised and updated version of this Working Paper has been accepted for publication in *Development Policy Review*:
http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1467-7679

ISBN: 978-1-905469-17-8

Published by: ***Centre for Development Informatics***
Institute for Development Policy and Management, SED
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http://www.sed.manchester.ac.uk/idpm/research/publications/wp/di/index.htm

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Abstract

Mobile phones are diffusing rapidly in developing countries, but research conceptualisations have been lagging behind practice, particularly those that link mobile phones to livelihoods. This working paper seeks to fill this gap in two ways.

First, by means of a literature review that uses key livelihoods concepts as a template for analysis. It starts by analysing mobile phones according to how they impact upon assets – through facilitating asset substitution, enhancement, combination, exchange and forms of dis-embodiment. The analysis also incorporates an understanding of the intervening structures and processes that intermediate assets through passive diffusion and active innovation of mobile technologies. On this basis key roles for mobile phones are defined within livelihood strategies.

The second part of the paper revisits the livelihood framework and suggests a number of adaptations that: a) integrate a broader conception of capitals; b) emphasise underlying information processes within livelihoods analysis; c) interpret forms of intermediation; and d) delineate outputs, outcomes and impacts. Finally, the paper suggests areas of research concerning mobile phones and livelihoods where the revised framework can be applied.

Introduction

One of the most significant development trends in the past decade has been the explosive growth of mobile phones. Mobile cellular technologies have enabled even the poorest countries to extend telecommunication network coverage to the mass of their populations including the rural poor.[i] A number of recent reviews of practice have revealed widespread application of mobile phones in support of livelihoods in rural and less-developed regions of developing countries. Reviews from South Asia (De Silva, 2008) and sub-Saharan Africa (Donner, 2009; Gakuru et al, 2009; Munyua, 2008) identify mobile phones as a key innovative technology in support of livelihoods, with evidence of growing integration into agricultural-extension, information provision and marketing systems. Mobile phones in support of livelihoods are not restricted to agriculture, but include new forms of micro-financial service provision and micro-enterprise support, and data gathering and dissemination for projects concerned with social development covering education, health, the environment and humanitarian relief in response to disasters and emergencies.[ii] Mobile phones are also being used extensively for advocacy and campaigning on livelihood-centred development issues (Hellstrom, 2010; Kinclade & Verclas, 2008).

There is a sense that the practical application of mobile phones in support of livelihoods is expanding rapidly, but conceptualisation of the interrelationship between mobile phones and livelihoods is lagging behind. The problem of rapid implementation of new information and communication technologies (ICTs) often on the basis of little understanding of their development impact has been raised by Heeks (2007:1). He states… "there has been a bias to action, not a bias to knowledge. We are changing the world without interpreting or understanding it". Thus, whilst it is assumed that mobile phones provide a new and innovative tool in the support of the livelihoods of the poor, there is lack of understanding of the interrelationships between the technological artefact and socio-economic development processes, as well as assessment of the outcomes that arise from its use. The sustainable

livelihoods framework provides a starting point whereby those interrelationships can be explored.

This paper seeks to address this gap in understanding of mobile phones and livelihoods in two ways. The first two sections of the paper review existing evidence about the use and impact of mobile phones in developing countries using the key components of the livelihood framework as a template for analysis. First, by identifying points of intersection between use of mobile phones and livelihood assets within diverse vulnerability contexts; second, by illustrating how processes of intermediation impact upon the ability of the poor to mobilise assets through use of mobile phones, demonstrating areas of contribution to livelihood strategies. The second part of the paper suggests ways in which livelihoods analysis needs to be adapted to take account of the impact of mobile phones and suggests how this revised approach can be integrated into a framework for researching mobile phones and the diversification of livelihoods, outlining key research issues of framework adaptation and application.

A. Mobile Phones and Livelihood Assets

Livelihoods analysis places emphasis on the potential of interventions to facilitate measurable changes in asset status (Ellis & Bahiigwa, 2003; Ellis, 2000). Within a context of vulnerability, assets play a vital role in determining the range and combination of choices that people have, and are expressed in terms of five types of capital – human (skills, knowledge, health, ability to work); natural (land, forests, water, etc); financial (income, monetary and non-monetary savings e.g., livestock); physical (tools, transport, housing, water, energy, etc); and social (networks, group membership, relationships and trust) (Carney et al, 1999; DfID, 1999). In relation to mobile phone use and impact, assets can be conceptualised in four main ways.

A.1. Assets Substitution

In the first instance, mobile phones are tools that facilitate direct substitution of assets. For example, there is widespread evidence of substitution between expenditure on mobile phone airtime and transportation costs. Research suggests this has beneficial outcomes, demonstrating that better communication via mobile networks leads to a reduction in the frequency of journeys and the time and expense afforded to travel, with an additional key benefit of enhancing the ability of poor communities to respond more quickly to emergencies (Mutu & Yamano, 2009; Aker, 2008; Jensen, 2007; Overa, 2006). Further benefits are demonstrated due to time saving, and the ability to reallocate saved time to other activities, such as the case where a cattle herder no longer needs to leave the herd to report a sick animal (Kithuka et al, 2007). Use of mobile phones also substitutes more indirectly for assets. A household study by Diga (2007) conducted in the Wakiso District of Uganda found that women were willing to forgo (or substitute) store-bought items in order to purchase mobile phones and credits, and in many cases this was undertaken to help strengthen longer-term asset accumulation strategies focused on micro-enterprise. However re-allocation of resources and the diverting of expenditure within limited household budgets also give rise to opportunity costs and negative impacts (May, 2010). Overall, however, there is lack of empirical data and research concerning how the poor absorb the costs of mobile phones, and uncertainty about possible negative outcomes associated with the reallocation of cash resources such as between male and female household members.

A.2. Asset Enhancement

Enhancement can be understood in terms of greater efficiency in the use of scarce resources. A study from Sife et al (2010) reports that four fifths of a sample of households in Morogoro, Tanzania experienced improved or greatly improved efficiencies in the conduct of social and productive activities, due to mobile phones, particularly when the costs associated with communication over large geographical distances were reduced. Peer-reviewed studies have pointed towards greater efficiencies in information search (Acker, 2008; De Silva, 2008) and in the

coordination of multi-level local activities in agricultural value chains that are geographically extensive and organisationally complex (Overa, 2006). Thus, greater efficiency of productive activity creates potential for better financial returns. Enhancement of forms of human and social capital is also evident. Coleman (1994:304) suggests that "human capital is created by changing persons so as to give them skills and capabilities that make them able to act in new ways". Castells et al (2008) observe this in the manner that local language expressions and conventions have been combined with other languages (such as English) and embodied in mobile phone use through local software adaptation. The language of mobile phones (short message services; use of codes; shortened forms; visual tools, etc) requires new skills as well as cultural and language reorientation on behalf of the user. Development of the capabilities for effective use of a mobile phone also leads to enhancement of social capital. This can be understood in terms of how social assets become disembodied.

A.3. Asset Disembodiment

The mobile phone can be viewed as tool that can disembody assets which then become represented in particular software designs, network architectures, organisational forms and patterns of usage. Thus, social contact information that may have previously been held in the memory, or recorded informally in an ad-hoc manner, becomes codified, recorded, formalised and potentially shared. Mobile phones can securely contain social capital resources – by means of contact lists and call histories. Through these contact lists users have the ability to connect into geographically dispersed networks such as with family and friends, market traders or local associations (e.g., church groups, savings or loans clubs). Research conducted by Horst & Miller (2006) amongst the poor in Jamaica suggests that mobile phone contact lists are used to establish extensive networks that become an important part of their coping strategies – enabling quick connection into networks for advice, support or direct assistance. Goodman (2007:63) from research conducted in Tanzania and South Africa shows how contact lists span both strong and weak social ties. "Mobile

phones were being used to mediate both strong links (with family, close friends and others in the community), essential for maintaining support networks, and weak links (others outside the community), businessmen, tradesmen, doctors, teachers and police), providing access to information and possible social and economic opportunities".

A.4. Asset Exchange and Combination

Cases demonstrate how mobile airtime is being used as a cash-substitute and thus as a means of financial exchange (e.g., for payment of school fees or for purchase of consumption goods in the market), or to facilitate small savings or remittances (Burrell & Matovu, 2008; Chipchase, 2009). This is an area of application where mobile phones are expanding most rapidly – increasingly through provision of formal mobile transfer services such as M-PESA where virtual money can be reconverted to real cash through networks of agents.[iii] Such services can also provide access to basic accounts from which transactions can be conducted. CGAP (2008) highlight this in two respects: first, the ability to enter, display, process, store and transmit information concerning finance; second, the ability to store, convert and transfer monetary value and enable transactions or payments – recognising the particular functionality of the SIM card – which is essentially a smart card that is embedded within a communication device with built-in security features that make it particularly suited to payment applications.[iv] In the growing arena of mobile money applications there is indication that mobile phone use serves to combine forms of capital, by providing access to financial capital at the same time as extending networks of communication either formally through agents or informally personal remittances (thus building social capital) and enhancing financial literacy (thus building human capital).[v]

The livelihood impacts associated with substitution, enhancement, exchange, combination and disembodiment – are realised at the micro-level where the user directly interacts with the communication device. However, livelihood analysis suggests that changes in asset holdings are mediated through forms of agency –

intermediation that shapes access to resources and which influences the choices that poor people have. This perspective is dealt with in the following section.

B. Intermediation of Assets

Heeks (2008) identifies the mobile phone revolution as part of a phase shift from ICT4D1.0 to ICT4D2.0 – which comprises "new technologies, new approaches to innovation, new intellectual integration, and above all, a new view of the world's poor". Processes of innovation are identified as twofold. In the first case, adoption of mobile phones is due to 'passive diffusion' driven by "a combination of a private firms' search for profits plus the poor's search for value" (Heeks, 2008:29). The most successful mobile phone applications – that have been scaled – have tended to conform to this market-driven model such as M-PESA: the mobile payments service operated by Safaricom in Kenya, which since its inception in 2007 has achieved significant penetration into segments of the population previously excluded from any form of financial service provision.[vi] However, most mobile-based livelihood services have not achieved scale, and are localised or at the pilot or proof of concept stage (Donner, 2009). The delivery of these services has required 'active innovation' – pursued by community-based organisations (CBOs) with donor support and in partnership with the mobile phone industry. This distinction is useful for understanding intermediation processes.

B.1. Processes of Passive Diffusion

Passive diffusion places emphasis on the effectiveness and responsiveness of market-based institutions and mobile service delivery organisations. In this respect, mobile phone network providers (and the broader telecommunications industry) exert a primary influence. To date, the economies of scale afforded through sector growth and competition due to liberalisation of telecommunications provision have led to falling costs, including that of handsets and call/text charges, which together with pre-paid service plans and low denomination airtime units have made mobile services more accessible and affordable (UNCTAD, 2010). However, and notwithstanding

falling costs over time, there has been weak motivation from mobile operators to tailor market-driven services to the needs of the poor. Growth in mobile phones in developing countries has been stimulated predominantly by better-off, better-educated, urban-based users. This is demonstrated in Kenya where, in 2006, 7% of those classified as poor were mobile phone owners compared with 42% of the non-poor. These figures had risen to 21.6% and 64.6% respectively in 2009, where the poor were defined as individuals in the bottom two wealth quintiles of an assets index (Aker & Mbiti, 2010).

Emergent technologies are likely to create further divides. In areas such as smart phones, 3G networks and mobile Internet access, patterns of innovation and application design also favour better-off users who are early adopters (Southwood, 2010). However, there are opportunities for innovative lower cost technological solutions, such as Voice over Internet Protocol (VoIP) which through services such as SMILE is able to prescribe a mobile number without the need to own a handset. Potentially, this can create very low cost communication, but usage is currently restricted by the ability of the user to locate an access point.[vii] Thus, the way in which the industry innovates – from the design of mobile devices, to the applications and services offered, and the business and charging models employed – will continue to play a key role in determining access for the poor.

The private sector also plays an important role in provision of support services and the form of consumer education which is necessary to overcome the many additional access and usage constraints that the poor face. These relate to the provision of physical capital resources such as for phone charging, the purchase of airtime or through the availability of agents to provide SIM card registration or points of access for value added services (such as for money transfer or SMILE). Also necessary are human capital resources that enable poor clients (who may lack e-literacy and attendant knowledge) to understand registration and privacy issues (such as awareness of the role of the SIM card in embedding personal information, passwords, contact lists or credit balances). Services also need to be backed up with requisite customer

care that can sustain their use by providing support and troubleshooting – and which are available in appropriate languages. There is evidence to suggest considerable difficulties for poor users in interacting with such formal support services, which in any case, tend to be poorly provisioned in developing countries (Duncombe & Boateng, 2009).

Because many of the poor (and certainly the poorest) cannot yet afford to own a mobile phone, most rely on public or shared access through market re-sellers, agents, community-based organisations or family and friends. For this reason – and due to lack of formal provision – a layer of (largely informal) market intermediaries also play an important role in delivering services. There is little evidence from the literature concerning their impact on livelihoods. Evidence from Hellstrom (2010) and from the operation of M-PESA (Jack & Suri, 2009) suggests that the presence of chains of re-sellers of mobile credits or other value added services reaching into rural and poor communities tends to increase the costs of access given the need for successive margins to be earned and the attendant overheads. However, informal intermediaries also play a critical role in overcoming informal access barriers, given that they are close to poor clients and able to understand their requirements, as well as being able to provide personal support in overcoming the constraints (including language) of consumer education previously outlined.

Other inequalities of access and use are also observed when support networks become mobile-centric. Research conducted in Zambia by Abraham (2009) identifies a 'virtual mobile divide' within women's groups that utilise mobile networking. In the first instance this is represented as a broader digital divide between those who are able to afford and access mobile and those who are not. The study also found that even amongst mobile users, those with power and access to resources were more likely to form part of the active contact network, whilst those women on low incomes became excluded. "Only women with talk time (call units) will be privileged members of the mobile community, with the ability to initiate conversations and the power to choose when to communicate. Those with no call units may be included at the discretion of

those who have them… they become silent listeners and simple recipients of texts and alerts from more financially empowered members" (Abraham, 2009:2-3). A further cultural constraint is identified by Wakunuma (2006) and concerns the private nature of disembodied social capital. Suspicion of saved data was reported to have been responsible for gender-based conflict resulting from mistrust over who the partner (in this case the woman) was contacting, raising issues of ownership of communication resources and how they are controlled and shared within households and communities.

B.2. Processes of Active Innovation

Passive diffusion has expanded access and reduced the costs of access and use of mobile phones, but within the structure of the market there remain significant inequalities. Thus, active innovation in favour of the excluded has been a feature of market development to date, involving collaboration between mobile service providers and CBOs. An example project is 'Collecting and Exchange of Local Agricultural Content' (CELAC) in Uganda which makes use of a mobile short message service (SMS) to facilitate access to markets and share farming good practice.[viii] Gakuru et al (2009) categorise such projects as fourfold: a) voice information delivery services – telephony services that provide advice on farming methods and access to markets to farmers along the lines of a call centre; b) radio – including dial-up and regular radio broadcasts providing transmutable information; c) extension services based on the mobile phone together with database monitoring – using tracking and profiling methods to provide market information as well as some transactional and brokerage services; d) e-learning for skills development and agricultural education using multi-media (predominantly video) content.

These types of projects are able to tailor mobile phone use more closely to the needs of the poor. As Gakuru et al (2009:21) recognise such projects are able to leverage the benefits of converged technologies. "When the back end of the farmer information system contains a call centre, the farmer information system can

implement farmer's feedback to be used for localisation and respond to specific farmers requirements such as language and specific products. The SMS platform can be used for alerts, targeted to provide farmers with specific information, thereby creating demand." This emphasises two key points. First, the importance of being able to integrate mobile phone initiatives at the intermediary level in a manner that is able to combine forms of capital. For example, the cattle farmer is more likely to be able to access both reliable information and actionable resources (such as specific personal assistance or suitable remedies) from a local veterinary service rather than from a distant or non-specialist provider of information.[ix] Therefore, information delivered via mobile phones is thought likely to be more effective when integrated within a broader range of services offered by development agencies or other sector-based service providers. Second, new ICT (and specifically mobile phone networks because of the extent of connectivity) can be effective tools for information provision, but they are equally, if not more important for providing information about the poor. Thus, within CELAC, poor farmers themselves can upload agricultural guidance and tips to the database to share with others, as well as communicate directly with other farmers in the network via their phones.

Research suggests that such information-centred approaches translate into greater market access, addressing the limitations of informal information systems through innovation in mobile phone applications and greater packaging of information resources for micro-enterprise (Donner, 2009; De Silva, 2008). More integrated systems use mobile phones to interface with web-based commodities exchanges offering product and price information directly to producers. An example is the Livestock Information Network Knowledge System (LINKS) that provides price and sales volume data for cattle, as well as climatic information, in Kenya, Ethiopia and Tanzania.[x] Formal systems offer advantages of scale and can absorb and distribute the financial and time costs associated with information search that might otherwise fall on individual producers (Donner, 2009). Thus, packaged information (concerning market prices, weather reports, health and agricultural advice, etc) can provide a more complete and reliable alternative to informal sourcing. Additionally, greater

information search, marketing (and transactional) benefits are attainable for micro-enterprise on a larger scale through participation in more comprehensive and scaled e-market places (Donner and Escobari, 2009; Donner, 2009). Platforms such as the Kenya Agricultural Commodity Exchange (KACE)[xi] and CellBazaar[xii] are able to coordinate information flows throughout the value chain – rather than just provide discrete pieces of information – such as solely market prices (Boadi et al., 2007; David Benz et al., 2006). By using various technologies, dedicated systems are able to provide a full information service to specific sectors (covering quality requirements, inventory levels, market prices, etc.) across a range of produce categories. This may confer additional benefits as all supply chain actors (individual farmers, producer groups, traders, final buyers/processors and wholesalers/exporters) can access a common rural information management system.

These approaches to active innovation illustrate how mobile phones and their attendant networks are increasingly acting as tools to facilitate intermediation within project-based initiatives. The way in which assets can be mobilised is stimulated by the range of innovative processes that such institutions/agents enact. In turn, these influence the way in which the poor are able to act to incorporate mobile phone usage into a diverse range of livelihood strategies.

C. Mobile Phones in Livelihood Strategies

Livelihood strategies are the range and combination of activities and choices that people undertake in order to address their vulnerability. Doward et al (2009) define livelihood strategies according to three complementary processes. First, the struggle to maintain existing livelihoods and levels of welfare often in the face of adversity and vulnerability; second, expansion or deepening of existing activities through investment such as to increase production or diversify assets; third, to use existing activities as a launch pad to move into different or new activities – such as micro-enterprise. This schema contains within it an explicit recognition of "the dynamic aspirations of poor people; of diversity between different people adopting different

strategies, and of diversification by people undertaking a variety of activities, as they mix their strategies in pursuit of those activities" (Doward et al, 2009: 243).

This emphasises that the key primary actors in addressing vulnerability are the poor themselves, and in this respect the mobile phone should be viewed as a tool (akin to a plough or hoe) with the advantage that it can be placed directly into the hands of the poor. As demonstrated previously, this potentially has direct impact, through processes of substitution, enhancement, exchange, combination and disembodiment of assets. Mobiles phones also impact indirectly, through the ability of the poor to 'link-up' and interact with a range of informal and formal networked intermediaries. This gives rise to active innovation in terms of a range of functionalities and diverse roles that mobile phones can play in the support of livelihood strategies which can be surveyed using the schema outlined.

C.1. Maintaining Existing Livelihoods and Mitigating Vulnerability

A large body of research from developing countries suggests that the major impact of mobile phones has been to expand private communication within personal and social networks which has been shown to have widespread benefits both for maintaining existing forms of livelihood and mitigating vulnerability. A three-country study (Souter et al, 2007) conducted in India, Mozambique and Tanzania found that mobile phones were extensively used in poor communities to maintain social (particularly family) networks, and were considered essential for responding quickly to emergencies. Over 80 percent of respondents from another Tanzanian study (Samuel et al, 2007) stated that use of mobile phones had improved family relationships, made communication easier, as well as reducing the need to travel long distances to communicate with relatives. Horst & Miller (2005) highlighted the importance of mobile in supporting social networks amongst poor women in Jamaica, and the role they play in building coping strategies.

As well as supporting informal social networks, mobile provides a tool for the collection of data (such as with personal digital assistants – PDAs) which together

with community radio, provide a new means to speed up the communication of the outcomes of analysis of data to those who can act upon it (Kinkade & Verclas, 2008). These are the 'link-up' strategies that support empowerment, social and political participation. For the mobile phone this may also be pertinent, as the impact of the use of mobile on political capital (through the phone's ability to connect and empower) may be deemed of equal importance to its use as a functional economic tool. There is growing evidence of this from practitioners in the field with mobile supporting information flows in areas of social development with packaged information (public service announcements, government information concerning taxes or land tenure, health advice, etc) providing the core of the service.[xiii] In this way mobile devices can be used to aid the monitoring and assessment of vulnerability factors, particularly those related to health and sanitation, climatic conditions, disaster preparedness or environmental assessment, such as earthquakes and flooding.[xiv] In the latter case, *Info*dev (2008) suggest that although national systems of early warning may function, the ability to broadcast warnings at the local level is neglected – but with phones serving to fill this gap.

C.2. Expansion and Enhancement of Existing Activities

African studies carried out by Sife et al (2010), Jagun et al (2008), Molony (2007) and Overa (2006) demonstrate that users of mobile phones are able to enhance (or make more productive use of) their pre-existing social and economic networks. Research suggests that the poor get their most valued market information via word of mouth, and the diffusion of mobile phones is playing a key role in extending these organic informal networks (Donner, 2006; Duncombe & Heeks, 2002). In this way, passive diffusion is increasing the efficiency of underlying market-related information processes. This is demonstrated by studies from the field of information economics that show conclusively how use of phones within local markets by producers and traders leads to a higher degree of market participation, as well as reduced search costs and a lessening in price dispersion (Mutu & Yamano, 2009; Aker, 2008; Jensen, 2007). The highly cited work of Jensen (2007) demonstrates reduced information blockages and asymmetries within the trading and consumer networks of fishing

communities in Kerala, reducing risk and uncertainty in the planning and coordination of fishing activities. With their phones, fishermen exchanged information about catch volumes and beach market prices at various locations, reducing information search costs for the best available market and prices for their products.[xv] More importantly, this research also demonstrates how these informational improvements can lead to a lessening in vulnerability. Aker (2008:1) in a quantitative study of impact of mobile communications on grain markets in Niger suggests that "cell phones improved consumer and trader welfare in Niger, perhaps averting an even worse outcome during the 2005 food crisis", whilst Jensen (2007:879) demonstrates an increase in both "producer and consumer welfare" in the South Indian fisheries sector.

Market-driven mobile payment services are also providing potential for poor communities to benefit from faster and more secure financial transactions (Duncombe & Boateng, 2009; Heyer & Mas, 2009; Jack & Suri, 2009). Infrastructure and service platforms are sufficiently scaled (e.g., through Globe Telecom's GCash in the Philippines, Wizzit in South Africa, and Safaricom's M-PESA in Kenya) to enable small farmers to receive money or to make payments, with the potential for the unbanked in poor communities to access formal banking services.[xvi] The specific functionalities associated with the use of mobile phones (i.e., their ability to handle monetary transfers of small denominations incorporating low transaction costs) are particularly suitable for low income users. They also put control and decision-making in the hands of users, who are able to enter, display, process, store and transmit personalised financial data, and to convert and transfer monetary value. Building upon m-payments are new mobile innovations for providing micro-insurance and facilitating social cash transfers. Micro-insurance can be used to protect against susceptibility to weather, price variability and health risks, and the ability of m-payment systems to reduce transaction costs could be an important factor for enhancing the reach and sustainability of such programmes. For social cash transfers, there are already examples of mobile payment systems assisting in the delivery of cash payments in Lesotho (Vincent and Freeland, 2008) and Kenya (Brewin, 2008)

and just as for financial remittances, the potential is considered to be large for national systems that have potential to be scaled (Devereux & Vincent, 2010).

C.3. Diversification into New Activities

Prowse (2008) suggests that 'sustainable' livelihoods, should build upon the productive capacity of the poor (rather than on their ability to consume). A significant amount of research has now been conducted which demonstrates an essential role for mobile phones in productive activity through micro-enterprise – both in urban and rural settings. A review by Donner & Escobari (2009) of fourteen such studies concludes that mobile phones are becoming key tools for communication, linking buyers and sellers within supply chains, as well as supporting access to market and other information. Through passive diffusion, mobile phones are increasingly becoming embedded into informal micro-enterprise networks such as for the self employed – taxi-drivers, domestic and casual labourers (Rangaswamy, 2009). Impact on established enterprises is increasingly well researched, but there is also growing evidence that mobile phones are leading to the creation of new entrepreneurial activity or new forms of livelihood – thus supporting diversification strategies. The Grameen telephone ladies of Bangladesh provided early evidence of this (Aminuzzaman et al, 2003), although their increased numbers and the dramatic growth of individual ownership of phones has diminished their importance as re-sellers of services in the community (Shaffer, 2007). However, the rapid growth of the mobile industry, particularly in the poorest countries, has created a plethora of new employment and income earning opportunities. For example, in Uganda, by the end of 2007, 350,000 people were indirectly employed in the telecommunications sector which included thousands of new income-generating informal enterprise opportunities countrywide for small kiosk owners and individual hawkers offering airtime, back street adaptation and repair and other mobile-related services (Chipchase, 2009). Other examples witness income generated by novel uses of the mobile's data processing, recording or camera functions (e.g. musicians recording, sharing and selling their music) (Lugo & Sampson, 2008; Ilahiane & Sherry, 2008). Informal productive settings are also conducive to the enhancement and upgrading of human capital such as in India where

the knowledge and skills required in the operation and maintenance of mobile phones were observed to be acquired through informal training and interaction around mobile-based micro-enterprises and kiosks (Rangaswamy, 2009).

D. Framework Adaptation

The preceding two sections have surveyed the current literature on mobile phone use and impact using the livelihoods framework as a template for analysis. The review suggests that a livelihoods approach provides certain advantages for researching mobile phones in a development context. As Scoones (2009) recognises, it is an approach that brings disparate perspectives together, allows conversations over disciplinary boundaries and provides an institutional bridging function to link technologists to social scientists, providing not only an appropriate conceptual tool, but also a practical framework for action. The livelihoods perspective developed in this paper provides such a bridging function by avoiding over-emphasis on the technical and placing the (poor) user at the centre of the analysis of the mobile phone revolution. Whilst the livelihoods framework provides an all-embracing framework and a useful starting point for pursuing research in this area, certain deficiencies also need to be addressed, and these shortcomings serve to highlight four gaps in the framework that require adaptation in each case.

D.1. Specifying Forms of Capital

Historically, livelihoods analysis has tended to emphasise the agrarian or material (primarily economic) basis for capital formation, whilst a complexity of social assets have been packaged rather uncomfortably under the heading of social capital. In order to correct this imbalance in the way that capitals are specified, a three-fold approach to re-defining assets is proposed that encompasses a broader and more relevant spectrum (Fig 1). First, resource-based assets (RBA) – these include the existing categories of physical, financial and natural capital represented in the original livelihoods pentagon (DfID, 1999). They comprise 'tangible' assets (income / savings / livestock / land / tools, etc) that the poor have at their disposal. A second

categorisation can be termed network-based assets (NBA) – these comprise forms of social, political and cultural capital which tend to be 'intangible' – group membership, relationships, trust and reciprocity – and are fundamentally based on the ability to participate in socio-political and socio-economic networks. These forms of capital are less easy to define and measure but encompass fundamental societal bonding factors and networks of social support which are also critical for sustaining market relationships. There also needs to be emphasis on how the framework incorporates political capital – dealing with power, powerlessness and unequal social relations (Moore et al, 2001). Powerlessness and exclusion are likely to be felt most strongly by the extreme poor who lack the necessary resources for mobile phone access, whilst political capital also needs to be recognised as an important asset which can be mobilised through new communication technologies and networks (Kinclade & Verclas, 2008). A third category can be termed cognitive-based assets (CBA) – which comprise human and psychological capital – including local knowledge, capabilities, skills, perception, etc (Kleine, 2010). Psychological capital plays a role in prescribing the attitudes, norms and behaviours that govern perception of technology, as well as user acceptance and use of the mobile artefact (Venkatesh et al, 2003). In this respect, studies of mobile phones in developing countries have identified both psychological and cultural factors as significant barriers to adoption and effective use (Duncombe & Boateng, 2009).

D.2. Incorporating Information Processes

Information is the primary resource upon which mobile phones act. Historically, within livelihoods analysis, information has been seen as a rather static resource, which along with technology, is compartmentalised within physical assets. Mobile phones provide a new and distinct way to communicate information, but the quality and form of information communicated is critical. This relates to the extent to which information content is relevant to the needs of recipients (Infodev, 2008; Chapman, Slaymaker & Young, 2004; 2001). The content should be relevant to their context and aligned with their interests and the information source should embody a certain level

of trust, whilst recipients must have sufficient knowledge and understanding to be able to assimilate and assess the information provided (Duncombe & Heeks, 2002). Thus, information cannot be viewed as a neutral entity, nor can it be viewed as static. This is because information received verbally or as raw data (such as presented on a mobile interface) needs to be assessed and applied in some way to create usable information which can be acted upon to inform choices and decisions and consequent actions (or transactions). Additionally, this process requires further information chain resources (Heeks, 1999). These are both intrinsic (network and cognitive-based) assets including pre-existing knowledge and capabilities, and overt (resource-based) assets – the necessary infrastructure, technical and specialist expertise – that are required to make effective use of information received. In research from Uganda, Burrell & Matovu (2008:3) concur, suggesting that the "main challenge to providing information services to rural Ugandans rests on providing dependable accurate information that is 'actionable'. Whether information is actionable depends especially upon what capital and what social connections are required to make use of it". Thus, the adapted framework views information as a cross-cutting and dynamic resource that is required to access and enhance all forms of capital.

D.3. Understanding Structures and Processes

This paper has defined intermediation according to processes of passive diffusion and active innovation. These are, however, idealised constructs that require further interpretation. Implicit within the notion of passive diffusion of mobile phones are presumptions of optimal and unfettered workings of market forces. This is reflected in conventional policy prescriptions towards extending access which dictate that "the market is likely to fulfil a significant portion of the coverage gaps, particularly when pro-competitive policies are adopted" (UNCTAD, 2010:35). However, as Doward et al (2009) point out, markets most often fail the poor, and particularly those in most need. Thus, adoption and use of mobile phones cannot be focused exclusively around economic contingencies. Some of these (such as market liberalisation) have had an impoverishing effect on subsets of the population which include large proportions of the poor, women and other historically disadvantaged groups.

The key intervening agency that can re-balance these digital divides is that of national government. For example, government has the power to change the balance between facilitating ease of access (which favours the poor) and the need for more complex registration procedures that may make it more expensive and more complex to own and use a mobile phone SIM card. Government decides whether policies towards universal (or greater) access to mobile infrastructure are pursued through a lessening of regulation and taxation and greater competition or through expansion of universal access funds and cross-subsidisation.[xvii] Government controls the rate at which mobile devices and call rates are taxed and can thus influence market prices. In many developing countries high taxation environments keep overall charges of mobile phone services high, which have had a regressive effect for the poor and those on low incomes.[xviii] Government also plays a lead role in the broader policy arena which governs decisions over capital investment in new technologies and infrastructure, not only for new mobile phone technologies, such as 3rd generation networks and broadband, but also the complementary investments in the electrical and transport infrastructure that are required to attain the potential benefits offered by further expansion of mobile networks. It is important, therefore, that our understanding of structures and processes extends to the macro-level, and indeed, to the meta-level, where donors and other international organisations (such as the International Telecommunications Union) play an active role in influencing national government policy.

The construct is also questionable in the way it views the poor as passive consumers of market-driven goods and services provided by mobile phone operators. This rather negates the more complex interactions that users have with new technologies which, historically, have been observed according to processes of appropriation that involve both adaptation and modification, which give rise to changing patterns of consumption, arising from within poor communities themselves (Bar & Riis, 2000). Unexpected forms of technology appropriation and adaptation were identified quite early on as integral to the mobile revolution. For example, Chipchase (2009) and Donner (2006) demonstrate how the requirements of low income users have become

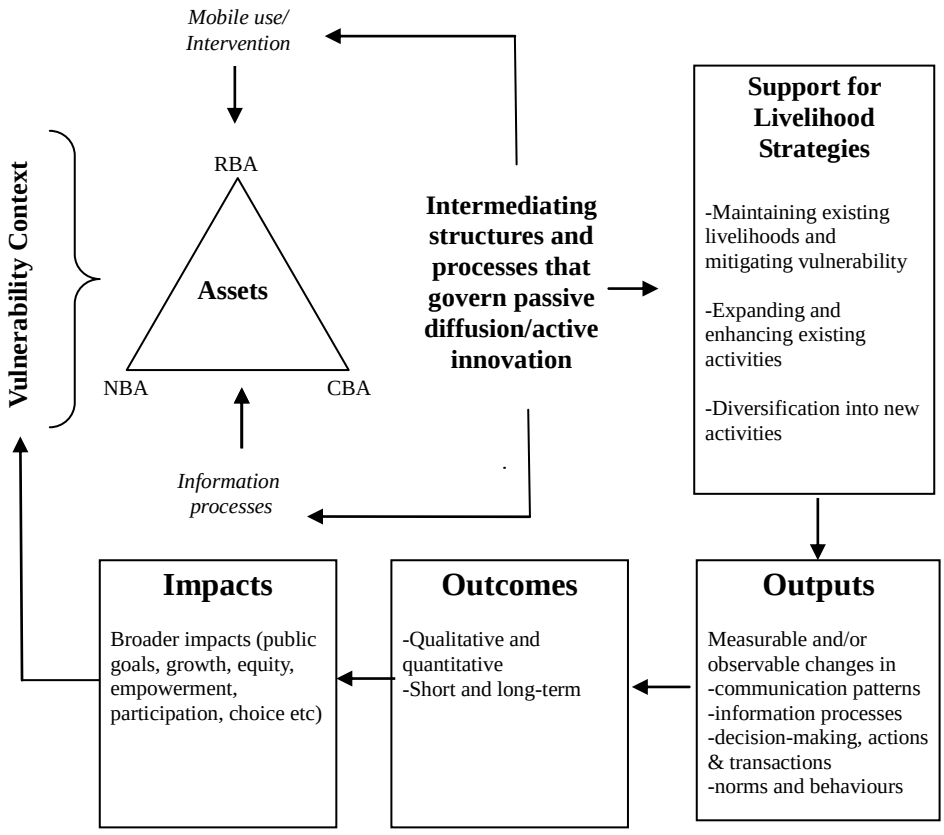
re-embodied in user behaviour through 'beeping' (calling another user or network participant and hanging up before they answer – prompting a return call). Another example concerns the widespread use of the phone as a store of value (through accumulating call credit or in a mobile money transfer account such as M-PESA) – a sign of pent-up demand for individual micro-savings. It was this type of user innovation that stimulated donors together with CBOs to take an active interest in developing applications that could build upon the type of adaptations that the poor themselves were making (Donner, 2009). Thus, an understanding of structures and processes requires analysis in two respects: those which arise from arise from a 'top-down' perspective (government policy, active intervention by donors, etc) and those which arise from the 'bottom up' (market processes, user innovation, etc).

D.4. Delineating Outcomes

The emphasis on dynamic information-driven processes, suggests that livelihood outcomes need to be delineated. Thus, the revised framework suggests a distinction between outputs, outcomes and impacts (Duncombe, 2009; Heeks & Molla, 2009). Outputs identify and measure immediate changes in behaviour and practices due to information or advice received via the mobile phone's interface (this could be voice, text or pictorial). This emphasises that whilst the mobile phone offers practical and functional advantages of access, immediacy and mobility, the key output for the recipient will relate to the quality of the information received or exchanged. Outcomes, however, identify if, and in what manner, information can be used to expand the spectrum of choices that are open to the recipient, and whether that information can be used in support of decisions that are made in pursuance of their livelihood strategies (Klein, 2010). The assessment of 'impact' tends to have a longer term perspective and will involve determining the extent to which the use of a mobile phone has been responsible for supporting livelihood strategies and changing lives (such as through mitigating vulnerability, expansion of existing activities, or diversification).

In this regard, issues of attribution become ever more challenging as we move from assessing output, outcomes and broader impact, due to the difficulty of disentangling the effects of exogenous factors. Thus, identifying and observing and measuring immediate changes in behaviour and practices due to use of mobile phones will be relatively straightforward compared with the task of identifying how that information impacts on decision making and action. However, the emphasis of impact assessment should not only be on assessing adaptive strategies over the longer term, as this rather negates the importance of shorter term responses to more immediate shocks and emergencies (bereavement, a climatic shock or domestic conflict, s sick animal, for example). Due to their shrinking of time and space, mobile phones have been shown to be particularly effective in this respect. Thus, an assessment of outcomes should also encompass more immediate response needs as well as potential for longer term strategising.

Fig 1. Mobile Phones and Livelihoods Research Framework (source: Author)



E. Framework Application and Future Research

Application of the framework can be considered in four main respects which provide pointers to areas where further research into mobile phones and livelihoods is required.

First, the starting point for livelihoods analysis is the context of vulnerability that shapes people's lives via shocks (e.g., emergencies or conflict), socio-economic trends (e.g., fluctuations in global markets or migratory trends) and seasonality (e.g., fluctuating incomes from agricultural outputs) (Carney et al, 1999). Understanding these changing contexts will be fundamental to understanding how changing needs for communication are manifesting themselves within poor communities, and how mobile phones can be utilised to fulfil those needs. A lack of emphasis on the changing context of livelihoods is recognised Scoones (2009) who is critical of the lack of integration of information and communication processes (and hence technologies) within livelihoods analysis and action. He identifies the 'naïve localism' of previous livelihoods thinking which has tended not to be engaged with the broader effects of economic globalisation and technological innovation. Livelihoods analysis needs to be less insular (tending to have focused on assessment of narrow household-based variables within agrarian settings) and more outward looking – taking account of changing socio-economic and demographic processes – such as enhanced urban-rural links, rising labour migration and the increasing dispersal of the household unit – trends which themselves are creating new demands for better information flows and communication services.

Second, it needs to be emphasised that mobile phones are a development trend that is fundamentally market-driven (i.e., responding to market demand through passive diffusion and not to necessarily to the needs of the poor). Doward et al (2003) previously recognised that livelihoods analysis tends not to deal adequately with market processes and there needs to be a re-emphasis within livelihoods research on the role of markets, and how they stimulate demand for the outputs of diversified

livelihood activities. In this respect, and in relation to impact of mobile phones, there is a need to evaluate two divergent hypotheses. On the one hand, mobile phones are viewed as a form of innovation that can make markets more inclusive for the poor (Mendoza & Thelen, 2008). Specifically, mobile phones are able to address three key criteria for inclusive markets – that of facilitating access to market information and transactions, creating direct development impact for the poor through personal access and usage, and having the potential for financial viability, given their relatively low cost, and ability to handle small quantities and transactions. On the other hand, research also suggests that such market processes give rise to inbuilt inequalities of access and ownership of mobile phones (May, 2010). Thus the benefits of market inclusiveness remain denied to a large proportion of the poor (and certainly the poorest) that still lack access, or the means to make effective use of expanding mobile phone networks.

Third, as recognised by Ellis & Bahiigwa (2003:1003) a sustainable livelihood results from the ability to "deepen and broaden asset holdings over time" and within a context of vulnerability, assets play a vital role in determining the range and combination of choices that people have. Here it should be recognised that mobile phones differ from previous telecommunication provision, as they are devices that exhibit a wide range of applications and multiple functionalities. As such they have potential to play an enhanced role in support of communication processes and asset accumulation strategies that cut across all forms of capital (Duncombe, 2006). This points towards the need for greater research into how mobile phones impact upon asset accumulation strategies at the household level – to gain a deeper understanding of both the benefits and the costs of mobile phone ownership, use or sharing; taking into account a complex set of micro-processes that involves substitution, enhancement, combining, exchange and embodiment of assets. This analysis needs to encompass a broader range of capitals (suggested as material, networked and cognitive) than is catered for in the traditional livelihoods framework, and which are commensurate with a rapidly-changing vulnerability context driven by new technologies and attendant information and communication processes.

Fourth, livelihoods analysis highlights the importance of the (intermediating) organisations, institutions, policies and legislation that determine the ability of the poor to access infrastructure and the other complementary resources that they need to pursue livelihood strategies. Mobile phones are an increasingly important intermediating tool that is affecting the terms of exchange and returns that are open to the poor in pursuit of livelihood strategies. This relates not only to terms of financial exchange, but also other social and political terms of exchange such as based on gender roles or other social, cultural and digital divides which, unless confronted, can give rise to forms of economic and social exclusion – including digital exclusion and digital poverty (May, 2010; Barrentes, 2005). There is need for greater understanding of these intermediating factors (structures and processes in livelihood terms) that facilitate market (or non-market) demand for mobile phones and the services that they offer, with particular emphasis on access – not only to markets – but to forms of market empowerment, rights and supporting services.

As illustrated in the paper, mobile phones have the potential to support 'link up' strategies – providing an intermediating tool that can bring together and coordinate the various market and non-market actors and institutions that are required to facilitate greater market (and non-market) participation. However, such processes of intermediation tend to fulfil a dual role. On the one hand they seek – via philanthropy and donor or industry subsidy – to overcome inequalities of market access by encouraging adoption and use of mobile phones on the basis of project-based initiatives which seek to assist the poor to apply mobile phones in pursuance of their livelihoods. On the other hand, they provide a platform for the mobile phone industry to actively test and evaluate new innovative applications that may lead to future commercial advantage through market channels. Thus, when mobile phones are the preferred delivery mechanism, market models for information delivery and exchange tend to dominate, and there is a risk that sustainability will be defined exclusively according to willingness and ability to pay for services and information, rather than on the basis of need.

In conclusion, this paper has suggested that mobile phones are an important technological innovation that is increasingly impacting the lives of the poor in developing countries. These interactions have been conceptualised in relation to how the use of the phone leads to interrelated forms of substitution, enhancement (or diminution), exchange, combination and disembodiment of assets. Assets themselves have been re-defined and re-categorised according to a broader range of capitals that reflect the greater emphasis on network and cognitive processes facilitated by new communication technologies. The ability of the poor to mobilise assets and develop livelihood strategies has been shown to be intermediated through processes of passive diffusion, but also active innovation both by providers and users of services, whilst the important role of policy and regulatory structures at the macro-level has been emphasised. A livelihoods approach suggests that mobile phones can be best understood as the poor themselves understand them – as a technological artefact that has direct impact upon a complex set of interacting factors at the micro level. It is hoped this analysis and adaptation of the livelihoods framework will provide a useful tool for understanding this rapidly changing technological phenomenon and will make a contribution to future livelihoods research.

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Endnotes

[i] In the case of the poorest continent – Africa – mobile penetration for individual countries increased from an average of 2% of total population in the year 2000 to an average of 33% in 2008. This impressive growth masks extreme variations between countries, but overall, mobile cellular networks extended coverage to 58.5% of the total African population during this period creating potential for network access for previously un-served communities in some of the poorest countries. African countries with the highest mobile cellular growth rates between 2003 and 2008 were dominated by those that are least developed. Ethiopia with a compound annual growth rate (CAGR) of 128%; Chad with 94%; Guinea with 88%; and, Niger with 83% occupied the top four places (ITU, 2009).

[ii] Details of a wide range of text-based mobile phones and development projects can be found at Kiwanja.net. http://www.kiwanja.net/database/kiwanja_search.php. Lists of projects can also be accessed via MobileActive.org. http://mobileactive.org/directory

[iii] M-finance can be thought of as an umbrella term to encompass all areas of innovation where mobile phones and mobile-cellular networks are being used as a delivery channel for finance, information and transactions. M-finance includes 'mobile payments' as well as 'mobile banking' which may involve access by mobile devices to a broader range of banking services, such as account-based savings or transaction products offered by banks. For further information, see: Porteous (2006).

[iv] Mobile payments can store value in a remote account accessible by a handset; convert cash in and out of a stored value account by visiting a bank branch or a retail agent that may be located locally in a kiosk; and transfer the stored value between accounts of individual account holders by means of text message or menu-driven commands and PIN numbers.

[v] Financial literacy defines the knowledge and capabilities that the poor need to make informed choices and decisions concerning their finances. Research suggests that lack of financial literacy is a key constraint for poor households in the pursuit of asset-building strategies and effective financial management. See, for example, Bell & Lerman (2005).

[vi] M-PESA has attracted a customer base of approximately 9 million users and 17,000 service delivery agents over a three year period (Safaricom, 2010).

[vii] SMILE, which has been granted licences in number of sub-Saharan African countries, offers free telephone numbers and voice message boxes to customers, whether they own a handset or not. A customer is provided with a secure PIN code to use on any SMILE phone. Smile Communications operate through agents, which provide mobile handsets in street kiosks, stalls and payphones. Refer to: http://www.smilecoms.com/pages/default.asp

[viii] CELAC is funded by the Grameen Foundation and brings technology partners (MTN and Google) together with local not-for-profit organisations such as BROSDI (Busoga Rural Open Source and Development Initiative) that are active in working with local communities in livelihoods support for agriculture, health and education. The project has a database of phone numbers to which agro-related information is sent weekly, composed of farmers, community development and agricultural extension workers. The use of community radio call-in programmes is integrated into the service as is drama on video and DVD to portray the farming practices and their challenges. Besides farmers, CELAC also engages former agricultural extension workers as knowledge brokers to help in the collection and dissemination of traditional methods that work, including sharing information with other affiliates via mobile networks (See: http://celac.or.ug/)

[ix] This example is drawn from a case study of mobile phones and development application for the cattle farming sector in Kenya. Full details are available from: Kithuka et al (2007).

[x] See: http://links.tamu.edu/Pages/Public/Home.aspx

[xi] KACE provides a comprehensive market information system plus an e-market place that individual farmers can access through information centres, SMS or voice recordings via a toll free number. Results show significant use of the system to match supply and demand, as well as to learn about current market prices, providing leverage with brokers and traders. See: http://www.kacekenya.co.ke/

[xii] See Cell Bazaar: http://www.cellbazaar.com/web/

[xiii] See, for example, recent services launched in Uganda through a partnership between MTN Uganda and Google. These include a range of information delivery services aimed at the poor and

disadvantaged concerning agricultural advice, weather forecasting, health, reproductive and market-related information. See AppLab in Action: http://www.youtube.com/watch?v=dPaMeONj6sM

[xiv] See, for example, Samarajiva (2005) who draws on the experience of the Indian Ocean tsunami of 2004 to demonstrate a range of applications for mobile networks and other ICTs for effective disaster warning.

[xv] Improved market coordination resulted in fishermen's profits increasing by an average of 8 per cent, including a revenue raise by an average Rs.205 (about US$4.5) per day while mobile costs were about Rs.72 (US$1.6) per day. Also fishermen without mobile phones saw their profits rise as a result of an overall improvement in market efficiency. Fish prices were seen to fall by 4 per cent, thus also benefiting poor consumers. In addition, wastage of fish within the market as a whole fell significantly (Jensen, 2007).

[xvi] The proportion of M-PESA customers making use of non-cash transfer options (e.g., to withdraw cash from an M-PESA linked account or to pay bills) is relatively low (between 2 and 5%) but the proportion of customers using their M-PESA cash balance as a saving mechanism or to store money before travelling is high (26% and 17% respectively). This 'unintended' usage of the M-PESA system suggested unfulfilled demand for a secure savings mechanism which stimulated the introduction of M-KESHO which, in partnership with Equity Bank, offers deposits, interest paying savings and payment products that are linked to the M-PESA mobile user interface, aimed at the estimated 3 million M-PESA users that currently do not access formal banking services.

[xvii] This type of 'smart subsidy' has been enacted in Uganda via the Rural Communications Development Fund (RCDF) which allocates universal service funds to stimulate rural ICT investment and connectivity by means of a 1 percent levy on overall telecom revenues. The argument, however, has two sides. Outcomes from such investment have been mixed, showing significant national expansion of rural 'last mile' infrastructure since the inception of the fund in 2001, but considerable problems of sustaining that investment, with only 923 of the 3,863 projects completed still in operation, and with the on-going costs of those remaining rising considerably. Refer to: http://www.balancingact-africa.com/news/en/issue-no-479/money/uganda-s-failed-rura/en

[xviii] For example, Uganda has a 12% excise duty on mobile phone services, in addition to a standard VAT rate of 18%, which together with other less developed countries in sub-Saharan Africa (e.g., Zambia, Tanzania and Kenya) puts it in the top ten of markets with the highest taxes on mobile telephony. Refer to: http://www.apc.org/en/node/9093/