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Impact Assessment of Mobile Phones on Development: *Concepts, Methods and Lessons for Practice*

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Assessing Impact of Mobile Phones on Development: *Concepts, Methods and Lessons for Practice*

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Abstract

The use of mobile phones is an increasingly important part of development across all sectors, which has led to rapidly increasing investment by the mobile phone industry and new demands on the resources of donors. Impact assessment (IA) is an increasingly important tool for evaluating whether or not mobiles-for-development (m-development) funds are being used effectively. This paper reviews 18 published studies, which are critically evaluated with reference to key building blocks for good practice in IA. These building blocks encompass: the extent to which the studies address the needs of defined audiences or beneficiaries, the choice of types of impact to assess and units of assessment, the application of suitable conceptual frameworks, and the rigour of the methodology followed.

The findings suggest that m-development IA to date falls into three main categories: purely quantitative approaches rooted in information economics, and purely qualitative approaches rooted in social impact assessment. A further mixed method category provides cost effective and timely findings, but with the result of diluting the rigour evident at the methodological poles.

Overall, the paper concludes there is a need for more and better guidance for the conduct of such studies, particularly in relation to identifying the rationale and objectives of IA, and linking the choice of concepts and methods with the requirements of key audiences and beneficiaries. Thus, the paper identifies m-development IA as a contested area, and by taking stock of experience thus far, seeks to raise the level of debate concerning the relative merit of alternative methodological and conceptual approaches.

A. Introduction

Since the advent of mobile phone technology, rapid improvement has been experienced in the penetration and coverage of telecommunication networks in all developing countries. As a universal communication device, the mobile phone strikes at the heart of all human activity fulfilling the desire to communicate and to interact with others.

In a seminal study of mobile communications and society, Castells et al (2007:243) conclude that…

> "the evidence we have been able to unearth shows the pervasive diffusion of wireless communication in all spheres of social life and economic activity. We also appreciate the ability of people and communities to adapt the technologies to their own possibilities and to shape them around their specific communication goals. Wireless communication is no panacea for development. But development projects, from all corners of the planet, are embracing the potential of new technology and are using it for their own purposes according to what they are able to achieve".

This observation is further evidenced by the proliferation of development interventions centred on the use of mobile phones that have come into public view. These include a broad range of applications across an equally broad range of development sectors. Most prominent are new services to facilitate electronic banking and more efficient and cheaper means of making money transfers[i]; new models of income generation and empowerment for women such as through the Grameen Village Phone Operator (VPO) programme[ii]; a means to exchange information through text-based services for agricultural and local economic development[iii]; and as a means to advocate and campaign on development issues such as through the increasing prominence of mobile initiatives in the activities of non-governmental and community-based organisations[iv]. All these examples add weight to the view that mobile phone technology is increasingly becoming a key tool for development.

The growth of mobiles for development (m-development) will inevitably lead to the disbursement of increased investment and resources. This includes monetary investment in the form of up-front and on-going expenditure, but also investment in time and effort for those engaged in development. As the amount of resources allocated to m-development grows there will be an increased requirement to understand the effects of that investment. Impact assessment (IA) is likely to become an increasingly important tool for evaluating whether or not m-development funds are being used both efficiently and effectively.

The reasoning for this is as follows. In the first instance there is a need to enhance the prospect of accountability over the considerable resources allocated by donors, the mobile phone industry and other international funding organisations that are driving m-development. Secondly, due to not wanting to repeat previous experience of a high level of project failure associated with information and communication technology for development (ICT4D) projects – particularly those projects that have been guided by

technological investment.[v] Thirdly, due to the relative lack of independent IA studies currently available that can inform policy and decision making in this area.

It is recognised by development theorists and practitioners alike that IA is a contested area in many development sectors. According to Mayoux & Chambers (2005:272) IA stands at a crossroads…

> "on the one hand the underlying agendas of pro-poor development and 'improving practice' necessarily require participation by poor women and men in deciding priorities and identifying strategies. On the other hand the sheer numbers of people involved, the potential conflicts of interest and consequent difficulties of decision making require rigorous quantification and analysis in order to minimise domination by local vested interests".

The prioritisation within IA and the types of approaches and methods chosen are also key issues for m-development. For this reason this paper argues that there is need to take stock of experience thus far, and to raise the level of debate concerning the relative merit of alternative methodological and conceptual approaches. In order to do this the paper incorporates the following objectives:

- First, to clarify the key building blocks of IA for m-development.
- Second, to consider suitable frameworks and methodologies and assess their applicability to IA for m-development.
- Third, to critically evaluate existing studies of IA for m-development.
- Fourth, to outline lessons learned and suggest some preliminary guidelines for IA for m-development.

Impact can be assessed at different levels: macro-level (analysing country level data or making international comparisons); meso-level (impact on intermediary level organisations); or micro-level (impact on recipients, clients or final end users). This paper analyses 18 published studies conducted at the micro- and meso-level encompassing impact on individuals, households, enterprises, communities and intervening organisations, identifying studies where primary data had been collected, or where secondary data has been accessed and analysed.[vi] This focus has been chosen due to the greater number of studies available at the micro- and meso-level, but also to confine the review to a coherent and manageable set of conceptual and methodological approaches.

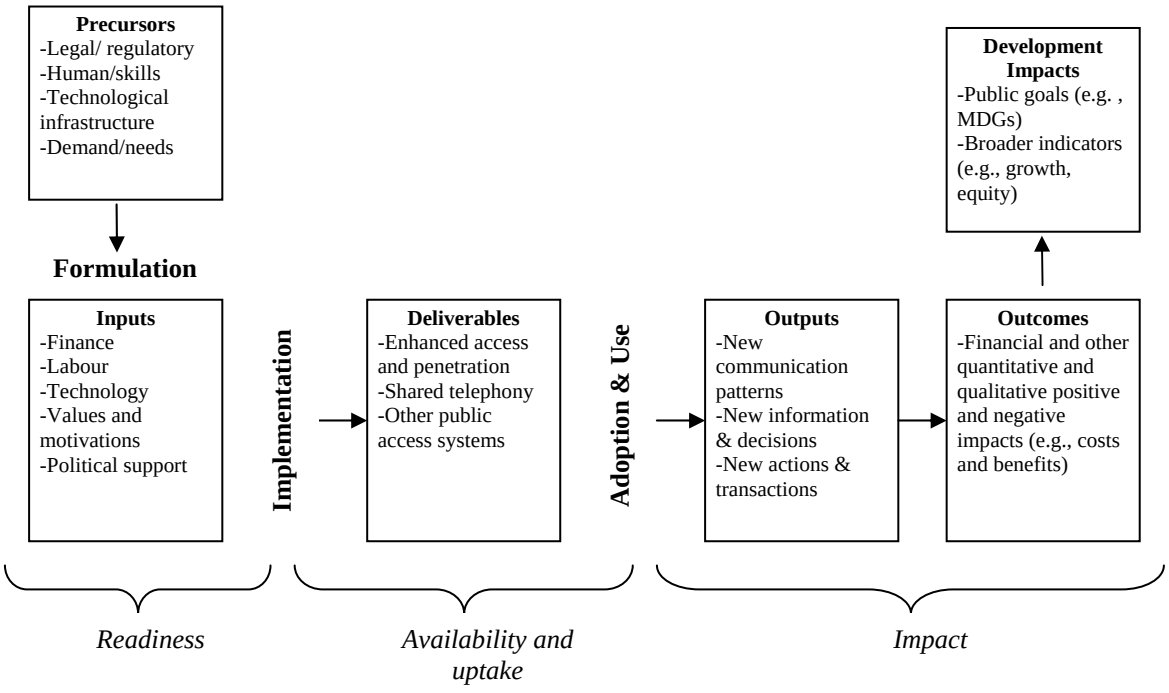
The sample of papers includes peer reviewed studies of impact of m-development published in journals and conducted by academic researchers, but also a smaller number of practitioner studies carried out on behalf of donor organisations that are active in support of m-development. The sample identifies the key studies of impact that have been reported in the literature since the year 2000 with a cut-off point of December 2008. Studies are drawn from a spectrum of disciplines incorporating information and communication technology for development (ICT4D), development studies, economics, banking and finance, and management.[vii]

B. Building Blocks for Impact Assessment

According to Kirkpatrick & Hulme (2001:2), "IA is the process of identifying the anticipated or actual impacts of a development intervention, on those social, economic and environmental factors which the intervention is designed to affect or may inadvertently affect". The notion of IA can be further understood by considering it as part of a value chain of activities which incorporates: a) readiness; b) availability and uptake; and c) impact (Fig.1). In this model, IA is represented as an *ex-post* activity which identifies the actual impacts which follow the adoption and use of mobile technologies. This is in contrast to *ex-ante* IA which would be carried out prior to the development of an intervention in order to model or forecast potential impacts. This paper surveys *ex-post* studies.

Fig.1 indicates that *ex-post* IA can be broken down into three interrelated areas of focus. First, the immediate *outputs* associated with the intervention, defined as micro-level changes (in behaviour or practices) that are associated with use of mobile phones; second, the resultant and more immediate *outcomes*, defined as measurable differences in cost and benefit associated with the intervention of mobile phones; and third, broader and longer term *impacts*, defined as the contribution of the mobile phone intervention to broader development goals such as the growth or decline in socio-economic indicators (e.g., income or equity).

Fig 1. m-Development Impact Value Chain



Adapted from Heeks & Molla (2009)

B1. Rationale and Intended Audience

Forming a rationale for IA of m-development involves understanding why IA is a necessary and useful activity. In this respect, Kirkpatrick & Hulme (2001) identify three sets of objectives for IA: a) for accountability to funders through measuring the achievement of m-development and efficiency in the allocation of resources; b) for improving organisational effectiveness by providing lessons for the improvement of specific m-development interventions, as well as recommendations for comparable or planned interventions; c) to contribute to broader processes of policy development concerning m-development on behalf of donors, government or the private sector.

For m-development interventions the intended audience (the beneficiaries of the IA) may include:

- Those who make decisions about intervention-related investments or the policy and regulatory environment within which the intervention operates.
- Those who are responsible for the management of the intervention.
- Those who are the beneficiaries of the intervention or the users of the services provided.
- Other local or community stakeholders who may have some influence over the intervention – particularly its sustainability.

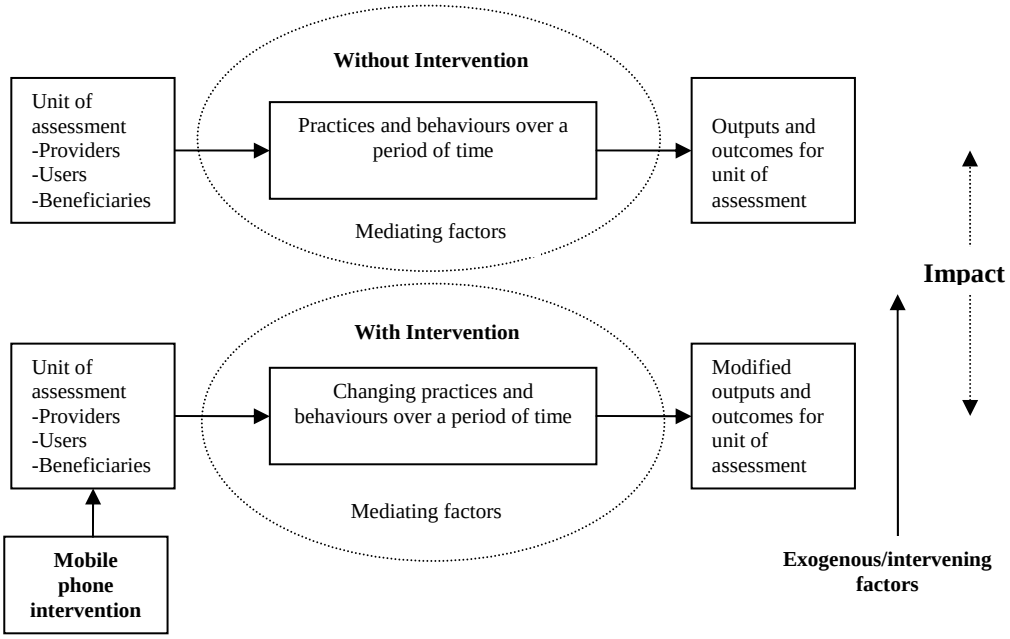
There are two key tensions within IA that impact upon the requirement to satisfy different audiences. The first relates to possible conflicts of interest concerning how suitable conceptual frameworks are chosen, and the difficulties in satisfying different audiences within a single methodological approach (Wright & Copestake, 2005). Thus, public policy makers or donors may be more interested in hard evidence of broader socio-economic impact and justification for further expenditure on infrastructure or subsidy of access; whilst service providers or project managers may find client and project level information related to outputs and outcomes more useful.

This leads on to a second key tension that has been voiced by a number of IA practitioners (Mayoux & Chambers, 2005; Hulme, 2000). This concerns the relative importance given within IA design to *proving* or *improving* impact. Proving impact requires the demonstration of causal relationships (more commonly demonstrated at least partially thorough quantitative means) with the intention of measuring as precisely as possible the broader impacts of the intervention. Improving impact, on the other hand, requires a deeper understanding of the underlying processes associated with an intervention with the intention of improving those processes. Proving impact is likely to be more expensive and consuming of resources, requiring rigorous analysis of reasonably large representative samples, and use of control groups, whereas improving impact can be focused on producing credible and comparable findings by means of smaller samples of project beneficiaries, and making greater use of qualitative data sources accessed within the boundaries of the intervention. The make-up of the IA audience should largely determine the comparative focus on proving or improving impact, how the IA is designed, and the conceptual and methodological approaches adopted, as well as how the results are disseminated and used.

B2. The Conventional Model of IA

A conceptual framework is an essential tool for larger IA exercises, but also for the assessment of smaller-scale interventions. The purpose of a framework is to model the mediating processes that link the use of a mobile phone or any other mobile-related intervention to measures of output, outcome or impact. This is elaborated succinctly by Hulme (2000:81)… "IAs assess the difference in the values of key variables between the outcomes on agents (individuals, enterprises, households, populations, policy makers, etc) which have experienced an intervention against the values of those variables that would have occurred had there been no intervention". This is illustrated in Fig 2 as being representative of a conventional model of IA.

Fig 2. Conventional Model of Impact Assessment



Adapted from Hulme (2000:81)

By way of illustration we can consider a situation where use of a phone stimulates communication between a cattle farmer and a veterinary service.[viii] This gives rise to the exchange of text-based information concerning communicable diseases, further stimulating the gathering of useful information (a measurable output). This changes behaviour and encourages new ways of tending to cattle during calving which results in a reduction in stillborn calves (a measurable outcome). In the longer term this increases the income and welfare of the farmer (a measurable impact). What is not clear is the extent to which the use of a mobile phone has been responsible for changing behaviour, and what role other mediating factors may have played. Neither is it clear whether the positive impacts are wholly the result of the actions taken by the farmer on the basis of the information received (if at all). A conventional approach to IA seeks to address these methodological problems either by creating a wholly experimental approach or more commonly through the use of a control group of comparable farmers who had no access to mobile phones, assessing the difference in outcome and impact as compared with phone users. This constitutes what might be

termed the 'scientific' approach which will be appraised in more detail in section C. First, however, there are two further building blocks that need to be considered. Definition of the framework also requires choices about what impacts to assess (i.e., what variables/indicators to measure) and the unit of assessment (i.e., at what level and from whom or where to elicit IA data).

B3. Types of Impacts to Assess

Table 1 maps the 18 reviewed studies according to whether they are focused on assessing outputs, outcomes or impacts (or a combination) together with an indication of the primary unit of assessment that was chosen for the study. The mapping suggests that existing studies tend to be focused on assessing output and outcome rather than broader impact, while the unit of assessment tends to be the individual or enterprise rather than the household or community. There were no studies from the sample that identified community-level groups or organisations as the primary unit, but some did include such groups through key informant interviews and as a means to build in triangulation of data sources.

Table 1. Mapping of IA Studies Reviewed According to Value Chain Positioning and Primary Unit of Assessment

Unit of Assessment	**Studies assessing outputs**	**Studies assessing outcomes**	**Studies assessing broader impact**
Individual	3, 6, 9	8, 16, 18 7	4, 15
Enterprise	12	2 1, 10, 11, 14	
Household	17		5, 13
Community			

Source: Review of studies
Refer to Section E1 for full reference according to study number

In general terms the complexity of IA will increase as we move from assessing outputs to outcomes and impact. Thus identifying and measuring immediate changes in behaviour and practices due to use of mobile phones (e.g., the ability to open up a new channel of communication and access new information) will be relatively straightforward compared with the task of identifying how that information is used, and the costs and benefits associated with its use. It is also the case that outcomes may be attributable to the value or quality of information received rather than the means by which it was delivered. Such issues of attribution become ever more challenging as we move from assessing outcomes to broader impact, due to the difficulty of disentangling the effects of an m-development intervention from a myriad of other possible intervening or exogenous factors. For this reason, the measurement of impact is generally more straightforward when focused on a single area and comprising a limited number of variables (e.g., solely economic impact) rather than multiple areas (e.g., social, economic and cultural impact), which while desirable may present significant methodological challenges (Bond et al, 2001).

The types of variables to assess are wide ranging, and the reviewed studies tend to focus on either economic or social indicators. Measuring economic indicators at the micro-level presents significant challenges, particularly gauging income due to reasons of fungibility[ix]. Both consumption and expenditure can be measured, as well as assets which are generally more stable and easier to identify and calibrate. Social indicators are increasingly evident in more recent studies and they may be educational, health, nutrition, socio-political, gender or culturally related, or choice of other measures, which will depend upon the particular sector focus of the intervention, and the needs of the assessment.

A further issue concerns how variables are specified. Virtually all studies frame the types of impacts to assess by specifying the mobile phone as an independent variable. An independent variable is one that, when changed, can be seen as the cause of a change in other variables (which are dependent). This raises questions not only about what dependent variables to measure (output, outcome or impact) but also how to define the phone as an independent variable. Many studies rely on ownership data. However, merely noting the presence of a phone within a household (such as through ownership/possession by the head of the household) may not be a sufficient measure unless further indicators of access to networks, motivation and ability to use the phone, and accessibility to other household members are factored in. This highlights the importance of being able to understand the attendant processes of activity that lead to particular outputs and outcomes, as well as seeking to establish correlative or causal links between isolated variables.

B4. Units of Assessment

In most studies, largely for reasons of practicality and simplicity, the chosen unit of assessment is either the individual or the enterprise (Table 1) where the primary respondents have been individual owners of mobile phones or individual owners and/or managers of enterprises that use mobile phones. The primacy of the individual as a unit of assessment within the studies may not be surprising given that the mobile phone by its very nature is a personal communication device, and its utility is normally expressed through individual use. For example, a number of studies

(Donner, 2006; Horst & Miller, 2005; Aminuzzaman, 2003) track the call-logs of individual phone owners which provides detailed data on usage and networking behaviour.

However, the individualisation of mobile phone use is challenged by the extent and complexity of mobile phone sharing in developing countries (James & Versteeg, 2007) and this is likely to present difficulties for creating clear distinctions between units of analysis in the way in which mobile phones are used in practice. A deeper understanding of mobile phone sharing would require the mapping of the social relationships of the individual mobile phone owner, and the way in which they cross over between household, enterprise and community. With the exception of the ethnographic approaches of Ureta (2008) and Horst & Miller (2005) there were no studies that focus on the extent of mobile phone sharing (or non-sharing) within close or extended families (thus examining intra-household factors). With this caveat in mind, Table 2 provides a comparison of advantages and disadvantages attributable to differing units of assessment.

Table 2. Units of Assessment Advantages and Disadvantages

	Unit	Description	Advantages	Disadvantages
Micro	**Individual**	*A person who owns or uses a mobile phone, or a non-user.*	Easy to identify and associate with mobile phone ownership and use.	Impacts beyond the individual may not be captured.
	Household	*Ownership and use of a mobile phone by a domestic unit consisting of members of close and extended families.*	Relatively easy to identify and define. Tends to coincide with availability of other secondary data sources concerning livelihoods and enterprise.	Intra-household factors such as gender and inter-generational differences may be overlooked. May be some problems defining exact membership.
	(Micro) Enterprise	*A business owner or individual economic unit that owns and makes use of a mobile phone.*	Can provide a range of quantifiable indicators of outcome (e.g., sales volume, profit, market share).	Relatively difficult to define and identify. Reliability of data open to question due to fungibility of enterprise income and individual and household consumption.
	Community	*A phone is owned by a community facility, and is available to the community.*	Externalities and ripple (network) effects can be captured.	May be difficult to quantify. May be difficult to define boundaries (i.e., distinguishing between units).
Meso	**Organisational (intermediary)**	*Mobile phones are used as a mediating tool by organisations that provide services to communities, households or individuals.*	Easy to identify and may provide access to aggregated data on users/recipients of services.	Provides an organisational perspective rather than that of the end user.

Sources: Based on compilation of study findings and Hulme (2000).

As indicated in Table 2, the unit of assessment can also encompass the organisations that intermediate between users and providers of services. In this case the unit of assessment lies at the meso-level involving an organisational focus. This includes intermediaries that deliver information and communication such as mobile telephony service providers, as well as sector-based organisations (public, private or NGOs) that deliver a broader range of end-user services with use of mobile phones (financial, education, health, etc). In this case the IA focus will be on assessing the effectiveness and sustainability of those services (more focused on improving impact) but possibly less concerned with demonstrating impact on the final beneficiaries (less focused on proving impact). The survey sample turned up no studies where the primary unit of assessment was set at this level, but interviews with such intermediary organisations were used for purposes of triangulation of data sources.

C. Methods and Concepts

C1. Methodological Approaches

Methodological approaches to IA range from exclusively quantitative through various qualitative methods and to participatory (Verhagen, 2001; Hulme, 2000). Table 3 provides an analysis of the reviewed studies according to a number of criteria for assessing the methodologies adopted, as follows:

- *Data type*: Is the IA data collected mainly quantitative, qualitative or mixed?
- *Data-gathering methods*: What are the methods used to collect the IA data (surveys, interviews, focus groups, etc)?
- *Coverage*: What is the extent and make up of the sample of respondents?
- *Baseline/Counterfactual*: Is there use of baseline data and/or controls within the IA design?
- *Triangulation of data/methods*: What evidence is there of mechanisms to cross-check the validity of data?
- *Timing*: Was the IA conducted using a cross-sectional (CS) or longitudinal (L) design or a combination?
- *Method guidance*: Is there sufficient guidance on the methods used in order to be able to replicate the study?[x]

Table 3. Methodological Approaches for Reviewed Studies

	Study and focus	Data type	Data-gathering methods	Coverage	Baseline/counterfactual	Triangulation	Timing	Method guidance
1	Small-scale fishing units in Kerala	Mixed	-Questionnaire survey -Focus groups	-172 respondents in -12 locations	No	Yes - KI interviews (50)	CS	Limited
2	Traders and farmers in Niger	Quantitative	-Panel survey	-395 traders -205 farmers -35 markets -6 regions	Yes	Yes – between farmers and traders	L CS	Detailed
3	Capabilities of poor users in the Philippines	Mixed	-Questionnaire survey -Key informant (KI) interviews	-250 households (HH) -2 locations	No	Some – use of focus groups	CS	Detailed
4	Grameen VPO programme in Bangladesh	Mixed	-Questionnaire survey -Key informant interviews	-350 respondents -20 locations	Some – 50 non users surveyed	Yes – 158 users, 85 operators, 55 key informants, 75 distant beneficiaries	CS	Limited
5	Micro payments amongst poor households in Senegal	Mixed	-Questionnaire survey	-650 households -urban/semi-rural rural locations	No	Yes – some comparisons with national household survey data	CS	Limited
6	Micro-entrepreneurs in Rwanda	Mixed	-Interview survey -Analysis of call logs	-277 completed interviews -2,700 discrete calls logged	No	Some – owners and non-owning users	CS	Some detail
7	Individuals and enterprise users in Latin America	Mixed	-Questionnaire survey	-800 respondents -4 countries	No	Some – between users and non-users	CS	Some detail
8	Social capital of individual owners in RSA and Tanzania	Quantitative	-Questionnaire survey	-252 respondents in RSA -223 in Tanzania	No	No	CS	Limited
9	Social networking amongst low income mobile users in Jamaica	Qualitative	-Participant observation -Interview survey	-Survey 100 HH -detailed budgetary survey 20 HH -2 sites	No	Yes – Individual, HH and KI interviews	L (over 1 year)	Detailed

	Study and focus	**Data type**	**Data-gathering methods**	**Coverage**	**Baseline/counterfactual**	**Triangulation**	**Timing**	**Method guidance**
10	Cloth supply chain for peri-urban Nigerian Enterprises	Qualitative	-Interview survey -Observation	-16 respondents	Some	Some – KI interviews Observations	L (8 months)	Limited
11	Small-scale fishing units off coast of Kerala	Mixed	-Questionnaire and interview survey	-300 fishing units -20 interviews -3 districts	Yes	Yes – producers and consumers	L (5 years)	Detailed
12	Micro-entrepreneurs in Tanzania	Qualitative	-Interviews -Observations	-3 case studies	No	Yes – entrepreneurs and traders – other supply chain participants	L (15 months)	Some detail
13	Household agricultural market participation in Uganda	Quantitative	-Household survey (secondary data)	-National (excluding Northern region)	Yes – users and non-users	No	L (2 years) CS	Detailed
14	Changing trading practices in Ghana	Qualitative	-Interview survey	-80 respondents indicative sample/ snowball method	Some (non-users in 2001)	Some - 10 KI interviews	L (2 points - 2001 and 2003)	Some detail
15	Patterns of usage amongst individuals/enterprises in RSA and Tanzania	Quantitative	-Questionnaire survey	-252 respondents in RSA -223 in Tanzania	No	No	CS	Limited
16	Economic impact amongst individual users in India, Mozambique and Tanzania	Mixed	-Interview survey	-3 locations in each country -250 adults in each location	No	No	CS	Detailed
17	Spatial mobility amongst low-income households in Chile	Qualitative	-Interview Survey -Observation	-20 low income households	No	No	L (10 months)	Some detail
18	Airtime transfer for users in Egypt	Mixed	-Questionnaire survey -Focus group interviews	-1000 respondents -nationally representative	Some – 700 user and 300 non-users	Yes – focus groups, airtime resellers, dealers, users.	CS	Limited

Source: Review of studies
Refer to Section E1 for full reference according to study number

C2. Conceptual Approaches

Conceptual approaches to m-development are varied. Heeks & Molla (2009) emphasise this in a survey of IA frameworks for a broader range of ICT4D applications. They classified frameworks according to whether they are generic, discipline, issue, application or sector-specific. Whilst this a useful classification, the evidence from the studies of m-development IA suggests that most studies tend to cut across these categories. For example, those which are specific to the discipline of economics also focus on particular sectors (such as fishing) and applications (mobile) as well as defined issues such as market development. An alternative classification devised by Heeks (2006) creates a hierarchy moving from 'shallower' conceptualisation to 'deeper' theoretically-based approaches – as follows:

A. *Theoretically-based approaches*: which make clear use of an identifiable theory that can be applied or tested.
B. *Framework-based approaches*: that make use of a framework for analysis that is derived from a body of theoretical work.
C. *Model-based approaches*: models that are applied, but without reference to a deeper body of knowledge.
D. *Concept-based approaches*: that make use of a defined concept such as 'information poverty', but which is not theoretically grounded.
E. *Category based approaches*: that make use of a prescribed set of factors to carry out analysis (e.g., critical success factors).

Table 4 identifies groupings of conceptual approaches according to the schema above together with key references to their antecedents – previous research cited in the article upon which the conceptual approach was based. Overall, the conceptual approaches identified are quite limited, and this would be expected from a nascent field of study. Thus far IA of m-development has been guided by two main areas of theory – information economics and various aspects of theory associated with social capital. This leaves a wide range of gaps – both in relation to existing ICT4D IA (see Heeks & Molla, 2009) as well as in comparison with IA conducted in other development fields – most notably within social development that makes use of a broader range of socio-cultural, political or institutional theories.

Table 4. Conceptual Approaches Identified in the Reviewed Studies

Conceptual approaches identified	Classification of conceptual approach	Antecedents cited	Article
Asymmetrical information and cultural perspectives on collective action	Theory	Putnam (1993)	4
Asymmetrical information and the structure of supply chains	Framework	Overa (2006); Stiglitz (1989); Porter & Millar (1985)	10
Capabilities approach	Theory	Sen (1999)	3
CATIA Framework for IA	Model	CATIA[xi]	5
Information economics	Theory	Jensen (2007); Stiglitz (1989); Stigler (1961)	13, 11, 2, 1
Network effects	Concept	None stated	15
Social capital – social and spatial mobility	Theory	Horst & Miller (2005); Ling (2004); Katz & Aakhus (2002)	17
Social capital – networks and trust	Theory	Fafchamps (2004); Katz & Aakhus (2002); Murphy (2002); Lyon (2000); Putnam (1993); Granovetter (1985)	14, 12, 9, 8, 6
Sustainable livelihoods	Framework	Ellis (2000)	16

Source: Review of studies
Refer to Section E1 for full reference according to article number

Before the conceptual and methodological approaches for IA are considered in more detail, it is useful to summarise some of the findings from the studies (although this is not the primary aim of this paper). As suggested in Table 1, the reported findings relate to outputs and outcomes to a greater extent than they do to broader impacts. They also comprise a mix of positive and negative impacts, as well as those that were unexpected. Most studies report evidence and instances of positive impact, while highlighting a lesser number of negative. A small number of studies are more pessimistic and report predominantly negative impacts with regard to widening differentials between socio-economic groupings due to mobile phone penetration. The positive outputs cited most often in the studies relate to strong evidence of better information flow (Mutu & Yamano, 2009; Aker, 2008; Abraham; 2007; Jagun et al 2008; Jensen, 2007; Overa, 2006). In the economic sphere, more timely information flow has led to a range of positive outcomes including better market coordination (particularly for transportation), market participation, reduced search costs and price dispersion. A further positive impact concerns the ability of poor communities to respond more quickly and effectively to emergencies (Souter, et al, 2005). A small number of studies were able to demonstrate how these benefits had been translated into positive welfare gains, but the evidence for this is much more limited at this stage, and overall the studies point toward monetary savings due to mobile phones rather than increased earnings. In the social sphere, better information has led to positive outcomes in terms of enhancing social capital (Walia &

Goodman, 2007; Donner, 2006; Horst & Miller, 2006; Goodman, 2005). Positive benefits have been demonstrated in relation to the strengthening of family ties, enhanced group membership and participation, and general levels of social satisfaction due to mobile phone ownership and/or use.

Some studies are more cautious about associating mobile use too strongly with both social and economic change. They highlight the primacy of pre-existing channels for information exchange and the overriding importance of personal face-to-face communication (Jagun, et al, 2008; Molony, 2007). They also provide evidence that mobile phones tend to support and reinforce pre-existing networks and social ties rather than forge new ones (Ureta, 2008). This is also seen to apply in the economic sphere where intermediaries within existing supply chain networks are seen to benefit through use of mobile phones in preference to both producers and consumers (Jagun et al, 2008; Overa, 2006), although contrasting findings are also evident in this respect. A key finding concerns the overall impact on equity (of which there is still very limited evidence). A number of studies point toward growing inequalities as a result of rapid mobile penetration into developing countries. These are highlighted with regard to inequities of access and outcome. For example, lack of affordability means poor users have been forced to adapt the way they use the phone (e.g., through beeping/call backs or small denomination airtime transfers). These can be viewed as either novel innovations or lesser forms of communication, depending upon your perspective. They are, however, reflective of the wider inequalities in access, usage and outcome that many studies illustrate.

C3. Methods and Concepts – Contrasting Views

Thus far, m-development IA has encompassed a relatively small number of studies, but from a conceptual and methodological standpoint, two broad camps seem to emerge. The first and most easily identifiable group are from information economics and embody a quantitative approach (Muto & Yamano, 2008; Aker, 2008; Jensen, 2007; Abraham, 2006) focusing more narrowly on indicators of market efficiency including price, time, resource and risk-based variables. They conform more closely to the conventional model of IA, employing longitudinal designs, incorporating baseline data, and addressing the counterfactual by surveying both treatment and control groups. On the whole, these studies provide detailed method guidance. This is important as such studies need to pay careful attention to sample selection through matching control groups of non users to phone user (treatment) groups in terms of tangible measures of socio-economic status and environmental conditions (as well as more intangible – and less measurable – factors such ability and motivation). Such studies can also be victim to cross-over or contamination of the control group by those making use of the mobile phone intervention. For example, the control group may gain the same information through a friend or contact who is part of the treatment group. Quantitative studies also tend to presume a unidirectional relationship between cause and effect where the direction is from the phone (independent variable) to the assessed (dependent) variables. However, reverse causation may also occur. For example, it would be important to understand whether use of a phone

stimulated greater income, or whether those on higher incomes were more able to afford and make better use of mobile phones. Establishing the direction of causality across a broad range of indicators within a scientific approach requires large samples and careful use of methodological and computational techniques, or alternatively, complementary use of qualitative means to understand the directionality of influence within the complex process chains that link variables. In either case, the challenges are significant due to the prohibitive costs associated with large-scale repeat surveys or the difficulty of assembling researchers with complementary skills. The quantitative studies surveyed demonstrate varying degrees of transparency in the way they deal with these methodological challenges, but in what is a nascent field of research, the degree of rigour they exhibit is to be welcomed.

A second group of studies can be found at the other end of the quantitative—qualitative spectrum. These also tend to be studies that exhibit a relatively high level of rigour, employing a varied set of qualitative methods that fall within the ethnographic research tradition – rooted in social method rather than scientific (Ureta, 2008; Jagun et al, 2007; Molony, 2007; Overa, 2006; Alampay, 2006; Horst & Miller, 2005). Conceptually, these studies are located in diverse disciplines (anthropology; information/management studies; development studies). Through necessity they also employ longitudinal designs that vary from six months to two years. Rather than addressing causal relationships, they are concerned with interpreting the meanings associated with the modified behaviours and practices which result from mobile phone use (output rather than outcome or broader impact). For example, both Molony (2007) and Overa (2006) demonstrate in their African studies, the importance of pre-existing networks of communication as the basis for positive outputs from use of mobile phones, enabling users to add value to (or make more of) pre-existing channels of communication between trusted partners. On the other hand, Horst & Miller (2005) point towards the establishment of extensive new networks of communication via cell phones in a Jamaican study, whilst Ureta (2008) finds that use of mobile phones amongst poor households in Chile is a result of exclusion from other more valuable networks. Such contrasting findings highlight both the strengths and weaknesses of qualitative research. The key weakness being that the use of small indicative samples means that findings can only be inferred within the particular context of the study, and validity of those findings will depend upon the detail and quality of the evidence provided, as well as the degree of triangulation used to cross-check data or demonstrate areas of contestation. The strength of qualitative research, however, is precisely that it is able to highlight the extent to which findings can be context-specific, which itself calls into question the credibility of the scientific approach when universally applied to a population that may exhibit considerable cultural differences.

The third, and largest group of studies, falls between the two methodological poles. These tend to employ mixed method approaches most commonly combining a questionnaire or interview survey with more in-depth key informant interviews or focus groups. With one exception (Aminuzzaman et al, 2003) they are snap-shot surveys that employ varying degrees of cross-sectional design. Conceptually, they tend toward social impact assessment, measuring indicators of network behaviour, trust and other aspects of social capital (Samuel, 2007; Walia & Goodman, 2007; Donner, 2006; Frost & Sullivan,

2006; Goodman, 2005). Other studies come more directly from a development perspective specifying indicators through use of a livelihoods framework (Souter et al, 2007). Batchelor & Scott (2007) is more overtly issue-based, focusing on the impact of mobiles on micro-payments for poor users and non-users. The objective of these (largely practitioner conducted) studies is to provide timely information on impact at a relatively low cost. In terms of contributing to stated programme and policy objectives they achieve their goal, but the rigour and transparency of their stated methods varies. Studies are less clear about whether or how they address the counterfactual, and tend not to employ sufficient triangulation of data sources to demonstrate validity. There is also limited method guidance. Thus, there is a challenge of creating the optimal mix of methods, and practitioner-led IA more often than not will be guided by what is possible, what is practicable, and what suits the requirements of the funding body. This may result in combining methods, which will likely have the effect of diluting the rigour evident at the qualitative and quantitative poles, but may provide for a more affordable and practical approach to IA that produces quicker results. Mixed method studies that are effectively designed and properly conducted can add value in comparison with single method approaches by combining correlative findings with further explanation of causation.

One key methodological gap in the studies surveyed, concerns lack of evidence of participatory methods or action research. This is surprising given the ground level nature of much m-development activity and the high degree of involvement of practitioners within m-development initiatives, as suggested in the introduction to this paper. One must assume that the lessons learned from this activity have not yet been translated into definable and publishable approaches to IA involving participatory methods. In this respect, m-development can be considered to be lagging behind other development sectors where participatory methods have been developed as a critique of positivist (both quantitative and mixed method) approaches (Mayoux & Chambers, 2005). It is also noticeable that the quantitative and mixed method studies surveyed provide little evidence (with some exceptions) of having made use of participatory methods in the process of developing indicators and survey instruments – or if they have, they have not been made explicit, and reported in the study.

The basic objective of participatory methods is to empower the beneficiaries of IA (either the final beneficiaries or those more closely associated with the m-development intervention). This combined with a focus on learning (termed participatory learning and action) seeks to justify the large amounts of resources expended on IA in terms of positive development outcomes that address local priorities (Mayoux & Chambers, 2005; Wright & Copestake, 2005). This is in contrast to other approaches that may be primarily directed at meeting the needs of funders or donors. In this sense participatory methods are purely focused on improving impact, and the subjective nature of the approach would tend to exclude it as a means to come to verifiable and generalisable conclusions. Table 5 provides a strengths and weaknesses overview of quantitative, mixed, qualitative and participatory methods in terms of their application to m-development IA, and according to: a) key features; b) main data collection methods; c) main research design requirements; d) main strengths; and, e) main weaknesses.

Table 5. Method Selection: Strengths and Weaknesses Overview

	Quantitative IA	**Mixed-Method IA**	**Qualitative IA**	**Participatory IA**
Key features	-Collects quantifiable data using random sampling and matched control groups, ideally setting baseline data within a longitudinal design	-Combines small-scale survey (ideally with a control group) with other cross checking methods	-Requires the researchers to be resident in the field for an extended period	-The IA beneficiaries form the starting point for the definition of indicators and research instruments assisted by a facilitator
Main data collection methods	-Sample survey (structured questionnaires) -Possibly field studies or experiments	-Sample survey (interviews or questionnaires) combined with key informant interviews or participatory appraisal.	-Participant observation as part of case study or other ethnographic techniques -May be combined with a small interview survey	-Group discussions, workshops, use of diagrams/oral tools
Research design requirements	-Careful attention to sample section, correct hypothesising of causal relationships, and accuracy/motivation of survey responses/respondents	-Careful balancing of methods and triangulation of data sources.	-Careful attention to quality of data/method and triangulation of data sources -Structured analysis techniques	-Understanding of the motivations and perceptions of the IA beneficiaries
Main strengths	-Provides quantifiable and comparable measures of impact -May satisfy the need for quantifiable impact findings from wider audiences -Can be seen to be representative of impact on a wider population	-Can produce quick results that are presentable and acceptable to outside audiences -Relatively low cost and quick turnaround	-Provides detailed data that can inform questions of attribution and causality -Can capture impacts not originally foreseen within the research design -Can gauge diversity of impacts according to beneficiaries' perceptions	-High beneficiary involvement and ability to contribute to impact improvement -Also captures many of the advantages of qualitative research -Gives rapid results that can be fed back into interventions
Main weaknesses	-Incurs high financial costs due to large sampling requirements and longitudinal design -Restricted to quantifiable indicators (says little about causation) -Time lag in results becoming available	-Usually based on relatively small samples from which it is difficult to produce valid statistical inferences -Can fail to identify important factors that exist outside the confines of the study	-Not representative of wider populations -Inability to measure a broader range of variables not connected to the immediate context -Difficulty in aggregating/ presenting findings in a structured way	-Objectivity of data is open to question -The nature of the method may make findings open to the criticism of bias towards one set of beneficiaries

Sources: Based on compilation of study findings and reviewed IA literature

D. Conclusions

As in all research, the choice of conceptual and methodological approach for m-development IA should be guided by the overall objectives of the study which are defined at the outset of the research process. This paper has suggested four key building blocks which should be central to guiding the choice of concepts and methods.

The first concerns the requirements of the beneficiaries. The studies surveyed vary considerably in terms of their scoping of beneficiaries. Academic studies conducted for the purposes of doctoral research or peer reviewed publication form the majority of the studies reviewed. As such, the choice of concepts and methods tends not to be guided by a clear understanding of the target audience, but according to the confines of the discipline within which the researcher is located. In this respect, most impact studies of m-development, thus far, have been discipline-led. On the other hand, the lesser number of studies conducted by practitioners are more clearly focused from the outset on satisfying the requirements of decision makers or those who are responsible for the management of interventions. The extent to which studies have attended to the requirements of final beneficiaries or other local and community stakeholders varies considerably. Overall, there is lack of evidence of incorporation of stakeholder views such as through use of participatory methods at the early stage of research processes.[xii]

The second building block refers to the types of impact to assess. Here, a distinction has been drawn between the assessment of output, outcome and impact. A reading of the studies suggests that most m-development IA provides findings of output and/or outcome rather than broader impact. These studies are more likely to contribute to improving impact at the level of the individual intervention. The lesser number of studies that seek to provide proofs of broader impact demonstrate varying degrees of methodological rigour. Such rigour will increasingly be required within m-development IA to inform higher-level policy and decision making processes (by governments, donors and the private sector) associated with larger-scale m-development investments. It is hoped that the categorisation of differing foci of IA along the m-development value chain will help to bring greater clarity for researchers at which point a particular study is aimed, and hence how it can be linked to an appropriate audience.

It has also been noted that most studies pan in on the mobile phone as the key independent variable. This provides for mobile-centric research, but negates the fact that mobile phones are not the only type of device that can be connected to a cellular network. The network allows a wide range of devices to be connected – computers providing greater scope for processing of data, and other hand-held devices that may be more suited to the needs of development practitioners. Thus, a focus on phones may create less scope for comparative studies, not only comparing other access technologies, but also non-technological means of facilitating communication, handling data and accessing information or services. Further, emphasis on the mobile phone artefact highlights the importance of the access device rather than the network and infrastructure that supports it.

The third is the unit of assessment. The reviewed studies have tended to specify units of assessment quite distinctly rather than addressing areas of crossover, or seeking to gain an understanding of a more complete household economic portfolio (drawing interconnections between individual, enterprise, household and community). This is because incorporating multiple units of assessment adds significantly to the complexity and the costs of the research design. However, the choice of a unitary measure can fail in identifying the true extent of crossover between individual, enterprise, household and community concerns, and this, combined with the high prevalence of shared user models in developing countries, may challenge conventional notions of defining units of assessment at the micro-level.

The fourth is not so much a building block, but a key point of decision for IA researchers concerning the extent, and the manner by which the choice of concepts and methods should depart from the conventional view. Where IA demands only answers concerning outputs and /or outcomes associated with the intervention, then there will be more scope to adopt wholly qualitative or participatory methods which are more suited to improving impact. However, if the requirement is for answers concerning broader impact on societal factors not directly connected with the intervention, then the key decision for the researcher will be the 'mix of methods' chosen from within the conventional view. This assumes that an exclusively quantitative approach (that contains sufficient rigour and size to inform policy) remains financially and logistically out of reach in most developing country settings. In this regard, the limitations of pursuing exclusively quantitative findings for policy purposes are evident in the reviewed studies where relatively small samples and coverage are a key constraint.

Thus, mixed method studies are likely to be the preferred option. Mixed methods seek to combine strengths of approaches (Table 5), with most of the surveyed studies seeking to combine a quantitative sample survey (with a range of depth of statistical inference evident) with qualitative data collected through interviews and/or focus groups. Thus far, m-development research that adopts mixed methods has offered little guidance for other researchers concerning methodology, and this reflects the overall lack of method guidance in this category overall. Resource constraints for conducting research are also evident from previous studies, suggesting a need to balance, not only methods, but also methods with available budgets for carrying out impact studies. Thus, Hulme (2000:89) concludes… "for studies of moderate budget (i.e., most studies) the best approach to ensuring validity of the findings will be through triangulation and using a mix of survey, qualitative and participatory techniques. The alternative, of trying to achieve a representative sample size on a limited budget, is likely to lead to severe losses in the quality of data and/or the representativeness of the sample".

As the value chain model (Fig.1) suggests, a move towards impact assessment necessarily involves greater attention focused on proving impact via objective means, and a move away from more subjective internal project monitoring and evaluation which can become self serving to the project or intervention. The danger, however, is that m-development IA (if it moves too far in the proving impact direction) can become disconnected from the requirements of the intervention and lean too far in the direction of donors and funding agencies. It is also likely that the results of IA will become available in a form that is inappropriate, and at a time which is too late, to

serve the needs of project beneficiaries. Thus, the central initial question concerning m-development IA choices remains – who is the intended audience and what is the primary rationale for carrying out the assessment?

If the requirement is to satisfy the needs of the beneficiaries at the project output level, then a number of alternative approaches to IA could be considered including process approaches that move away from external evaluation and look to integrating IA methods into the internal management structures of the project or organisation under review. This is likely to have more positive benefits for capacity building, empowerment and development of technical systems. If, however, there is an overriding need to demonstrate outcomes, and particularly broader impacts, then the key requirement will be to choose a mix of methods that can achieve that goal, whilst balancing budgetary constraints and maintaining a level of rigour in the conduct of research that would be expected from purely qualitative or quantitative studies. Finally, it is of utmost importance that all studies that are carried out pay particular attention to providing more detailed guidance on the methods adopted, and the challenges faced in their implementation.

E. References

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Endnotes

[i] For a recent overview of m-finance literature refer to: Duncombe, R.A (2009) 'Mobile phones and financial services in developing countries: A review of concepts, methods, issues, evidence and future research directions' *Centre for Development Informatics Working Paper No.37*, IDPM, University of Manchester, http://www.sed.manchester.ac.uk/idpm/research/publications/wp/di/di_wp37.htm

[ii] Refer to the Grameen Village Phone website for further information: http://www.grameenfoundation.org/what_we_do/technology_programs/village_phone/heritage/

[iii] Details of a wide range of text based m-development projects can be found at Kiwanja.net. http://www.kiwanja.net/database/kiwanja_search.php. Alternatively lists of projects can also be accessed via MobileActive.org. http://mobileactive.org/directory

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[v] For an analysis of the reasons for IS/ICT project failure in developing countries see: Heeks, R. (2002) 'Failure, success and improvisation of information systems projects in developing countries', *Centre for Development Informatics Working Paper No.11*, IDPM, The University of Manchester. http://www.sed.manchester.ac.uk/idpm/research/publications/wp/di/di_wp11.htm

[vi] The review was conducted by the single author. This means that the interpretation and categorisation of the methodological and conceptual approaches of the studies is in line with the author's perception of the field. In this sense the paper is, to some extent, reflective of the author's point of view, and should not be read as a completely objective view of the field of study.

[vii] On-line searches were conducted accessing a broad range of databases from within the social sciences – incorporating a broad range of disciplines – Economics, Banking and Finance, Development Studies, Business and Management Studies, as well as more specialised disciplines – Information Systems and Information and Communication Technologies for Development (ICT4D). Databases searched were: *ABI-Inform (ProQuest)*, *EBSCO Business Source Premier*, *Emerald Fulltext* and *Science Direct* as well as more general searches using both *Google* and *GoogleScholar*. Additionally, a number of websites specialising in the dissemination of research concerning mobile phones and development were searched (*kiwanja.net/ dgroups.org/ mobileactive.org*). Studies were included in the review on the basis of the author's perception of their importance to the field of study, and it is acknowledged that some relevant studies may have been omitted, although it is the author's belief that all major studies up until Dec 2008 have been included.

[viii] This example is drawn from a case study of m-development application for the cattle farming sector in Kenya. Full details are available from: Kithuka, J., Mutemi, J. & Mohamed, A.H. (2007) Keeping up with technology: the use of mobile telephony in delivering community-based decentralised animal health services in Mwingi and Kitui Districts, Kenya, *Farm Africa Working Paper No.10.* http://www.farmafrica.org.uk/view_publications.cfm?DocTypeID=11

[ix] Fungibility is the interchangeability of things that are identical or uniform. For example, the term is frequently applied to enterprise income because any given amount can be used interchangeably with any other amount. The use of financial resources is highly fungible as the household budget shifts between consumption and investment in response to changing needs and opportunities. The divide between business and personal assets is often not clear.

[x] Provision of '*detailed'* method guidance (typically covering two to three pages of notes) suggests that there was sufficient detail to be able to replicate the study. *'Some detail'* (typically less than one page of notes) indicates that whilst some areas of methodology were covered sufficiently, there were also gaps. '*Limited'* (typically one paragraph or less) suggests lack of guidance.

[xi] More information concerning the development of this framework can be found at CATIA (Catalysing Access to ICTs in Africa) http://www.gamos.org/influencing-policy/transformational-m-payments.html

[xii] A detailed exposition of the assessment of ICT pilot projects incorporating an approach that emphasises the early integration of stakeholder views is laid out by: Batchelor, S. & Norrish, P. (2005) Framework for the assessment of ICT pilot projects: beyond monitoring and evaluation to applied research, Information for Development Program (*info*Dev), The World Bank, Washington, D.C http://www.infodev.org/en/Publication.4.html