MICRO-ENTERPRISES AND INCLUSIVE INNOVATION: A STUDY OF THE KENYAN MOBILE PHONE SECTOR

A thesis submitted to The University of Manchester for the degree of Doctor of Philosophy (PhD) in the Faculty of Humanities

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Micro-enterprises and inclusive innovation: a study of the Kenyan mobile phone sector

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Micro-enterprises have traditionally been connected with goods vending or trading in developing countries. But, increasingly micro-enterprises are emerging which centre on information and communication technologies (ICTs) where such micro-enterprises tend to connect ICTs into low income customers.

Literature suggests that these enterprises are often unstable and have elements of informality, but they undertake innovative practices which are central both to building ICT-based livelihoods, and more widely to support the adoption of ICTs by low income users. Literature analysis suggests there are also gaps in knowledge around ICT micro-enterprises, particularly in understanding the link between innovative activity of micro-enterprises, and the wider conditions in ICT sectors. This thesis looks to explore these issues with the aim to build clear policy relevant understanding to enhance ICT micro-enterprises and low income-focussed ICT sectors.

Innovation system models are adopted which are well suited to analysing interactive activities around ICT innovations, but these models initially require some refinement to fit in with the low income delivery of ICTs. This is done through integrating notions of 'inclusive innovation' which consider innovation from the perspective of wider development outcomes, and allow integration of a more diverse range of actors and processes around innovation. These models form the basis of qualitative study on the mobile phone sector in Kenya, with findings providing significant new insights.

Firstly, empirical work is used to examine inclusive innovation models and refinements to innovation systems models are suggested based upon empirical work. Innovation needs to be conceptualised in minor processes, as well as the inclusion of wider intermediary actors and a more contextual examination of relations and institutions.

Secondly, drawing on this model, it is found that the innovative activities of a range of systems actors, including micro-enterprises are vital to push innovations to be more inclusive. Thus, relationships that enable interactive learning between system actors, notably between ICT producers and demand-side intermediaries can support innovation. Crucially, where 'reverse' flows around innovation can be enabled and supported, then innovation tends to become more inclusive.

Thirdly, policy plays a role in inclusive innovation. In one sense, conventional policy approaches in systems models hold: coherent underlying policy drives competitive markets. However, evidence also suggests that specific 'inclusive' policies for low income market might be successful. From a wider institutional perspective it is also important to analyse policy weaknesses which can lead to problems amongst ICT micro-enterprises, and these can be detrimental to an inclusive innovation system.

In sum, this thesis makes contributions in a number of areas. Conceptually, it extends system models and offers one of the few empirically grounded studies of inclusive innovation, drawing on this ICT case. Thus, these findings potentially have applicability to examine other innovations in low income markets in developing countries. For ICT sectors with a focus on low income consumers, this work highlights new policy relevant approaches to analysing such sectors and provides knowledge about how to push innovation in the ICT sector which is more inclusive, particularly by better consideration of the important role of ICT micro-enterprises.

Declaration

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Copyright statement

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Glossary of terms

Below a set of common abbreviations and terminologies used in the thesis are outlined for reference:

Agent: Provides cash to e-cash conversion for the M-Pesa service.
Aggregator: From the later model of M-Pesa, an M-Pesa manager of other agents.
Askari: Swahilli slang refers to local law enforcement and inspectors.
BoP: Base/bottom-of-the-pyramid.
Branded phone/mobile suppler: Multinational handset brands.
CCK: Communications Commission of Kenya, Kenya's telecom regulator.
Chinese phone/mobile supplier: Phones that come from Chinese-based suppliers.
Commission: Payment that M-Pesa agents receive for conversion processes.
Corridor: Shared downtown spaces used for small business in Nairobi.
Counterfeit phone: Mobile phones which mimic elements of branded phones.
Dealer: Large operator approved intermediaries reselling airtime in the mobile sector.
Dedicated Distributor: New generation of mobile phone handset distributors.
Deposit: M-Pesa conversion of e-cash to cash.
DFID: Department for International Development, UK development agency.
e-Cash: Virtual cash, held by an M-Pesa user on their phone.
Float: Cash and e-cash reserves held by an M-Pesa agent.
Float Balancing: Cash and e-cash exchange where float levels become uneven.
Grey market phone: Imported phones not officially licensed for country.
Hawker: Street seller of goods, often unlicensed.
ICT: Information and Communications Technologies.
Jua Kali: Swahilli term referring to less formal small scale manufacturers.
KSh: Kenyan shillings
Master-agent: M-Pesa agent who manages sub-agents.
MFI: Micro-finance institution.
MoP: Middle of the pyramid.
M-Pesa: Safaricom's mobile money service in Kenya.
MSE: Micro and small enterprise.
Mutatu: Common cheap shared taxi van services used by low income Kenyans.
P2P Transfers: Person to person transfer in M-Pesa.
ROSCA: Rotating Savings and Credit Association, saving groups.
SACCO: Savings And Credit Co-operative, common co-operative form in Kenya.
Sub-agent: M-Pesa agent underneath a master agent.
Safaricom: Kenya's largest mobile phone operator.

Sim card: Card inserted in a mobile phone that allows connection to a mobile operator.

SME: Small and medium enterprise.

Withdrawal: M-Pesa conversion of e-cash to cash.

Preface

During several periods spent working in East Africa, I was always curious as a former IT worker, to see first hand the role that ICT innovation can play in the development of these countries. But, I was always disappointed that on talking to people and walking the streets, that ICT barely made an impact outside a few projects, often emerging through the elite in the big cities.

But, then it stated to slowly appear. In Dar-e-Salaam I lost my mobile phone one day, and I was persuaded to go and buy a new one from the 'market', where I found myself in the cramped streets of Kariakoo surrounded by the vibrant activity of all types of electronic vendor - mobile phone, PCs, pirate movies and cybercafés. Eventually I managed to poorly negotiate an unmarked $40 phone with more features than the expensive one I had lost.

It was after this that I realised that I was looking for ICT innovation in the wrong places. It wasn't in the Western style ICT shops that I should be searching, but in the activity of the informal street traders selling to the poor consumers. Later I began to intentionally interacting with these innovative entrepreneurs; in a mobile money kiosk in Mombasa an agent helped me reserve a hostel using a new money transfer service, and an electronics repairer I met in Kigali cheekily tried to persuade me to buy him some goods from the internet with my credit card to help him start a device unlocking business!

Searching the academic databases on my return to the UK, I entered a few keywords: 'informal ICT'; 'ICT micro-enterprise', 'urban ICT developing country' expecting to find a wealth of literature outlining the significance of these ICT enterprises, but I found little. A few conference papers here and there, an occasional mention in a report never officially published.

It seemed that like me before my trip to Kariakoo, ICT study had been caught up looking for the great ICT innovation, and that those entrepreneurs – in the markets and kiosks focussing on poor consumers - were nearly invisible…..

Notice of Publication

Parts of this thesis have been published, or are pending publication in the following peer reviewed journals (available on request):

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1. Introduction

1.1. The emergence of ICT micro-enterprise

Small and informal micro-enterprises have traditionally been connected with goods vending, trading, or small-scale industrial processes in developing countries (Brown 2006, King 1996). But, increasingly micro-enterprises are emerging in developing countries which centre on information and communication technologies (ICTs).

In many of these enterprises, ICTs are not a peripheral component but fundamental to the existence and operation of the micro-enterprise, ICT playing a central role in new firms or to transform existing firms (e.g. Lugo & Sampson 2008, Rangaswamy 2009a). Micro-enterprises of this type are particularly part of the ICT producing sector for developing countries (UNCTAD 2011).

Such ICT micro-enterprises tend to take two key roles (Ouédraogo 2009). First, they play a part in production of ICT goods (such as PC assemblers and multimedia production). Secondly, they play a role closer to consumers, either through adding value to existing ICT based products and services (such as provision of small cybercafés, ICT training or mobile phone repair services) or in retail provision of ICT goods and services (such as mobile phone top-up cards, mobile money services and payphone services). What is common in all these roles is that often ICT micro-enterprise activity connects between ICT innovations and low income customers.

Focus in this thesis is towards examining these ICT micro-enterprises, particularly the locally innovative activities which link ICT innovations into low income users. Analysis of such firms is crucial in that such work occupies the intersection of two crucial processes: the core livelihoods activities of the poor as actors in such processes of innovation, and the growth of ICT innovations focussed on low income groups in developing countries. Thus, this research can be seen to play a role in exploring the link between these two processes, understanding the changing nature of ICT innovations as they diffuse amongst the poor and in considering the innovative practices of such groups as ICT is adopted.

Literature will be outlined that shows the growing number of ICT micro-enterprises in developing countries. In such firms it will also be shown that where ICT is the centre of their daily practice, behaviours tend not follow conventional managerial models of enterprise type, growth profiles or patterns of entrepreneurship. Thus, at present the

research agenda on such actors in unclear, particularly in linking them into wider understandings around ICT innovation.

1.2. Rationale

In this section, some basic understanding of the roles and activities of ICT micro-enterprises is introduced. This is done by drawing on the established literature on (non-ICT) micro-enterprises in developing countries, and considering links into ICT micro-enterprise. This results in the construction of an overall aim of research for the thesis.

1.2.1. Benefits from being involved in 'production'

For several decades, the literature on micro-enterprises has recognised that they play an important role in the livelihoods of lower income and marginal groups in developing countries, by allowing such groups to be involved in productive side of the economy (Hart 1973, King 2001).

Such productive roles provide jobs, particularly for those 'pushed' into self-employment for lack of other options (Mead & Liedholm 1998). Micro-enterprises can also dynamically grow to become more significant, but this tends to be a small minority. Typically enterprises struggle to grow, seemingly limited by 'growth ceilings' - cost, skill, resource and technology barriers in production that limit a move into more dynamic growth (King 1996, Palmer 2007).

Nevertheless, even without a clear path to wider firm and economic growth, productive involvement in micro-enterprise can play a significant role for less affluent groups in developing countries. Firstly, employment and income from micro-enterprise serve an important role in poverty reduction amongst low income groups (La Porta & Shleifer 2008). Secondly, even without dynamic expansion, enterprises contribute to growth of knowledge, capabilities and skills through learning and interacting that are crucial in ensuring the livelihoods and agility of such lower income actors (Bell & Albu 1999, Mead & Liedholm 1998). Thirdly, from a social development perspective, other less economically tangible benefits can accrue from being involved in such productive activity, such as empowerment and community position.

From the perspective of ICT micro-enterprises, these are somewhat different to traditional micro-enterprise. Emerging products and services are constantly in a state of flux, with changing trends and improving technology (Sey 2008). For ICT micro-enterprises, whose roles link into these products and services, this offers a potentially more vibrant source of micro-enterprise activity. ICT micro-enterprises can offer 'safety nets' to quickly provide low level income and jobs (Rangaswamy 2010b), whilst

the flexible and dynamic nature of ICTs (including the digital nature of production and/or digital products) offers intriguing potential for entrepreneurs to build ICT skills, through learning and interacting (Bell & Albu 1999). Thus, better understanding of ICT micro-enterprise will look to how the sector might provide employment and growth in such knowledge-based sectors and the active activities that ICT micro-enterprises undertake to secure their livelihoods. At the same time, these constant changes provide a highly unstable environment for micro-entrepreneurs looking to build secure livelihoods in the long term (Rangaswamy 2010b).

1.2.2. Consumption and the role in growth of ICTs

Micro-enterprises can also play a positive role in consumption through provision of appropriate goods and services for marginal groups (Brown 2006, de Soto 1989), and this aspect is especially important in terms of ICT innovations.

In developing countries, recent years have seen the rapid expansion of connectivity and availability of ICTs with growing adoption of ICTs even amongst less affluent groups. However, the way that such innovations have been adopted and used, particularly by those less affluent groups, is often in unexpected ways, outside those expected by ICT designers (Heeks 2010, UNCTAD 2010). Understanding this activity allows a better insight into how ICT innovations are having 'impact', and how to promote these impacts (Heeks 2008a). Thus, understanding ICT micro-enterprises that are closer to low income users, and examining their role in processes of ICT growth is a crucial element in exploring the consumptive benefits of ICTs. So far, from this perspective micro-enterprises have often been underplayed in the literature, yet they may be central to the approaches which drive availability and usage of ICT innovations amongst the poor (Szogs et al. 2011).

1.2.3. Micro-enterprises as linked into wider networks and policy

Work has argued that it is important to consider micro-enterprise relations with wider firms - who supply goods and make rules – and how this influences the activity of micro-enterprises (Castells & Portes 1989, Palmer 2004). Further, the role of policy and intervention on such micro-enterprises is not one that should be ignored, with both macro-level policy and local rules of enterprises potentially playing a role in growing and shrinking such sectors (King 1996, Liedholm & Mead 1999, Portes et al. 1991).

As alluded to in the consumption section, network considerations are also particularly relevant in the case of ICT micro-enterprise, with the suggestion that ICT micro-

enterprises play a role in diffusing ICTs and ICT services created by larger, potentially multinational firms (Cheneau-Loquay 2010, Sey 2008). The relationships between ICT micro-enterprises and these large enterprises will thus impact on the activity of ICT micro-enterprise (Mujica 2007).

There is also evidence that policy considerations are very relevant to this ICT micro-enterprise research. Work so far has particularly referred to the role that specific ICT policy itself plays in isolated cases, but wider and systemic analyses of policy have not been made (Galperin & Bar 2006, Qiu 2007). Intuitively, some (non-ICT) micro-enterprise policy concerns such as local rules and enterprise regulations are also likely to be relevant for ICT micro-enterprise, given that such enterprises also occupy similar informal spaces as conventional micro-enterprises.

In sum, by acknowledging this link of ICT micro-enterprise to wider policy and connections, it is appropriate to consider this research as one that whilst placing ICT micro-enterprise as the central concern, both in productive and consumptive spheres, will consider these actors as part of wider relationships and networks of ICT supply and policy.

1.2.4. Summary

From this outline, a rationale for a major analysis of ICT micro-enterprises can be seen to extend understanding of ICT in developing countries in three essential ways. Firstly, on the productive side research can provide insight into ICT learning, entrepreneurship and employment that can be gained in microenterprises as part of building livelihoods in developing countries. Secondly, micro-enterprises are active and innovative in driving consumption of ICT to low income consumers. Thus, analysis of ICT micro-enterprises has value in more clearly understanding the nature of delivery of ICT into less affluent groups. Thirdly, in highlighting the network and policy elements linked to ICT micro-enterprise, research will need to move away from solely focussing on ICT micro-enterprise, to acknowledge that these productive and consumptive benefits are not solely in the hands of micro-enterprise actors, but are part of wider flows of connections and influences.

Following this outline, a general overarching aim of this research can be defined which will shape the mode of investigation:

To more clearly understand the activities of ICT micro-enterprises in developing countries, and how related firms and policy can support or inhibit such ICT micro-enterprises.

1.3. Research problem

Whilst there is evidence of growing numbers of ICT micro-enterprises, and increasing interest in such actors, the literature is highly fragmented. This will be explored in more detail in Chapter 2, so here the basic knowledge gaps and what this means for research are briefly highlighted.

ICT micro-enterprise studies have focussed, to date, on detailed descriptive or ethnographic analysis of a particularly ICT sub-sector (such as mobile phones or IT). This work illuminates the entrepreneurial, often innovative practices that take place in micro-enterprises, and central to ICT's relevance for low income consumers (e.g. Chipchase & Tulusan 2006, Rangaswamy 2009a). But, there is a lack of knowledge related to analysing, the connection between wider networks and policy related to ICT micro-enterprise and their innovative practices.

The result of this is twofold. Firstly, micro-enterprises often linked to low income ICT users, remain peripheral in discussions of ICT for development concerns. The strong focus at a micro-level has also resulted in lack of clear analytical conceptualisations. Secondly, stemming for this point, this literature illustrates that there are clear gaps in our understanding of wider processes ICT innovation for low income groups, and a lack of clear and complete conceptualisations, particularly with respect to the role of micro-enterprises.

It is argued that a more 'linked' perspective can help to solve these dual problems. By locating micro-enterprises as an actor linked into wider processes of ICT innovation, such linked perspectives can better understand productive and consumptive benefits, particularly by building knowledge of often 'indirect' influences on localised ICT innovation. In wider policy terms, the knowledge gap connects with building recommendations and policy understanding of such informal ICT micro-enterprises, and how their activities effect employment and delivery of ICTs to poor consumers.

1.4. Research aims and objectives

Given the fragmentary nature of the academic literature which has examined micro-enterprise and ICT innovation for low income groups, it is prudent to firstly explore this literature in more detail before constructing specific research questions.

Here drawing on the previous section, a set of three very general objectives is introduced which shape the mode of investigation:

Aim:

To more clearly understand the activities of ICT micro-enterprises in developing countries, and how related firms and policy can support or inhibit such ICT micro-enterprises.

Research Objectives:

1) *To provide a clearer picture of ICT micro-enterprises, and to link to frameworks or models, if necessary refining these frameworks in light of empirical understandings.*
   As outlined above, starting from an exploration of existing work on ICT micro-enterprises is made. This literature is framed within a more general lack of knowledge around ICT innovation and low income groups and models which allow researchers to move from examining ICT micro-enterprises at a micro-level to wider, cross-sectoral analyses of innovation are sought. At this stage, it will be essential to examine the applicability of models selected and how appropriate they are in light of empirical investigations.
   (This objective is principally addressed in Chapters 2, 3 and 6.)

2) *Drawing on empirical data, to examine how such frameworks and models expand insight into the productive and consumptive role of ICT micro-enterprise.*
   From this more solid and wider conceptual position, an more linked analysis of ICT micro-enterprise based on models that include core innovative activities can serve to build better knowledge and better understand their productive and consumptive roles of micro-enterprise and link into wider understanding of innovation s for low income groups.
   (This objective is principally addressed in Chapters 6 and 7.)

3) *To analyse the implications of this work for the actors and actions which support ICT micro-enterprise.*
   Drawing on the outcome of this research work, it is prudent to connect this into more policy relevant research, drawing on empirical study which might help to maximise the potential of ICT micro-enterprises from the two perspectives of benefit (productive and consumptive) mentioned. Given the framing of this work around wider processes of ICT innovation, this will likely encompass both direct activities (i.e. supporting micro-enterprise) and indirect ones (i.e. supporting ICT innovation for low income groups more generally).
   (This objective is principally addressed in Chapter 8 and 9.)

1.5. Organisation of thesis

The key concepts that emerge from these objectives are summarised below:

1.5.1. Linking ICT micro-enterprise into wider frameworks around innovation

Given the relative immaturity of the literature in this area, detailed analysis of the literature on ICT micro-enterprise (**Chapter Two**) reveals three key themes. Locally relevant innovation tactics undertaken by micro-enterprises are a core element of enterprises as well as key in how ICT innovations become relevant to low income groups. Additional themes highlight the presence of ICT networks and supply chains in influencing such tactics, but that these innovation tactics tend to be unstable in changing contexts.

While there are few clear theoretical directions, two focal areas appear in this literature (implicitly): the appropriation of technology, and the concept of micro-enterprise 'informality' in developing countries. An in depth analysis of the literature in these two areas highlights knowledge gaps that this work seeks to explore. This relates to the fact that ICT micro-enterprise literature focuses on 'the local', and specifically local technology appropriation and micro-enterprises. These elements are vital for understanding these firms, but there is a lack of knowledge of how such firms connect into wider actors that influence these processes, both in terms of networks of ICT supply and wider policy making.

Thus to tackle this knowledge gap, ICT micro-enterprise study needs to be recast as a study of the wider elements and policies around ICT innovation for low income groups. Thus, models will need to examine unstable but innovative practices within wider relationships in the ICT sector, and in wider conditions of economic production.

Given this knowledge gap, a number of models are examined which have the potential to provide this wider insight linking to the key themes that were identified in the literature, and potentially useful aspects of these models are discussed.

1.5.2. Exploring inclusive innovation systems

Innovation systems are a set of approaches that could allow a perspective on both the local activity and wider connections of micro-enterprise. Thus, innovation systems approaches are investigated in more detail as a potential conceptualisation for this thesis (**Chapter Three**).

Core elements of the innovation system literature are found to be well suited to analyse the wider systemic activities connected to ICT micro-enterprise, but their

predominant use within globalised industrial sectors, mean that models require some refinement for the low income ICT innovation contexts in developing countries which are part of this analysis.

Research also suggests that emerging literature on 'inclusive innovation' will be an important element of study, which refines innovation system models to analyse innovation which connects not only to growth but to wider development outcomes of innovation, such as livelihood outcomes and inclusive products that emerge in innovation processes.

Thus, drawing on these two observations, a number of refinements are suggested for innovation systems models that can make them more appropriate for this research. In particular, approaches which position micro-enterprise local market activity around innovation as part of wider processes of innovation, where interactive learning, relations and institutions orientate their efficacy. From this analysis, it is suggested that there are still a number of knowledge gaps in conceptualisation which require empirical research work to clarify.

1.5.3. Kenya: a growing sector of ICT innovation

Empirical research to examine ICT innovation took place in Kenya, drawing mainly on qualitative work in the mobile phone sector in 2010 and 2011. An outline of the selections and methodology is made in **Chapter Four**.

The work illustrates the previous arguments of a growing importance of ICT micro-enterprise and both the productive and consumptive benefits of their involvement through a case study of the mobile phone sector in Kenya, taken as a sectoral innovation system (introduced in **Chapter Five**). Two specific mobile phone innovations in Kenya are analysed in more detail within this case. Cash conversion 'agents' in Kenyan mobile money innovations, provide employment for over 30,000, many in proximity to less affluent users, and these micro-entrepreneurs have taken a central role in driving this mobile money service to its success. In mobile handset selling channels which focus on less affluent groups, micro-enterprise roles have become a significant employer, particularly for ICT-savvy young entrepreneurs, and the activities undertaken illustrate the potential and limits of ICT micro-enterprise being part of such channels.

The study principally draws on interviews with micro-enterprises, and links these to other actors in the innovation system, to analyse the nature of inclusive innovation, drawing on systems models.

1.5.4. Extending systems of innovation for inclusive innovation

Given the knowledge gaps in the inclusive innovation literature, and its unclear application in such a study of ICT micro-enterprises, models are clarified and refined in the light of empirical research (**Chapter Six**). In particular, focus is made on the notions of innovation, to conceptualise the small and sporadic activities around innovation observed in ICT micro-enterprises in field study within inclusive innovation models, and in understanding actors as *innovative intermediaries* for local markets, as part of systems that also include other intermediaries and lead firms. From these results, the conceptual models are adapted and thus, this analysis helps answer the first research question of building appropriate models.

1.5.5. Relations and innovation

Drawing on this clarified model it is argued that systems relations, particularly in relations of ICT supply are vital to orientate innovation in these cases. Thus, systems relations and their effect on ICT micro-enterprises are examined in this case (**Chapter Seven**), looking to substantively answer the second aim of this thesis.

In line with systems models, dynamic analysis of the Kenyan research shows varying modes of innovation in the two sub-sectors analysed, but a crucial commonality is the role that innovative activities by non-lead firm actors, particularly micro-enterprise play in driving innovations towards low income users. Thus, the way in which systems actors connect and learn from such activity through network relations is vital to considering inclusive innovation.

In terms of models, this is particularly well encapsulated within the systems notion of user-producer interactions, which provides a potential framework to conceptualise the link between relations and innovation. User-producer relationships in these unfamiliar, complex and reconfigurable networks are particularly defined by indirect elements of managerial and technical control, in their throughput of rules, monitoring and technological 'objects'. Relationships with an excess of these elements risk inhibiting interactive learning, particularly 'reverse' flows around innovation driven by micro-enterprises.

In other cases where relations into micro-enterprises are marketised, relationships are defined by many small actors and much intermediation in networks. Whilst this tends to lead to some leeway for autonomous 'local' innovation, if relations are disconnected, innovation is not absorbed and supported by lead firms, then innovation will only diffuse locally leading to system mismatches and a problematic effect on both the stability of ICT micro-enterprises and innovation in the longer term.

Thus, from a systems perspective, adapted user-producer interaction models help to consider the balance between networks, network relations and understand what this will mean in terms of inclusive innovation.

1.5.6. Policy and inclusive innovation

The dynamic analysis of innovation from above also highlights wider policy drivers and inhibitors of inclusive innovation as systems emerge, in line with what would be expected in systems models. Thus to provide insight, evidence is examined around the link between policy and inclusive innovation (**Chapter Eight**). This analysis substantively answers the third question in the thesis.

In one sense, evidence corresponds to policy discussion taken by conventional innovation systems models: having the 'right' rules and coherent underlying policy making can drive competitive markets and provide a solid foundation from which inclusive innovation will be driven. In the case of the ICT micro-enterprises this relates to both core enterprise policies which improve the stability of firms, as well as sound underlying mobile sector policy, particularly regulation and competition where inclusive innovation and sectoral growth tend to be complimentary.

The Kenyan case also suggests that specific, more active drivers of inclusive innovation (and consequently ICT micro-enterprises) are worthy of consideration. These relate to the nature of these low income innovation systems. Given systems have been positioned as traversing the supply- and demand- side, both active supply-side and demand-side policies can support inclusivity. Policies supporting the emergence of inclusive innovation objects and inducing low income market demand are particularly highlighted as relevant from findings. Centrality of ICT micro-enterprises in these systems also implies the importance of both regulatory and specific policy measures around stabilising and supporting micro-enterprise as part of inclusive innovation.

By taking a wider institutional approach to analysing inclusive innovation, research findings at a micro-enterprise level also highlight further considerations given the often indirect linkages of policy to micro-enterprises. Policy lacks can lead to problems amongst ICT micro-enterprises where vacuums and the resultant contestations are a limitation to inclusive innovation, and these lead to instability in the innovation system.

1.5.7. Original contribution of work

In sum, this thesis can be seen to make novel theoretical contributions and offer advice for practitioners in a number of areas. It also offers a number of directions for further research, which are discussed in length in **Chapter Nine**

First, it highlights the area of innovation for low income groups in developing countries as being under conceptualised. This work specifically offers new approaches to analyse emerging ICT sectors and the key role of ICT micro-enterprises more coherently.

In terms of models, this work critiques and extends systems models as well as offering one of the few empirically grounded studies of inclusive innovation models, drawing on analysis of ICT innovations. This work thus also has a wider conceptual potential to provide insights into how systems models can provide a clear understanding of networks of actors who are part of innovation for low income markets. In terms of the wider development literature, it can also be seen to contribute to the emerging interest in incorporating models of innovation into development, which can have wider applicability to examine other innovations in low income markets in developing countries.

Second, drawing on these adapted models, the analysis of the Kenyan cases of ICT innovation is also novel, in the way that both local, contextual and lead firm driven innovation are combined in the analysis, and how this is resolved in systems models. The approaches used here provide insight for other research studies which seek to analyse this union of innovation actors.

Third, this work highlights coherent models for researchers which can lead to policy relevant knowledge about how to push innovation in the ICT sector which is more inclusive, particularly in centring the role of ICT micro-enterprises. Using inclusive innovation models offers a systemic approach which provides a new direction for more clearly examining such local market focussed innovations that can lead to clear policy suggestions, something that has been underplayed in the low income focussed ICT sector to date.

2. Linking ICT micro-enterprise into wider concepts

2.1. Introduction

The purpose of this chapter is to examine the knowledge gaps around ICT micro-enterprise, and build on the research objectives first introduced in the previous section, as a first step to more in depth study.

The chapter starts by examining the current state of knowledge on ICT micro-enterprise in developing countries to outline directions for research. Initially, a clear set of definitions which clarifies the terminology of ICT micro-enterprise is examined. This allows the appropriate literature to be selected for review. The literature related to ICT micro-enterprises is thus reviewed, focussing particularly on two sub-sectors of ICT entrepreneurship, around mobile phones and digital video production to provide insight. Three key themes are addressed drawn from this literature – the centrality of locally relevant appropriation for low income customers, the instability of these innovation tactics in changing contexts, and the importance of networks and supply chains.

Secondly, conceptual approaches related to ICT appropriation and informality are examined in more detail as concepts which have been referred to implicitly in this literature. Drawing on more detailed literature analysis of these conceptual approaches, key gaps in present knowledge are identified with relation to ICT micro-enterprises. These particularly highlight that research has made a close focus on the localised innovative action and entrepreneurship of such micro-enterprises and their instabilities, but treated these elements as isolated from the wider economy.

Thus, there is a knowledge gap regarding how wider conditions influence activity of ICT micro-enterprise. Research has rarely examined the link between the processes of locally relevant innovation in micro-enterprises and networks, particularly relating to ICT supply chains. Equally, there is a gap in analysing the informality of ICT micro-enterprises from the perspective of wider understanding of ICT innovation for low income groups. These gaps in knowledge reduce the ability to form policy relevant

understanding of the wider developmental position related to the productive and consumptive benefits outlined in the previous chapter.

Having highlighted this gap in the literature, this ICT micro-enterprise study is concequently framed around understanding processes of ICT innovation for low income groups, of which these micro-enterprises are one part. The broader development literature is reviewed to examine approaches that could conceivably be used to link between these ICT micro-enterprise and the wider actors, networks and conditions related to ICT innovation. Three conceptual literatures are examined: enterprise clusters and value chains, literature on base-of-the-pyramid markets, and innovation systems. The respective merits of these approaches are analysed, and elements which provide potential for use in the remainder of this thesis are highlighted.

2.2. Defining ICT micro-enterprise literature

Before undertaking the literature review, it is important to more clearly define 'ICT micro-enterprises', which will determine the literature which is included within the review. This is done by first clearly defining micro-enterprises, and secondly in fully understanding the concept of 'ICT' within these enterprises. From this, the literature to be reviewed is briefly summarised, illustrating the extent and potential for ICT micro-enterprise.

2.2.1. Defining micro-enterprise

There are multiple approaches in the literature to defining micro-enterprises: according to financial size, number of employees, sector, location or market focus (Mead & Liedholm 1998). The other major identifier of micro-enterprise in developing countries refers to its predominant market-orientation, as opposed to household redistribution or gifting practices (ibid.).

In developing countries, given the difficulty in ascertaining other figures, number of employees has become a de-facto standard approach used as the way of determining micro-enterprise (Nichter & Goldmark 2009). Whilst size limits can vary, typically a small enterprise is defined as one with fewer than 50 employees, with a micro-enterprise being one with fewer than 10 employees (OECD 2005). Following on from this OECD definition, 10 employees is used in this thesis to denote a micro-enterprise. However, in line with the literature, micro-enterprises will tend towards the lower end of this scale, the majority being single person enterprises (Mead & Liedholm 1998).

2.2.2. ICT micro-enterprises

The terminology 'ICT micro-enterprise' is used to denote an *extensive* ICT micro-enterprise, that is a micro-enterprise which use ICTs as the *key input for new products and services as opposed to enhancing pre-existing ones* (Heeks 2008b). Examples of literature on micro-enterprises and ICTs in developing countries is presented in Table 2.1 below, and divided into those which are 'extensive' or not:

Outline	Literature	Type
Practices of mobile phones adoption in existing micro-enterprises	(Donner 2005, Donner 2004, Jagun et al. 2008, Molony 2007)	Non-extensive
Role of ICTs and connectivity within existing micro-enterprises	(Duncombe & Heeks 1999, Ilavarasan & Levy 2010)	Non-extensive
Formal ICT focussed 'start-up' firms and conditions in developing countries	(Agboma 2010, Excelsior Firm 2010)	Extensive (but less focus on lower income users)
ICT micro-retailers for low income customers *(mobile sellers, PC sellers, mobile money provision, mobile top-up, payphones)*	(Burrell 2010, Cheneau-Loquay 2010, Chipchase 2009, Collings 2011, Mas & Siedek 2008, Mujica 2007, Sey 2009, Sivapragasam 2009)	**Extensive**
'Value added' ICT retail services to low income users *(IT training, PC assembling, services, mobile recharging, mobile repair, cybercafés)*	(Cheneau-Loquay 2008, Fluitman & Momo 2001, Oyelaran-Oyeyinka 2007, Rangaswamy 2008, Rangaswamy & Nair 2012, Roy & Wheeler 2006)	**Extensive**
Entrepreneurs in ICT production for low income consumers *(film production, media production, internet activities)*	(Floyd 2008, Impio et al. 2008, Kolko & Putnam 2009, Larkin 2008, Mansfield & van Oosterhaut 2007, wa Mungai 2008)	**Extensive**
Entrepreneurs in ICT infrastructure provision for low income users *(localised internet provision, micro-telcos)*	(Galperin & Bar 2006, Gordon 2004, Southwood 2007, Wu & Zhang 2009, Yam Pukri 2010)	**Extensive**

Table 2.1: Literature on ICT and micro-enterprises in developing countries

The definition of *extensive ICT micro-enterprises* is significant in differentiating it from *non-extensive* ICT use within existing micro-enterprises; such as ICT adoption in retail, handicraft, tourism micro-enterprises etc. In non-extensive cases, evidence suggests that where ICTs are adopted into existing firm functions, whilst aiding transactions, interactions and collapsing spatial distance, they tend to be adopted in

gradual and peripheral ways. Thus, evidence suggests that such adoption does not typically lead to wider transformations of an SME's practices or structures driven by these ICTs (Donner & Escobari 2010).

This study of *extensive* ICT micro-enterprises is markedly different, as shown in the nature of extensive categories in Table 2.1. Where ICTs are central to operation of the micro-enterprise it is not possible to gradually modulate ICT into existing practices over time. The literature on extensive micro-enterprises suggests firms embrace technology more dynamically. Technology use, and enterprise behaviours are likely to be markedly different to those in non-extensive enterprises (Rangaswamy 2009a).

As shown in the table, research has also been done on extensive ICT micro-enterprises amongst higher skilled entrepreneurs looking to grow into the formal IT sector in developing countries, particularly a growing interest in 'start ups' involving technically educated graduates. Whilst there is likely to be parallels in this research, such activities where both productive and consumptive elements of micro-enterprises relate less to lower income actors can diverge in some ways from the current focus (Excelsior Firm 2010).

ICT micro-enterprises are taken using a wider sense of information and communication technologies, moving beyond the core IT understanding of PCs and internet to consider wider technologies (such as mobile phones and multimedia production). This is a deliberate choice, which allows a link between a wider set of parallel ICT-led practices that ICT micro-enterprises are involved with. ICTs are delineated as including only 'digital ICTs' thus excluding some older ICT micro-enterprises such as those around radio, cassette, newspapers and poster production (Manuel 1993, Takahashi 2000). Again, such research displays some parallels to present research. However some differing properties –more established technologies and simpler forms of service – must also be acknowledged and these are therefore set outside the boundary of the current work.

In Table 2.1, a number of examples of extensive ICT micro-enterprise are shown. As can be seen, such enterprises exist in a number of sub-sectors and connect to various positions in the processes of production and consumption of ICTs. The majority of literature points towards ICT micro-enterprises close to the consumer; selling ICTs and services into low income consumers, both in a 'simple' retail role, and through a specific 'value added' role where existing ICTs are modulated for such consumers. There is also some literature that highlights a growing number of micro-enterprises involved in earlier stages of production using ICT to produce goods and services for low income groups. Examples of this include work on media production activities and infrastructure provision.

In line with the rationale introduced in Chapter 1, a preliminary examination of the literature supports both the productive and consumptive potential that such ICT micro-enterprises can be seen to play, related to low income consumers in developing countries as outlined below.

Micro-enterprises in production

Few analyses have examined in detail the wider productive roles of extensive ICT micro-enterprises that were outlined in Chapter 1. Nevertheless, rough estimates indicate that the employment associated with such ICT micro-enterprise is significant in developing countries. For instance a UNESCO/Orbicom project on measuring the size of the ICT sector, reported that in Cameroon 'informal' ICT roles, that tend to align with the types of ICT micro-enterprise outlined here, provided an estimated 46,000 jobs (Nzepa et al. 2011). In addition, research by the GSMA of the mobile sector in Pakistan (in 2007) and Kenya (in 2010) indicated informal mobile employment might be around 148,000 and 189,000 respectively (Deloitte 2008, GSMA 2011).

Micro-enterprises in consumption

ICT micro-enterprises play a role in how ICTs reach lower income consumers in developing countries. This is highlighted in work in the mobile phone sector. Figure 2.1 depicts the relative distribution of total mobile sector employment in production roles in four selected developing countries.

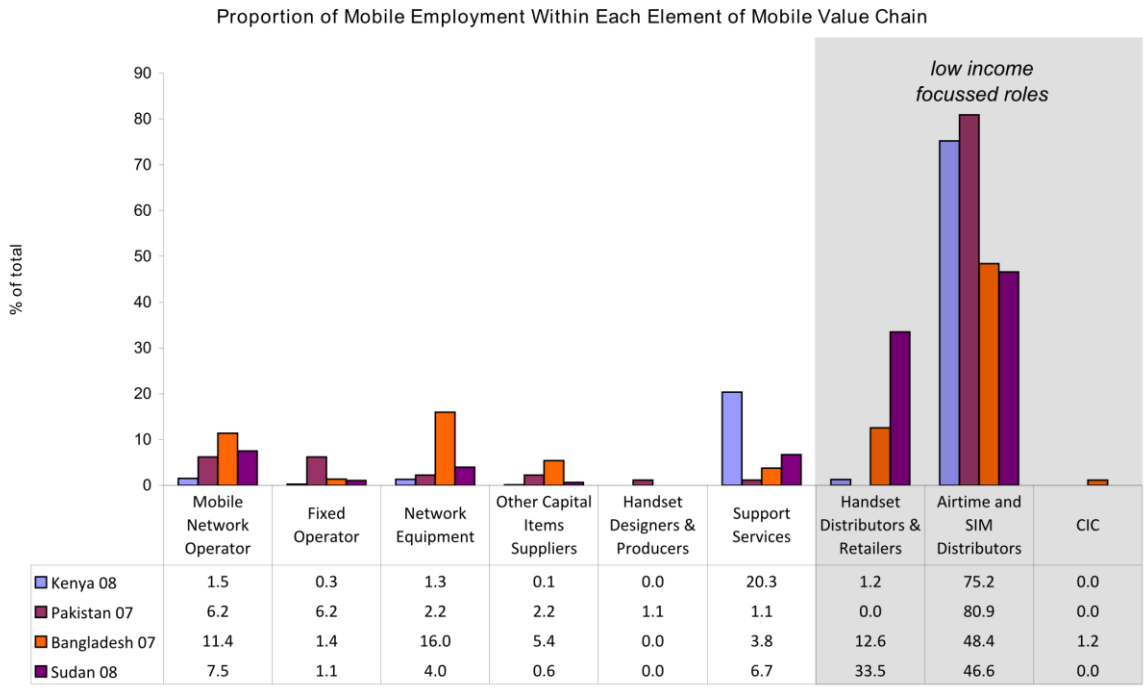

Figure 2.1: Distribution of mobile sector employment in four countries.
Source: Author's calculations adapted from (Deloitte 2008, GSMA 2008, Zain 2009)[1].

Whereas core firm roles (such as internal management and telecoms equipment maintenance) make up notable proportions, the majority of employment (highlighted in grey in Figure 2.1) is related to actors who contribute to distribution and retailing of such products to low income customers. In the mobile phone case this refers to the airtime distribution and handset retailing predominantly made up of micro-entrepreneurs who directly interact and sell these ICT goods to low income customers.

Thus, from a consumption perspective, this work suggests ICT micro-enterprises should not be seen as an accident, solely as emerging from entrepreneurship. The distribution of such micro-enterprises suggest that they are a key element of the means by which ICTs reach less affluent consumers in developing countries.

2.3. The ICT micro-enterprise literature

With extensive ICT micro-enterprises[2] defined, the literature is now analysed in detail. One can characterise research on such enterprises as still in its infancy, with literature in some sub-sectors minimal, highly descriptive and without a clear theoretical direction. Thus, in this section, two sub-sectors are examined where literature is more

[1] There are debates regarding the accuracy and comparability of such data. Roles on the supply-side tend to be counted differently and more informal ones not at all or underestimated. Here these figures are used as indicative of general trends around ICT micro-enterpise.

[2] For the remainder of the thesis, the shortened term *ICT micro-enterprise* is used to denote *extensive ICT micro-enterprise.*

plentiful, with the goal of looking for common themes to build a wider understanding of such enterprises, and serve as a basis for later, more theoretically-grounded analyses.

Examining the literature on ICT micro-enterprise, three key themes of discussion are highlighted; the centrality of locally relevant *innovative tactics* by ICT micro-enterprises in survival and growth; an understanding of *the dynamics of enterprises in changing contexts* which are often unstable, and the way micro-enterprises respond to these changes; and the existence of *networks and supply chains,* particularly connected to ICT supply which micro-enterprises connect and operate with.

2.3.1. Illustrative cases

Two sub-sectors of ICT micro-enterprise are particularly focussed on in this literature analysis, the mobile phone sector and digital film production. Both follow closely the previous definitions of extensive ICT micro-enterprise serving low income customers, so fit well the core criterion of study.

These two sub-sectors were selected principally based on the breadth of literature that exists in the sub-sectors in comparison to others, providing sufficient detail to be able to build a clearer picture of the key elements of such micro-enterprises. In addition, in these sub-sectors due to the volume of micro-enterprise, and presence in a number of developing countries, cases are more developed including a variety of conditions, actions and/or policies which can serve to build understanding of other sub-sectors.

The two cases also illustrate two contrasting positions as related to technology in ICT micro-enterprise. Digital video production emerges locally adapting existing technologies for use, whilst mobile micro-enterprise is more intricately connected into the technology flows from the wider mobile industry. These two sectors are descriptively introduced below and analytically expanded in later sections.

Mobile phone micro-enterprises

Mobile micro-entrepreneurs are present in many parts of the world, emerging to serve local demand for mobiles, and to provide associated mobile products and services. Mobile micro-enterprises can take any number of roles in the mobile industry such as selling mobile cards, phones, accessories, mobile repair or unlocking services (Cheneau-Loquay 2010, Chipchase 2009, CKS Consulting 2009, Ouédraogo 2009).

Mobile micro-enterprise should not be considered as disconnected from the wider mobile industry. Even with their often informal status, such entrepreneurs are connected into supply relationships that reach back to formal mobile vendors, operators and applications providers (Essegbey & Frempong 2011, Mujica 2007).

Digital video productiom

Growing digital video production in developing countries offers an insight into the productive potential of ICT micro-enterprises. In a number of countries such as Nigeria (Ugor 2007, Zajc 2009), Kenya (Edwards 2008, wa Mungai 2008), Ghana (Haynes 2010, Haynes 2007) and Ecuador (Floyd 2008), low budget digital video production and distribution of videos using digital ICTs has grown[3]. In some of these locations, the industry is a provider of significant income and employment (Ugor 2007, Zajc 2009) particularly in its urban centres of production, and it revolves around a sector of ICT micro-enterprises.

There is little in the way of a definitive description of such video industries. One stream connects growth to socio-political factors: the lack of support for cinema in developing countries, and recent increasing low income spending and consumption of such goods in developing economies. Another stream connects it to ICT entrepreneurship. Growth has particularly connected to the growing ability for cheap digital filmmaking – using cheap cameras, PC editing software and copying technology - with many facets of the industry operating in informal ways (Haynes 2008).

Crucial in the growth and survival of digital video has been the ability of these locally produced films to reach a large audience of low income consumers. As documented in countries such as Ghana (Haynes 2010, Haynes 2007), and Ecuador (Floyd 2008) this has been facilitated by micro-enterprises involved in distribution, media copying, and informal trading via market sellers and video centres (Larkin 2008). In analysing this sub-sector, particular emphasis is made on Nigeria given the strength of research related to this well known case.

2.3.2. Theme 1: ICT micro-enterprise innovation tactics

Niche

Examining the discussion of diverse services and goods that are offered by ICT micro-enterprises, it is noticeable that such enterprises, even those that might be considered solely as retailers, provide some kind of inventive 'niche' which differentiates their goods for a specific set of customers. There are a number of different articulations of niche in the literature as shown in Figure 2.2 and outlined below.

[3] Parallel entrepreneurial sectors in digital music production in a number of countries (Impio et al. 2008, Manuel 2012) are also likely to follow similar processes as outlined here.

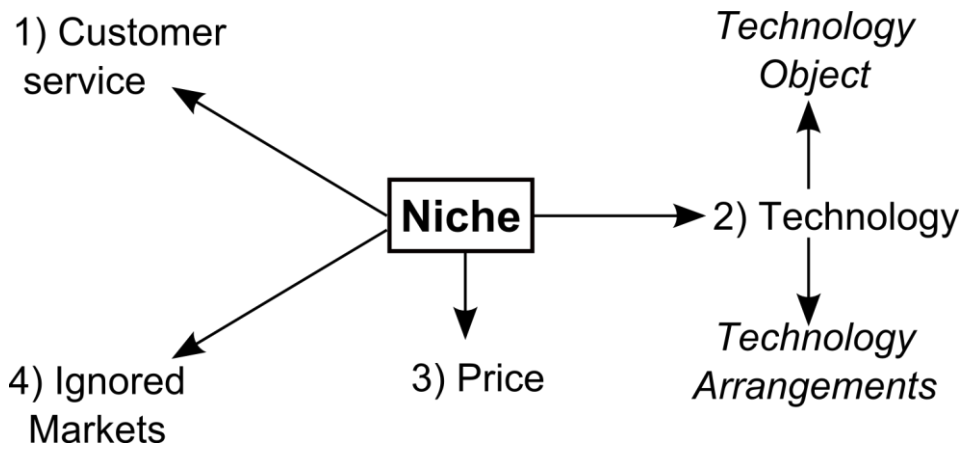

Figure 2.2: Approaches to niche in ICT micro-enterprise literature.

In mobile micro-enterprise, activity is often marked by the ability of vendor and customer to discuss or interact with mobile technology in a substantial way, before or after the sale (Chipchase & Tulusan 2006, Ilahiane & Sherry 2008). This is most aptly described by Moroccan mobile entrepreneurs who "will sit down with their customers, show them how to navigate the interface, and discuss the relative merits of various technologies" (ibid. p.351). Similarly, with certain services in the mobile phone sector, micro-entrepreneurs will often assist customers in the transactions, and hence provide value through 'mediated use' (Chipchase 2009). This value-adding *customer service niche* – based on the specific skills, knowledge, and connections of the micro-entrepreneur and their ability to invest a key commodity – time – to build a social as well as commercial relation – is not a side issue, but an essential part of business success (ibid.).

Technological changes are another niche which allows ICT entrepreneurs to fit into everyday lives of customers. This can come through niches in *technology arrangements,* to allow customers to carry out common tasks more easily. For example, studies of mobile micro-enterprise have documented a number of cases of such niche arrangements led by ICT micro-enterprises (ibid., Goodman & Walia 2006, Hughes & Lonie 2007, Tall 2004). *Senté* is one example*,* an informal model of money transfer using call cards requiring informal kiosk operators to cooperate over long distances which enables customers to transfer remittances conveniently with less expense (Chipchase & Tulusan 2006).

In digital video production, niches in technology arrangements related to the entire supply chain. This suggests that the processes and business models necessary to create, distribute, view and sell films are significantly adapted to task and locality. In the case of Nigeria, given rampant piracy and the rapidity of film releases into the distribution networks, financiers in the industry only have a small window in which to recoup investment. Hence the low budget form of production is shaped by the need for

low costs and a full production cycle of 10 days to 1 month (Zajc 2009), technology arrangements also mirror such configurations, where post-production occurs amongst cramped adapted computer studios (Evuleocha 2008). Whilst there is no in-depth analysis of such practices, these limitations are likely to result in niche technology arrangements, in ICT use and ICT mediated practices that have a particular and localised form, specific to that context.

Beyond niche technology arrangements connected to ICTs, there is also evidence of *niches of the technology object* itself (hardware or software). In mobile micro-enterprise this is particularly true in more emerging economies. For example, micro-enterprise mobile repairers offer services which modify the innards of mobile phones, for instance to allow customers to use dual sims which then permits cheaper calling (Barendregt 2008, Chipchase 2009).

ICT micro-enterprises can often provide a *price niche* over larger suppliers. Studies suggest this sits outside economies of scale. Rather, products are split down, into smaller portions, or services reconfigured, to fit in with the cash flows of less affluent customers. In mobile enterprise this can be seen in the way that phone top-ups are broken down into cheaper portions by entrepreneurs (Rangaswamy 2009b) or through providing cheaper alternatives to official ICT products, such as by sourcing cheaper generic or second-hand phones (ibid.). In digital video, popularity of such low-budget productions relates to the growth of adapted spaces for viewing, referred to as the 'video centre' in Nigeria or 'video parlour' in East Africa (Mansfield & van Oosterhaut 2007, Okome 2007), generally a small ICT micro-enterprise. Such centres provide a niche by adding viewing spaces to allow those who cannot afford to buy, to view the films onsite (ibid.).

Finally ICT micro-enterprises may also venture into niche provision in *ignored markets* where other enterprises do not operate. The growing Nigerian digital-video industry provides a successful case study where cultural goods that large enterprise have rejected as not profitable, have been produced by entrepreneurs able to step in and profitably provide for this untapped market.

Local appropriation

Niches emerge through locally relevant ICT appropriation, adaptations of technology and techniques by entrepreneurs (Cheneau-Loquay 2010, Cheneau-Loquay 2008), as summarised in Figure 2.3.

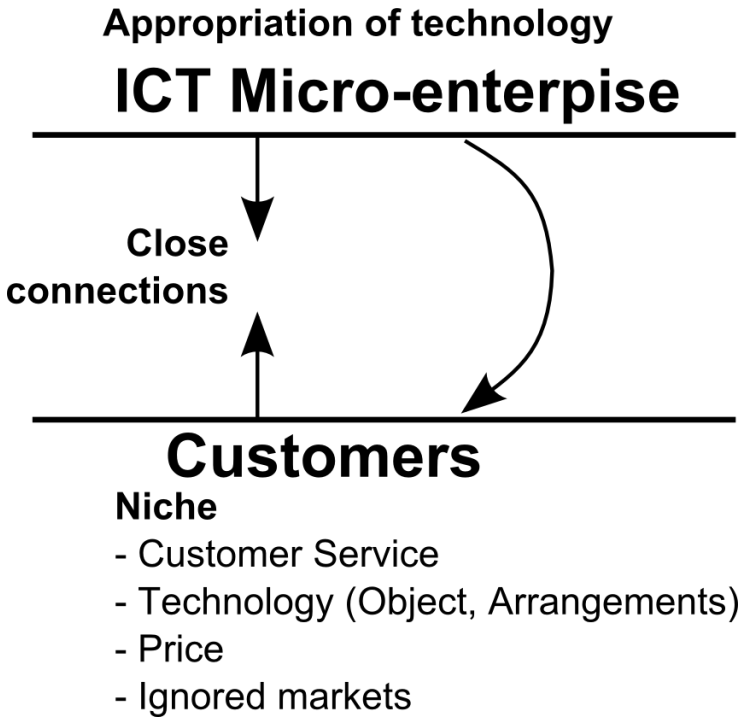

Figure 2.3: Niches and locally relevant innovation.

Niche building comes from the ability to reconfigure and appropriate ICTs and is at the core of ICT enterprises' potential to survive. The resources and capacities ICT micro-enterprises have for such appropriation are often very limited. Yet that very resource-poverty can also be a stimulus to adaptation; forcing these enterprises to find a different way of doing things in order to survive. The way that ICT micro-enterprises find and serve these niches can be attributed to both gaining knowledge of the ICTs and their very close connections to their customers. It is only through an intricate understanding of the often unique local ICT needs, the sector, sub-sector and customers that entrepreneurs are able to provide this differentiation (Qiu 2008). For many informal ICT micro-entrepreneurs, being close to their customers is a matter of daily life, and this is a crucial source of their 'ethnographic' understanding (Galperin & Bar 2006).

There is a suggestion that such micro-enterprise appropriations can diffuse to become more significant as innovations. For instance, appropriation in digital video in production and distribution in Nigeria, has spread to create a widely popular industry; telephony solutions were unexpectedly appropriated by small enterprises in China and became used by millions when adapted approaches were taken up by larger firms (Qiu 2007, Wu & Zhang 2009); appropriations of mobile airtime sharing in Egypt found unexpected applications led by entrepreneurs and these became more widely used as part of mobile innovation (Goodman & Walia 2006). Thus, there is evidence that such locally relevant appropriation may move beyond localised niches to play a

wider and important role in guiding the growth of innovations for low income groups in developing countries.

2.3.3. Theme 2: Dynamics in changing contexts

From static models to dynamic analysis

Micro-enterprises (whether connected to ICTs or not) are often identified as marginal in nature, particularly they are effected by wider economic conditions which reduce or expand incomes of their marginal customers (Mead & Liedholm 1998). Micro-enterprises are also strongly effected by the vulnerable livelihoods of entrepreneurs, local rules and contexts, and changes in competition (McGrath et al. 2005, Mead & Liedholm 1998).

In addition to these micro-enterprise factors, one can see additional instability in ICT micro-enterprise related to technology. This technological instability is an inevitable part of daily life for ICT micro-enterprises. For instance, in the mobile sector the literature has documented the rise and fall of entrepreneur-run 'shared phone' services for low income communities. In some places such services continue to thrive, particularly very rural areas (Carvalho et al. 2011, Futch & McIntosh 2009, Sivapragasam 2009) but in many others, with more marked personal adoption of mobile phones such as Bangladesh and Ghana, entrepreneurs encountered volatility from increasing personal mobile usage (Sey 2008, Shaffer 2007). In histories of Indian mobile, many sellers were documented to have moved into this sector following similar declines of older ICTs such as cassettes (Rangaswamy 2008). Hence, research highlights the instability for ICT micro-enterprises, suggesting that locally relevant appropriation and the niche advantages are likely to be transient.

Path, learning and livelihoods

Given the volatility of their appropriation, ICT micro-enterprises tend to adapt dynamically, which connects to surviving in these unstable contexts. One element of such dynamism within volatile contexts is the extent to which ICT micro-enterprises can mix multiple niches. This is documented particularly in micro-enterprises diversifying between ICT sub-sectors to improve income (e.g. between PC refurbishment and repair, cybercafés and skills training, media distribution and low income digital photography services) (Lugo & Sampson 2008, Rangaswamy 2008, Sundaram 2009). Alternatively where ICT micro-enterprise niches are more risky, combining ICT sub-sectors with non ICT-based elements can provide some secure income should instability occur in the ICT elements (e.g. some firms in an Indian slum were documented combining ICT with other informal retail activities (Rangaswamy 2010b)).

Given the shifting nature of volatile ICTs, in the longer term micro-entrepreneurs tend to shift focus as they build knowledge and respond to changing conditions. For instance, those running new ICT micro-enterprises are documented to have been involved in earlier ICT industries, as well as parallel sectors with similar technical skill-sets: in India, mobile sellers often came from the electronics repair and media distribution industries popular in the '90s (Sundaram 2009); in Morocco, an entrepreneur is documented as moving from car repair to mobile (Ilahiane & Sherry 2008); ICT micro-entrepreneurs are also documented as previously working in the formal IT and media economies in several cases (Lugo & Sampson 2008, Wu & Zhang 2009, Zajc 2009).

With low barriers into the lowest value ICT micro-enterprises, such as mobile card selling or video vending jobs, there is often room for new entrepreneurs to create or join ICT micro-enterprises in 'low value' roles (Chipchase 2009 p.10). Thus, there is scope for individuals to join, learn and potentially move into more profitable roles, where skills come in the processes of interacting with local customers and understanding how technology can be appropriated (Barnard & Tuomi 2008). Such, ICT micro-entrepreneur learning occurs in other diverse ways, utilising the social aspects of local networks outlined previously, through unpaid apprenticeships, friends or small uncertified training entrepreneurs (Chipchase 2008, Rangaswamy 2008, Rangaswamy & Kumar 2008).

The literature is not clear enough for us to pinpoint the level and core types of dynamic 'jumping' and 'juggling', but they suggest that firms adapt actively as niches rise or decline, and instabilities emerge.

2.3.4. Theme 3: Networks in ICT micro-enterprise

Literature suggests that ICT micro-enterprises are rarely isolated in developing countries, with successful micro-enterprises tending to have dense connections. This applies to both in the 'horizontal' connections particularly between micro-enterprises in localities, and in the 'vertical' connections that allow a flow of ICTs, services and other resources from larger service and ICT suppliers.

Horizontal connections

Connections between ICT micro-enterprises particularly as played out within localities are crucially important. Given the small size of ICT micro-enterprises, they tend to operate within very specific niches, but through their connection into a wider group of other ICT micro-entrepreneurs, they can provide a wider variety of services. In mobile micro-enterprise this interconnection often occurs within a street, market or bazaar

that can geographically provide a wider range of services to customers (Ilahiane & Sherry 2008, Lugo & Sampson 2008).

Such groupings also provide additional advantages, by potentially providing rich locations for new entrepreneurs to connect and learn the ropes (Rangaswamy 2009a), in the potential sharing of suppliers and storage (Ilahiane & Sherry 2008), and in providing potential for group approaches to problems and issues (Sundaram 2009). The literature on ICT micro-enterprises has predominantly focussed on urban settings where the density of customers and networks tend to be higher and thus makes such enterprises more viable.

Vertical connections

Beyond such horizontal connections between ICT micro-enterprises, micro-enterprises connect into supply chains. In mobile micro-enterprises, these supply chains connect into ICT suppliers, with connections often market-based and reconfigurable from the point of view of the micro-entrepreneur, potentially supporting dynamism of such informal mobile enterprises (Lugo & Sampson 2008). However, other literature suggests that ongoing and reciprocal supplier connections are also important, and over time become a source of knowledge and social capital. For example, studies in India (CKS Consulting 2009, Rangaswamy 2009a) suggest the relationships between mobile phone micro-enterprises and suppliers are crucial for survival of micro-enterprises. Here, suppliers can act more as a mentor to entrepreneurs than a simple seller of goods, taking their own time to help train and give advice to the sellers, providing them with bonuses such as cheap call time as an incentive to stay loyal. In other cases, where supply chains change, they are the source of instability for micro-enterprises, where changes in products, costs and availability link into to how viable specific niche tactics are (Cheneau-Loquay 2008, Sey 2008).

Horizontal and vertical connections are less easily separable in the digital film sub-sector. In the Nigerian case, supply is not connected by hierarchical chains into larger enterprises in the same way as mobile phones. Studies suggest instead that networks in Nigeria display aspects of both horizontal and vertical connection. Production is generally centred around the uneasy power relations between film ‘marketeers’ and ‘distributors’ in the supply chain (Larkin 2008, Ugor 2007). Over time alternative production chains have also emerged. One centres around a more empowered and financially connected producer, emerging from the middle-class, who generally connects into the growing middle classes and the diaspora (ibid.). Religious films follow a completely different path, financed by religiously minded institutions and individuals (Larkin 2004, Ugor 2007).

Core national distribution networks are multi-level, typically moving through central distribution clusters, into smaller stores and street sellers, often "based on a complex balance of credit and trust" (Larkin 2008 p.223), but there are also a disparate set of alternative modes of distribution, dependent on the type of video – diaspora networks, regional African distribution, religious congregations, local TV channels and online distribution (Adejunmobi 2007, Larkin 2008, Ugor 2007).

In sum, connections are diverse and there are suggestions that network relationships in ICT micro-enterprise are not solely marked by tangible flows (of goods, of money) but also by intangible flows (especially of knowledge and connections). Connections also embed social relations, and varied power balances. As the specificity of the networks outlined highlights, one may need to avoid generalities and make a careful study of localised practice in any given situation to understand networked relations of ICT micro-entrepreneurs.

2.3.5. Summary

The three themes highlight the underlying concerns of ICT micro-enterprise. As the first theme has suggested, key to this research will be micro-enterprises and locally relevant appropriation. The second theme refers to the inherent instability of micro-enterprise and the need for micro-enterprises to adapt more dynamic approaches. The third theme emphasises that dynamics can be both supported and destabilised by elements of networks.

The first theme provides the most clear and unambiguous focus, and this work suggests that the innovative activities of micro-enterprise are a core concern both in terms of how ICTs reach low income groups, and in the ways that ICT micro-enterprises survive and grow. However, the links between this and the second and third themes is more ambiguous and this suggests that more research is needed in linking into these themes.

2.4. Examining present conceptualisations

The goal of this section is to more clearly understand the themes in the literature, and to identify knowledge gaps related to these themes.

This is done by linking these themes to two wider conceptual discussions, on ICT appropriation and informality of small firms in developing countries. Whilst both of these notions pervade the literature, they are rarely dealt with directly and a more conceptually grounded analysis can provide insight.

These analyses lead to an identification of gaps in the literature which guide how ICT micro-enterprise should be researched in this thesis. In terms of innovation, there has been a lack of analysis of the drivers of the locally relevant appropriation tactics of micro-enterprise which the appropriation literature posits as a central consideration; in the ICT micro-enterprise case this is likely to be linked to ICT supply. From the informality literature, ICT micro-enterprises tend to be treated as isolated from the wider economy, and one can identify a lack of understanding of the instability in ICT micro-enterprises from the perspective of wider conditions and networks they are part of.

Thus, both the appropriation and the informality literature point to broadly similar critiques but with different emphasis, that one needs to move beyond the current dominant focus of ICT micro-enterprise and innovative practices at the micro-level in order to more clearly understand the larger contexts which are influential to ICT innovation.

Consequently, this suggests that work examining ICT innovation for low income groups, will need to embed these relevant local actors and innovative processes to build a more complete picture of these processes. Such a 'linked' approach to analysis can open up a clearer understanding of both the productive and consumptive role of such enterprises, through linking into these wider concerns around innovation.

2.4.1. Appropriation

The study of change of technologies through appropriations is well known within information systems, to fit technologies into local tasks, or to adapt to cultural norms, structure or power (Jamison & Hard 2003, Rogers 1995, Silva 2002). Social shaping theories argue that technology is non-neutral, it encapsulates norms, modes of working or other assumptions of the environment in which it was designed, made and marketed (Bijker 1995, Wajcman 2004), "developed through a social-political process which results in structures (rules and resources) being embedded within the technology" (Orlikowski 2000 p.405).

In developing country settings, appropriation has been an important concept to understand how ICTs, designed with certain concepts and markets in mind, are handled when they appear in differing contexts. Thus, given the non-neutral origin of ICTs, appropriation in developing countries can be seen as way to reshape ICTs and make them fit better locally (Avgerou 2008, Heeks 2002, Walsham & Sahay 2006). Heeks' (2002) notion of a 'design-reality' gap presents this notion within a more practicable model as outlined in Figure 2.4. The disconnection between an ICT design and reality is not solely connected to the technology object itself, but also in the

intended structures, resources and people surrounding the technology. Design-reality gaps can result in ICTs being rejected due to the disparity between a design and the practical reality. Alternatively, two possible changes might occur. Firstly, ICTs will influence behaviours, and this may lead to *social changes* in practices and structures, to fit with the ICT form (Avgerou 2004, Orlikowski 2007). Secondly, 'local improvisations' (*appropriations*) are possible whether in deliberate active practices or not which bring aspects of ICTs closer into line with local activity (Heeks 2002).

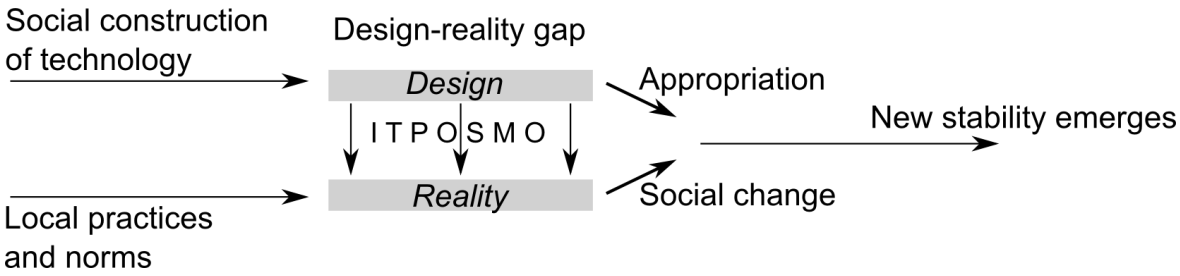

Figure 2.4: A view of appropriation in developing country settings.
Source: Adapted from (Heeks 2002).

However, appropriation literature does not necessarily assign free agency to those actors making appropriations. Such processes are guided and limited by a number of potential factors, such as the ICT forms which help or hinder appropriations (Dourish 2003), and the wider rules and institutions that encourage (or discourage) appropriation (DeSanctis & Poole 1994, Silva 2002).

There are ongoing debates on how best to balance what might be termed 'agency' and 'structural' components of appropriation, and this links with information systems discussions around 'agency' and 'institutions' in technology driven change (Leonardi & Barley 2010, Misa 1994, Orlikowski & Barley 2001). How to balance the two components is still contested, but such literature confirms that both elements are essential to understanding appropriation.

In the literature on ICT micro-enterprise, appropriations are documented as they emerge from micro-enterprises focussed on marginal groups, as ICTs are transferred into low income settings (e.g. Lugo & Sampson 2008, Rangaswamy 2009a). However, such processes are dealt with only descriptively with little substantive discussions linked to information systems conceptualisations. Drawing on the information systems work, one can say that they tend to focus more on describing actions of appropriation, without consistently linking these actions into more subtle 'structural' components – those wider forces or drivers which direct these appropriation actions.

Thus, there is a knowledge gap relating to understanding the wider power dynamics related to such appropriation, the conditions and institutions that drive appropriations in micro-enterprise. Or, as the information systems literature might term it, ICT

micro-enterprise literature has effectively assigned entrepreneurs more agency in appropriation than might be the case in reality, where a wider analysis of the drivers of such activity can build a clearer picture of appropriation (Boudreau & Robey 2005).

2.4.2. Understanding the informal

ICT micro-enterprises, which connect into more marginal groups, are often described to operate within 'informality', 'informal settings' or the 'informal sector' within the literature. Development studies and labour perspectives on informality can provide an understanding of these unstable settings of ICT micro-enterprises.

Dualist definitions of informality outline a 'sector' (of micro-enterprises) with focus on the registration statuses of such actors, where firms are either formal, or informal. For example early International Labour Organisation (ILO) definitions equated informality to "all unregistered or unincorporated enterprises below a certain size" (Chen et al. 2002 p.11).

There are multiple perspectives on such an informal sector. An entrepreneurial view sees informal sectors as potentially a source of innovation and disruption under constraint, where becoming formal is limited by various rules (such as bureaucracy related to enterprise formation) (de Soto 1989). A parasitic perspective focuses on the corrupt, unlicenced and illegal activity of the informal sector, where avoidance of formality threatens the position of 'law abiding' formal firms (Farrell 2004, La Porta & Shleifer 2008). An expansionist perspective also sees problems in the informal sector, but looks towards examining pragmatic wider support structures that can help such firms to become more productive and formal (Chen et al. 2002, Palmer 2004). Whilst these perspectives ascribe different considerations to informality, they are alike in that they predominantly focus on informality as problems or deficits around firms, activities and policy related to the informal sector, typically in areas such as enterprise training and education, equipment and infrastructure, and business procedures (Jeans 1999, Johanson & Adams 2004, Palmer 2007) – where policy refinements lead to removal, survival or growing formalisation of firms.

An alternative perspective on informality is the relational perspective, which argues for a move away from a focus on informality centred solely around micro-enterprises, to consider that such informality exist as a consequence of the structures of wider capitalism (Portes et al. 1991). In this perspective, it is highlighted that informal firms are not isolated but closely linked into the fortunes of formal firms; they often provide inputs, or diffuse outputs from formal firms; they provide flexible manpower for formal firms; they undertake roles that formal firms are keen to avoid (Palmer 2004).

Thus, from a relational perspective, the dualist position is critiqued as crudely simplifying conditions of informality. Enterprises are likely to be more or less formal in many different elements, and even fully registered firms might potentially still find themselves marginalised. Informality is thus not solely about an enterprise being registered, but rooted in a wider set of features that move beyond registration - tax, licence, location, land tenure, job stability, legality of products and processes - to name a few. Further, informality is not solely embedded within firm lack, but includes societal recognition of firms as an element of informality, "[firms]...not recognised, regulated, or protected by existing legal or regulatory frameworks" (Chen et al. 2002 p.12).

From a relational perspective, the conditions that emerge from informality – instability of enterprise, marginality, poverty – are part of the wider economic structure and conditions and thus, informality is examined through,

> "..focusing on the logic of the process, it is possible to look behind the appearance of social conditions (poverty, destitution, blight) to focus on the social dynamics underlying the production of such conditions". (Castells & Portes 1989 p.13)

Thereby relational approaches move beyond dualist ones, to see links between the conditions of informal actors and the wider economy and policy condition which enable such conditions.

The ICT micro-enterprise literature acknowledges that micro-enterprise tends to be informal, but it rarely links into the wider development literature that has been outlined above. When informality of these enterprises is specifically mentioned, it is generally positioned in terms of an 'informal sector' (e.g. Lugo & Sampson 2008, Rangaswamy & Nair 2012). Thus, if one was to characterise the perspective on informality that such work takes, the work tends to be positioned closer to dualist ideas of informality, generally the more optimistic perspective following de Soto. ICT micro-enterprise literature does include reference to networks, but the significance of these links has not yet been fully explored in depth in terms of wider relations and informality.

There are some exceptions to this (e.g. Cheneau-Loquay 2010, Mujica 2007), which begin to scrutinize the actors and policy which connect into such micro-activity, and these suggest that relational perspectives on micro-enterprise provide a useful way forward. This work seeks to expand on these approaches, arguing that the relational perspective is a knowledge gap, that few studies have sought to connect ICT micro-enterprise contexts to wider conditions, networks and policy which orientate the

informality of micro-enterprises, or as Castells & Portes puts it, examine the "specific form of relationships of production" (Castells & Portes 1989 p.12).

2.4.3. Summary

To summarise, information systems literature suggests that one needs to better examine the interplay between structure and agency within appropriation, and particularly to link between appropriations and wider ICTs and supply chain relations, which play a role in orientating locally relevant innovation tactics of ICT micro-enterprise.

Informality literature suggests that a relational perspective on informality of enterprises can potentially provide better knowledge of micro-enterprise marginality, which comes as much in wider policy conditions and strategies of large firms as it does from deficiencies in specific micro-enterprise policy or in the micro-enterprise itself.

In essence, both these critiques have led to similar knowledge gaps being identified, but with slightly different emphases. Both suggest a need to reframe the present ICT micro-enterprise debates, with its' preference for more descriptive analysis of local innovation but in danger of missing the 'bigger picture' around ICT innovation. Taking a strong locally-contextualised view of micro-enterprises is undoubtedly valuable, but one can legitimately argue that without wider analysis, fundamental questions regarding ICT micro-enterprise have barely been examined. This particularly relates to linking the nature of local activity to the policies and decision making related to the wider conditions of ICT innovation for low income groups.

This then orientates the remainder of this research thesis, to examine informal ICT micro-enterprises and innovative activities, but through a study of wider activity, networks and strategies. This work acknowledges the importance of local relevant innovation tactics already documented, but it is only through linking to wider perspectives on ICT innovation that such work is more amenable to critical analysis, and relevant to wider policy.

2.5. Research questions

Drawing together the literature review so far and the research gaps identified, it is now prudent to build more refined research questions to be examined.

Below the overarching aim and objectives that were outlined in Chapter 1 are reprised (in italics), now adding more specific research questions (in bold) drawing on this literature review:

Aim: To more clearly understand the activities of ICT micro-enterprises in developing countries, and how related firms and policy can support or inhibit such ICT micro-enterprises.

2.5.1. Objective 1

To provide a clearer picture of ICT micro-enterprises, and to link to frameworks or models, if necessary refining these frameworks in light of empirical understandings.

Firstly, as the exploration of major themes has shown, micro-enterprises activity revolves around activities of locally relevant appropriation, but within shifting and unstable contexts. Research gaps have been identified which will link ICT micro-enterprise activity into wider influences.

As has been outlined, the core theme suggest that this work should be reframed as a problem around ICT innovation for low income groups, and to examine frameworks or models that address ICT innovation, but with close consideration of micro-enterprises. As core models are unclear, model identification and refinement is a core part of research.

This research question hence looks to examine conceptualisations within wider connected frameworks, specifically looking to integrate and articulate the innovative elements of ICT micro-enterprise within these models. Acknowledging that models may not fit perfectly to the case of low income ICT innovation, further refinement may be needed in order for them to fit with this case.

RQ1: How do we conceptualise the wider factors which influence ICT micro-enterprises? In such conceptualisations, how do we position ICT micro-enterprises?

2.5.2. Objective 2

Drawing on empirical data, to examine how such frameworks and models expand insight into the productive and consumptive role of ICT micro-enterprise.

Discussions of the central role of micro-enterprise niche and locally appropriate adaptations is taken as a discussion around innovation and the active role that ICT micro-enterprises play as part of wider innovation process in ICT sectors.

In terms of the core locally relevant appropriation processes, a specific research gap has been identified which stems from the persistent focus on locally relevant appropriation, without examining the wider supply chain and ICT actors roles in innovation activities.

Thus, models that build a more linked perspective between ICT innovation and the networks of ICT innovators, and will provide a clearer understanding of the role of this locally relevant innovation.

RQ2: How do the network relationships of ICT micro-enterprises link into the forms of innovation that they undertake?

2.5.3. Objective 3

To analyse the implications of this work for the actors and action which support ICT micro-enterprise.

As the literature review has discussed, whilst ICT micro-enterprise and their local innovative activities are a core theme, these activities tend to be susceptible to unstable contexts and marginality. A knowledge gap has been identified from a relational perspective on informality, that wider factors and policy that influence the stability of these activities has been underplayed. Thus, wider factors and policy will have both an direct and indirect effect on ICT micro-enterprise. Indirectly, policy determines the conditions under which networks of ICT innovators act, more directly policy can influence actions of ICT micro-enterprises.

RQ3: What role is there for policy in shaping the conditions of ICT micro-enterprise?

In sum, the aim of these research questions specifically connects to the knowledge gaps that have been identified from existing literature. By seeking to extend it in a more analytic and holistic way, more relevant knowledge can be brought to an understanding of ICT micro-enterprise and ICT innovation.

2.6. Conceptualising beyond the local

Thus, with the research questions outlined, the first research question is approached, beginning by identifying a number of broader conceptual models that potentially provide approaches to link between ICT micro-enterprise activity and wider factors.

Figure 2.5 illustrates the three themes identified previously, and three conceptual directions, which conceivably provide directions to answer the research questions.

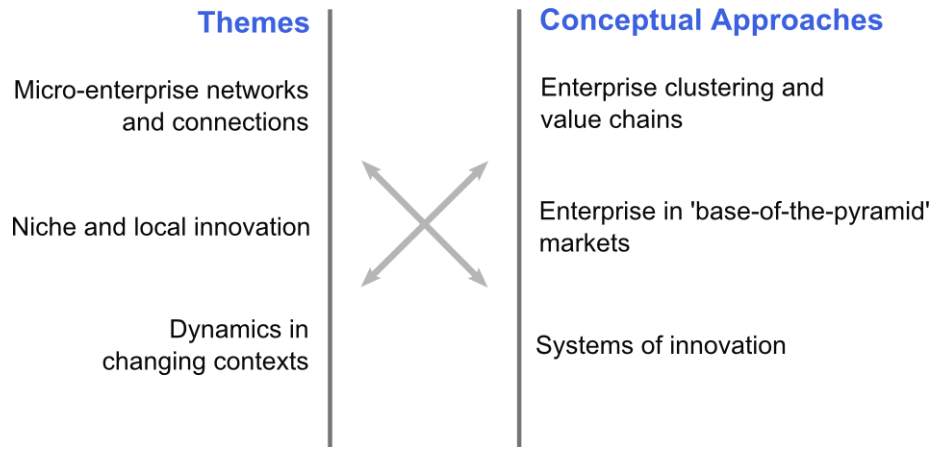

Figure 2.5: Themes of ICT micro-enterprise and wider conceptual approaches[4].

Enterprise clustering and value chains provide models useful for thinking about the way enterprises agglomerate and work together, and an understanding of power relations and value in the supply chain of production, linking closely to the role of local networks and supply chain connections of ICT micro-enterprise.

The literature relating to large *enterprises serving base-of-the-pyramid customers* excels in linking local appropriation into large firm strategies to reach poor consumers through innovative products and services. Taking a more critical position of base-of-the pyramid delivery, local appropriation can be seen as less empowering and simply part of wider firm strategies to reach the poor, resulting in micro-enterprise presence being highly marginal.

Systems of innovation models centre innovations within wider systems where the interaction and innovation of multiple actors in a system drive activity. Such models, which centre multiple linked actors and system emergence, provide a lens to examine local innovation, but with acknowledgement of unstable settings in which ICT micro-enterprise exists.

Each of these approaches can be said to have specific strengths and weaknesses as approaches to answer the research questions. The goal is to select the best suited single approach, in order for research models that are coherent and unambiguous. However, all three models provide important elements and perspective and useful elements are considered as later model adaptation occurs (Chapter 3).

[4] Note that the link between the three themes and the conceptual models is not one-to-one. Thus, the cross-arrow in the centre of the diagram indicates that these themes and models are interconnected.

2.6.1. Enterprise clustering and value chains

Models of clustering

Clustering is crucial to micro-enterprises in many sectors. Here the rich literature on clustering in developing countries is examined in order to understand its relevance to ICT micro-enterprises.

Clustering has been defined as "a geographically proximate group of inter-connected companies and associated institutions in a particular field, linked by commonalities and complementarities" (Porter 2000 p.254). Hence, studies of clustering in developing countries provides a literature to examine the intricacies of horizontal local interactions on the ground.

One of the commonly-used frameworks to understand clusters and their significance in developing countries is Schmitz's (1995) model of *collective efficiency*. This defines two dimensions which help clusters to achieve competitiveness. On the one hand, advantages are related to *external economies*; the efficiency gains that are made from firms being closer together. On the other hand, it is related to *joint actions*, where clustered enterprises act together to improve their situation. External economies can be seen as essentially a passive gain which comes from being in a certain advantageous location, whilst joint actions require active work on behalf of the clustered enterprises (Nadvi & Schmitz 1999).

Much of the literature on clustering looks to understand how such clusters grow, particularly with regard to more mature clusters, and how they are able to move into higher level, better quality work. This relates to the collective efficiency model and how industrial clusters can work together to undertake *joint actions* and move beyond easier gained *external economy* advantages. This can be done for instance through building measures for increasing local trust, upgrading technology, or improving quality of output (UNIDO 2002).

Integrating chains and global value chains

Later literature about clusters moves beyond looking at clusters in isolation to how they link into supply chains, frequently at a global level (ibid.). This has been influenced by the success of East Asian economies, where in technology-led industries, connecting into, and upgrading in, globalised networks is a key facet in understanding their wider technology-led growth (Mathews & Cho 2000). Given the globalised nature of production, clustering is increasingly conceptualised as a set of crucial horizontal links between inter-connected local enterprises, where vertical links allow a more global connection, and firm knowledge acquisition can diffuse from wider localities (Bell & Albu 1999, Bell & Pavitt 1993).

'Commodity chains' notions have been used to understand supply chains and firm interdependencies, often as a way to critique the indirect processes of power and control that emerge in such supply chains (Bair 2005, Gereffi 1999). This work provides a central site in which to consider wider network relationships as more than solely economic supply relations, also embedding other less tangible forms of power (Granovetter 1985, Uzzi 1997).

Later value chains work is more pragmatic, linking into business literature to provide more policy relevant understanding of supply chains through sectoral and business value analysis of roles and analysis of value creation by supply chain actors (Kaplinsky & Morris 2001). Policy guidance emerges through examining the *governance* of value chains, how sectors are co-ordinated and directed; and how this relates to the potential for smaller firms to *upgrade,* that is, to build capabilities, to diversify and move to higher value positions (Humphrey & Schmitz 2000, Kaplinsky & Morris 2001).

Insights for ICT micro-enterprise

The discussion presents a rich conceptual grounding particularly for understanding the networks of ICT micro-enterprise.

From Schmitz's (1995) model of collective efficiency one can better conceptualise how local networks benefit micro-enterprise. Typically ICT micro-enterprise literature has referred only to the passive *external economy* effects of clustering, concentrating on local network reciprocities in interaction and advantages of urban settings for agglomeration. More active *joint actions* may also be beneficial in ICT micro-enterprises, but as yet there has been less focus on this element.

Similarly, supply chain analysis for ICT micro-enterprise might analyse elements of governance and how larger firms control supply chains, and the potential for micro-enterprises to upgrade and extract improving value over time. As yet the literature provides little evidence in such areas; this may be because models of global value chains are less useful for ICT micro-enterprises where activities mainly take place within developing country markets (as opposed to typical value chain cases where production links into global markets). However, one must be careful not to dismiss such concepts: ICT micro-enterprise sectors are still in their youthful stages of growth where local markets can aid the birth of micro-enterprises, but in the future linking into wider transnational global chains may become more important for skills and knowledge growth.

In sum, enterprise clustering and supply chain models could provide insight into ICT micro-enterprise through analysis of the network linkages of micro-enterprise as a way to tackle the research questions. They also provide a framework which positions a

potential role for policy, both in how joint actions are driven in local networks, and in how governance of value chains might conceivably influence the contexts of ICT micro-enterprise.

Whilst these elements provide important perspective on answering the research questions, there is some doubt as to whether these models provide a good enough fit to ICT micro-enterprises contexts and activity, particularly as outlined in the differing forms of supply chains. Further such network-focussed approaches poorly conceptualise ICT and innovation which suggests that models would need significant refining to fit appropriately.

2.6.2. Base-of-the-pyramid

Studies of the base-of-the-pyramid (BoP), have been used to described how large enterprises can explore opportunities to provide goods and services to poor communities that both generate enterprise profits and simultaneously provide benefits for the poor – the so-called 'double bottom-line' (Prahalad 2009).

BoP scholarship connects closely to the ICT micro-enterprise literature, particularly in its insights on firm strategies to reach such marginal customers with products and services. It is also notable that the ICT sector has been highlighted as being particularly successful in adopting such BoP models. Work in e-government, ICT in health as well as mobile phone provision to the poor have been seen as trailblazing examples of this new approach to development (Anderson & Kupp 2008, Prahalad 2009).

Successful BoP ventures have typically adopted highly contextual, social-embedded approaches to achieve success, by offering uniquely tailored products to unique markets (as such one should strictly refer to multiple heterogeneous BoPs as opposed to 'the BoP') (Hart & Christensen 2002, London & Hart 2004)[5]. In such notions, local entrepreneurs are active players in BoP delivery connected to ‘user innovation’ models, which encompass concepts of appropriation and niche from an enterprise management perspective (ibid.).

User innovation

The user innovation literature (Bogers et al. 2010, Von Hippel 2005) focuses on the fact that commercial innovations can often be traced back to earlier forms of appropriation done by users. These so-called ‘user innovations’ are important for firms

[5] Here early ‘naïve’ approaches to BoP are not touched on, which assume that only simple technology changes are necessary.

where local conditions and knowledge are seen as 'sticky', that is highly tacit and difficult for outside firms to directly transfer into their innovations (Von Hippel 1998). Lead users or lead firms, actors with more intimate local knowledge of constraints and needs, can build specific innovative niches based on local 'sticky' knowledge contexts. Hence for enterprises, user innovation is important in that over time it allows products and services to become more appropriate and accepted locally than would otherwise be the case (Von Hippel 2007, Von Hippel 2005).

Thus, user innovation, takes a more managerial perspective on the subjects of appropriation and innovation, examining how large firms might be able to maximise the potential of user innovation for their commercial advantage. This can be done through nurturing and enabling sharing amongst user innovators (Von Hippel 2007, Raasch et al. 2008), through increasing benefits of user innovation for lead users (Franke et al. 2006), and in reduction of opportunity costs to user of making such innovations (ibid., Shah & Tripsas 2007).

Most crucial though is how large firms build relationships with user innovators to ensure that user innovations are captured and spread rapidly. This occurs in co-production, the active role of users connecting with organisations within the design and positioning of products (Etgar 2007, Wikström 1996), and in co-creation, where user innovations are not seen as an anomaly during a design stage, but include consideration of how users interact, modify and integrate products or services as an integral part of its functioning (Prahalad & Ramaswamy 2004, Prahalad & Ramaswamy 2003).

User innovation and base of the pyramid

Thus, innovation for BoP customers is considered a user innovation problem where from the perspective of large enterprises, BoP markets with their 'sticky' knowledge context and conditions can seem highly complex and risky. However, through undertaking processes to support lead users or lead firms, and to maximise user innovation these problems can be reduced. The aim is to allow user innovators leeway to innovate appropriately for specific contexts, and then to exploit these adaptations more widely. The role of the larger enterprises is thus to provide capacity building, and help smooth problems related to any wider market difficulties (Prahalad 2009) whilst,

> "allow[ing] local entrepreneurs, who are more familiar with local culture and customer needs, to innovate proactively" (London & Hart 2004 p.365)

BoP analysis has particularly focussed on the relationship element of user innovation, to conceptualise how large firms grow products and services in hand with local

entrepreneurs as lead users. The 'BoP protocol' methodology for instance, places 'co-creation' at the centre of an understanding of how BoP remains appropriate to the user (Simanis & Hart 2008).

> "the intent…is not to be additive and to simply couple the resources of the corporation with those of the community…[but] to develop a concept that exceeds what either the corporation or community members currently do" (ibid. p.23).

Relevance to ICT micro-enterprise

Thus, the BoP literature provides a clear conceptual framework to examine micro- and small enterprises and their locally relevant innovation for low income groups. It provides a logic that links large firms into ICT micro-enterprises, where large firms partner and allow space for user innovations that reach local customers. ICT micro-enterprise activity is powered (and empowered) by larger enterprise in BoP partnerships.

However, this should be considered in hand with the fact that base-of-the-pyramid models have been much critiqued, particularly from a development perspective with little clear articulation as to where actual benefit of BoP accrues beyond the large firms. In BoP models there seems to be a very tenuous link between activities which are typically portrayed as consumerist in nature, and poverty reduction and development (Walsh et al. 2005), and there are very few analyses which have moved beyond anecdotal cases to show wider impact (London 2009, London 2007, Walsh et al. 2005).

Thus, this research could orientate toward a critical view of ICT appropriation. For all the celebration of this micro-enterprise appropriation, it is the large firms (and not ICT micro-enterprises) that guide (and take much of the profits from) appropriation. Even when there are seemingly innovative dynamics in local ICT micro-enterprise, this does not necessarily mean that such BoP ventures will be transformational, either in terms of the consumptive benefits of innovations that are guided by large firms or in the productive benefits to micro-entrepreneurs who may be hostages to the whims of large firm strategy.

In sum, an understanding of BoP models and critiques of them provides a framework which fits with research questions where ICT micro-enterprises are positioned as a ground level actor to achieve the goal of larger organisations. This conceptual position would orientate work towards critical questions about which user innovations are adopted by large firms, and to consider the fairness of distribution of value between

micro-entrepreneurs, and how the instability under which ICT micro-entrepreneurs endure links to wider enterprise strategies.

2.6.3. Systems of innovation

In terms of models of innovation, systems of innovation approaches are now firmly established as an evidentially supported framework for developing a holistic understanding of innovation, and as a tool in policy making, replacing 'linear model' approaches (Edquist 1997a, Freeman 1995, Lundvall 1992a).

Systems of innovation centralises the notion of innovation as a driver of development, but focusing on innovation in a systematic sense, to understand the interactive behaviour of a number of actors – firms, support organisations, joint ventures, policy makers and implementers – who contribute to innovation (Freeman 1995). This connects to the idea that in the contemporary economy, innovation is seen to emerge not through linear processes, but through more complex systems of linked and networked actors in dynamic relations (Rothwell 1994). Equally in terms of understanding activity that drives innovation, a systems perspective suggests that whilst elements can be guided, innovation may not always be intentional, emerging as positive externalities or unanticipated side-effects of actions in the system (Edquist 1997b).

In developing country settings, such system approaches have mainly been used to analyse large, formal and national structures of innovation such as interaction between universities, research, policy and support agencies (Lundvall, Joseph, et al. 2009, Lundvall & Intarakumnerd 2006). However, even where innovation systems and institutions are less formal and well defined, systems approaches provide potential thorough analysis of the systematic ways of doing, using and interacting (DUI) related to innovation (Lundvall, Vang, et al. 2009). Such a position, looks towards definitions of innovation emerging in the everyday processes of interactive learning by multiple actors in the innovation system compared to 'narrower' definitions which have typically analysed formal institutions and organisations (ibid.).

Such DUI (often referred to as 'wider') perspectives thus position innovation as an ongoing incremental process (Lundvall 2011) spread throughout actors in the innovation system. Innovation is seen as a process, where wider innovation emerges from the combined and innovative efforts of a number of players, connected to those already involved intensely in production, and in a range of different processes that include,

> "improvement in product design and quality, changes in organization and management routines, creativity in marketing and modifications to

> production processes that bring costs down, increase efficiency and ensure environmental sustainability" (Mytelka 2000 p.19)

Thus, processes previously underplayed are deemed as important contributors to innovation, such as those involved in production (i.e. technicians and operational actors (Freeman 1995)); incremental innovation processes between markets and end users (Von Hippel 2005, Rothwell & Gardiner 1988), innovation via new combinations of existing innovations (Lundvall 1992a) and the innovative interplays between technology transfer and local innovation (Fu et al. 2011, Mathews & Cho 2000).

ICT micro-enterprises in systems

In terms of ICT micro-enterprise in developing countries, a systems perspective fits well with the research questions, positioning local appropriate innovation activities as a part of wider innovation systems, where all actions are influenced by the relations and institutions in systems.

Systems of innovation models excel in two crucial aspects in terms of answering the research questions. Firstly, through reference to interactive relations and institutions, systems of innovation reflect a wider set of actors that effect micro-enterprise. Thus, ICT micro-enterprise innovative activity is positioned within both the interactive relationships of production and as influenced by underlying drivers related to the wider institutions which orientate the system.

Secondly, the systems concept of 'emergence' fits with the ICT micro-enterprise texts. Many of the forms of ICT micro-enterprise appear unintentional, emerging through spillover and favourable conditions. System approaches thus provide a perspective on activity that moves away from solely rational and strategic interpretations where impacts can be seen to emerge through accidents, unintentional uses of ICT and in indirect ways, even with large firms and policy makers involved. Systems of innovation thus better conceptualise notions of dynamic change and instability within models.

In sum, such models provide the potential for analysis of innovation at a micro-enterprise level and to link to wider policies and strategies, ascribing agency to entrepreneurs through the notion of systems and system emergence. The prevalence of 'narrow' innovation systems models suggest there may be a need to develop models further for the specifics of low income markets in developing country, not least the fact that in contrast to conventional systems of innovation models, ICT micro-enterprises development might better be considered through wider livelihoods outcomes as much as common innovation perspectives on economic growth.

Nevertheless at its core, the model has strong potential to insightfully analyse the research questions.

2.6.4. Relative merits of conceptualisations

All three models provide useful approaches to answer the research questions by providing mechanisms to consider ICT micro-enterprises appropriation and unstable settings, and within frameworks where they can be examined from the perspective of wider factors which influence appropriation and stability.

The strength of the clustering and value chain literature is that it provides a way to clearly conceptualise networks, both vertical and horizontally, to which micro-enterprises link to. Such models also offer clear explanatory paths in terms of analysing network based control which can orientate micro-enterprise. However, the weakness of using this work is perhaps the most significant of the three models. Most notably, one can see that low income enterprises analysed by the value chain literature tend to be at the beginning of supply chains, in early production, in global facing chains. For ICT micro-enterprise, value chains focus on local markets, and the role of these enterprises would be unfamiliar to value chain research. As such, core notions embedded in the value chain literature are less convincing, where notions such as upgrading may be problematic considering the marginality and instability of ICT micro-enterprise and the need to respond to changing environments.

The base-of-the-pyramid literature is useful because it moves beyond some of these critiques, in that it specifically concerns itself with low income markets in developing countries, and the direction of activity is more appropriate. Focus in the literature is on ICT micro-enterprises playing a role in delivery towards low income ICT users, and it particularly conceptualises the role of locally relevant innovation well. Thus, this work better integrates activities of appropriation and provides a far more convincing understanding of the activities of ICT micro-enterprises, linking to the wider factors around appropriation through reference to large enterprises, and a critical analysis of the process of 'user innovation' in this model.

However, these models become problematic particularly relating to the management origins of this work which are more focussed on aiding large firm strategy, at the expense of understanding micro-enterprises. Firstly, this means that some of the micro-enterprise themes, particularly more granular analysis of networks and policy, are not articulated clearly within these models. This is particularly pronounced in ICT micro-enterprise sectors where there is no discernable lead firm, as illustrated in the digital-video example, where this model would be particularly poor, if not redundant in analysis. Secondly, with a firm level focus, models struggle to embed more complex

activity, notably the unintentional and dynamic elements of ICT micro-enterprise. Typically, BoP literature underplays these types of issues in favour of highly rational models of entrepreneurs without much focus on their activities, which can thus miss out on important aspects of such enterprises.

Systems of innovation models suffer from some of the same critiques that were outlined for clustering and value chain models. Like value chain literature, systems of innovation work typically has a more global focus where use in developing countries has been on accelerating industrial sectors into wider global circuits. However, in contrast to the clustering and supply chain literature, there are clearer directions around this problem, in more recent conceptualisations of 'pro-poor' and 'inclusive' innovation systems. These works have begun to discuss the role of innovation in driving more diverse development goals, and outline the types of scenario that allow ICT micro-enterprise to be included in such analysis (Berdegué 2005, Kraemer-Mbula & Wamae 2010a).

In sum, systems of innovation models provide the most persuasive model to take forward. Systems of innovation's core focus on innovation fits in closely with the core of the discussions of micro-enterprise activity whilst a core focus on innovation within interactive and institutional settings proves a compelling model. Systems models can also be seen as more general, and whilst this has been critiqued as leading to a lack of clarity (Edquist 1997b), the benefit of this is that system models have more room to integrate elements of the other rejected approaches. Thus, whilst a systems model in general is chosen, this will be adapted to embed some of the strengths of the other models covered in this chapter, via an understanding of innovation that includes user innovation ideas and low income adaptation taken from the BoP literature. Further, an awareness of the presence and role of networks taken from the clustering and value chain literature can be embedded within an understanding of the interactive relations of the innovation system.

2.7. Summary

The key themes and wider conceptualisations are summarised in Table 2.2. Column 1 identifies the three overarching themes that were identified from the ICT micro-enterprise literature and Column 2 identifies the key knowledge gaps which would provide a clearer understanding of ICT micro-enterprises, drawing on the more conceptual literature.

To summarise this work, it is important that a close analysis of practices and locally innovative technology use by ICT micro-enterprises remains a significant component of any research project. However, it is crucial that such analysis of ICT micro-

enterprises is reframed within wider conceptual frameworks around innovation. Such work will allow a move away from a narrow focus on local relevant appropriation as an end in itself, and towards examining the relation between ICT micro-enterprises' innovation and wider understandings of ICT innovation for low income groups.

Three wider areas of literature that would be useful in exploring these themes in a more coherent way are summarised in Column 4 (though noting the potential cross-fertilisation across themes and models, rather than one-to-one correspondence): enterprise clusters and value chains, base-of-the-pyramid studies and systems of innovation.

Systems of innovation models have been chosen in that they provide clear structures which can consider ICT micro-enterprise appropriation activities, and through a systemic perspective can provide more substantial insights on ICT innovation that can be understood by policy makers and external agencies, as Column 5 highlights.

The other conceptual models, although rejected, include some important considerations that come out of examining this work, and crucial elements of these models can be integrated when considering systems of innovation models in more detail in the next chapter.

(1) Key Themes	(2) Knowledge Gaps	(3) Framing	(4) Conceptual Models	(5) Potential Research Directions and Limitations
Local networks and connections *Micro-enterprises as linked to wider networks.* **Dynamics in changing contexts** *Unstable setting and trends resulting in tactics for survival.* **Niche and local innovation** *Micro-enterprises as active innovators for local customers.*	**Appropriation** *Adaptation of ICTs linked to wider network relations.* **Informality** *Innovation instability and informality of micro-enterprises as emerging from wider economy.*	**ICT innovation** *Linking ICT micro-enterprise into wider processes of ICT innovation for low income groups*	**Clusters and upgrading in value chains** *The interplay and collective work in clusters.* *Power and relationships between actors, particularly related to supply.* **Base-of-the-pyramid** *Local innovative models as part of co-creation of ICT products for marginal groups.* *Critical view of larger enterprise and activity leading to instability.* **Systems of innovation** *Focus on innovation within an interactive system.* *Relations and institutions as defining directions of innovation.*	• ICT micro-enterprise as connected in unequal relationships to ICT supply which can orientate them. • Such value chains provide one potential source of knowledge, learning and improvement of micro-enterprise. • Clear explanation of processes of locally relevant innovation through the concepts of user innovation. • Link into a more critical view of larger firm involvement. • The role of multiple actors in directing innovation within interactive relations. • Policy role within such systems defining underlying institutional settings. • Emergence and unanticipated outcomes of strategy and policy.

Table 2.2: Themes, models and research directions for ICT micro-enterprise

3. Inclusive systems of innovation

3.1. Introduction

As discussed in the previous chapter, systems of innovation has been identified as a model which can be usefully applied to understand ICT innovation and low income groups, and to link between micro-entrepreneurial networked activities of local innovation, and the wider drivers of ICT innovation and instability. In this chapter, systems of innovation models are examined in more detail with the goal of understanding how they need to be adapted to fit in with research on ICT micro-enterprise.

First, key systems of innovation concepts and the underlying theoretical lineage of systems of innovation models are reviewed. Drawing on this outline, an analysis is made as to the potential of such models to conceptualise ICT micro-enterprise in developing countries. This suggests that core elements of innovation systems provide useful understanding in conceptualising distributed innovative activity, amongst active innovators within emerging systems. However some limits are also found, most notably dominant models tend to focus on innovation 'new to the world' to drive national economic growth, and connect to processes of large scale industrial development. Conventional models struggle to integrate some of the elements of ICT innovation for low income groups that have been outlined such as ICT micro-enterprises, their locally relevant appropriation and the link between these innovations and wider development outcomes.

Secondly, expanding the need for refinements, literature on innovation systems in developing countries - particularly those which link to the notion of 'inclusive innovation' - are consequently examined. This work highlights directions to overcome some of the above conceptual weaknesses. Notably, inclusive innovation better integrates the types of innovative activities that have been outlined in the previous chapter. These tend not to be 'new to the world' and are best understood by moving away solely from economic understandings towards wider inclusive conceptions of development outcomes, particularly for ICT micro-enterprises.

The outcome of this chapter is an adapted version of systems of innovation that better considers inclusive innovation and low income markets in developing countries, and a

further set of problems which will be used to expand and answer the research questions through empirical work.

3.2. Systems of innovation

Systems of innovation approaches are now firmly established in the literature as an evidentially supported framework to understand innovation, grounded in a systemic understanding of a range of actors involved in innovation, within institutional environments. Such models have also been at the core of policy construction related to driving national innovation.

In order to build a clear analysis, this section reviews these models in more detail. This review particularly highlights the relatively diverse range of sources that have come together in what is now known as 'systems of innovation'. Understanding the differing inspirations for these models, and their underlying theoretical considerations is crucial in order to clearly understand how to apply systems of innovation models appropriately, and to understand their strengths and weaknesses as part of the analysis.

3.2.1. The historic emergence of systems of innovation models

Historically, innovation has particularly focussed on the primacy of high technological science and technology research articulated within 'linear' models. Linear models define a staged approach to innovation, with the stages (invention, innovation and diffusion) often undertaken in different locations by different actors, invention originating from high level state and firm R&D activities, these later commercialised by manufacturers and over time, diffused into the wider population through firms or other diffusion focussed organisations (Hobday 2005, Rothwell 1994).

Such models have been critiqued in a number of ways. In terms of the veracity of the models, they have been seen to underplay the important role of feedback between stages of innovation. For example, the literature (mentioned previously) on user innovation has outlined the links that often occur between consumers and innovation processes (von Hippel 1988), and work in countries such as Japan has shown the influence of manufacturers in basic research (Freeman 1987). Later innovation models have attempted to integrate some of these feedback loops, for instance in coupling and more integrated models of innovation in the '80s and '90s (Rothwell 1994). Yet, there is a sense that such models are still somewhat linear in nature and often the single firm or product focus misses out on the wider drivers and flows of innovation (ibid.). A second critique of linear models suggests such models have failed to deal

with innovation as it has become both more complex, and those contributing to innovation have become more interlinked (Lundvall 1992a). Thus, even if modified linear models may historically have represented reality, the processes of innovation may have themselves changed with linear models becoming less representative as innovation becomes "an ubiquitous phenomena in the modern economy…we expect to find an ongoing process of learning, searching and exploring" (Lundvall 1992b p.8).

Systems of innovation can be seen to be influenced by Schumpeter's work on innovation, particularly in the way that 'new production functions' of Schumpeterian radical innovation revolve around a dynamic constellations of products, supply and processes embedded in socio-political contexts (Hagedoorn 1996, McDaniel 2000). System models take these understandings of a wider set of actors and drivers of innovation, taking innovation in a more holistic manner and focussing on firm linkages within wider institutional environments (Edquist 1997a, Freeman 1995, Lundvall 1992a). Systems of innovation have been extensively used as a model for policy construction given that it centralises the role of innovation in driving national development (Smits et al. 2010).

Systems of innovation directions emerged in the '90s from a number of fields which were able to be combined together (Soete et al. 2009). In succeeding sub-sections it is useful to unravel these different strands to build a clearer understanding of the makeup of these models. This is done by focussing first on the influence of the three key authors in this field, Christopher Freeman, Richard Nelson and Bengt-Ake Lundvall[6] whose early work still pervades these models. Beyond this, one further consideration in the literature is discussed which is particularly pertinent to the focus of study - how systems of innovation approaches have become adaptable in their scope of analysis beyond the national.

This work on clarifying underlying models is useful in pursuing a coherent and critical approach to systems of innovation particularly in relation to the first research question, considering how to adopt and refine these models to make appropriate analysis of ICT micro-enterprises in developing countries and link between local forms of innovation and their wider drivers.

[6] These sections, draw and expand upon similar discussions in the literature (Lundvall 1992b, Soete et al. 2009).

3.2.2. Freeman: empirical work on production structure and innovation

Freeman's work on innovation illustrates in detail the underlying ideas of systems of innovation. This direction can be seen to be most grounded in empirical data, drawing on organisational and institutional analysis, particularly empirical analysis of the economic 'miracle' of Japan which emerged as an innovative leader in the '80s and '90s, and the production structures which drove this emergence (Freeman 1995, Freeman 1987).

Freeman's analysis responds to the fact that linear models, which centralise basic research activities, very poorly reflected the realities of growth of innovative economies such as Japan. In this case, even with a comparatively modest investment in basic R&D, constructing an appropriate production structure in hand with a coherent drive for innovation from an active state, pushed institutional change and led to rapid innovation driven growth (ibid.). Thus, Freeman suggests that beyond basic research, the ways that basic knowledge and research are organised, structured and guided into innovation will orientate economies. His focus on innovation systems thus examines the,

> "ways of organising production, investment and marketing and novel ways of combining invention with entrepreneurship" (ibid. p.31)

Of particular relevance were Freeman's findings that innovation emerged through the way that various parts of the economy - education and learning, production processes, research, and state support – were complimentary in supporting the same directions of innovation and that such elements were well interconnected. Underlying this coherency was the role that 'institutions' play in innovation. This term is used in two senses by Freeman, to refer to large state research bodies where in Japan, active guidance and research drove institutional change in multiple sectors. Institutions also link to longer running structures, such as common forms of education which emphasise practical training, and in cultural structures which aided horizontal knowledge flows which in Japan coupled well into the process of technology-led innovation that emerged (Freeman 1991).

In terms of actors of innovation, whilst focussed R&D played some role in Japan, firm learning (through imitating and reverse engineering foreign technologies) was a crucial part of technological acquisition and knowledge, with a key role for subsequent incremental "assimilating and improving upon imported technology" (Freeman 1987 p.40). Thus, innovation was led not solely by research scientists but in hand with linkages into engineers within firms. These firm processes of incremental innovation

were particularly crucial in driving innovation in optimising production processes and quality control (Freeman 1987).

Thus, Freeman's work, as supported by later empirical analyses of innovation in other East Asian economies (Kim 1997, Mathews & Cho 2000), points towards a wider understanding of the linkages and actors involved in successful innovation, and how policy and guided institutional change can drive the economy. This work is particularly relevant for the present study in that it begins to establish the role of non-R&D actors in innovation, here embedded within everyday activity of the production engineers and the role of such actors in incremental innovation which can in the longer term contribute to more widespread innovation.

3.2.3. Nelson: national benefits of innovation and path dependent structures

Nelson's work broadly follows similar ideas to that of Freeman, with a focus on the links between basic R&D and the supporting structures which drive wider economic growth (Dosi et al. 1988, Nelson & Nelson 2002, Nelson & Rosenberg 1993). Nelson also takes an examination of innovation from a national perspective, but this work scrutinizes solely the links between primary generators of invention and innovators: large firms, R&D, universities and the state.

Nelson's models are influenced by his previous work in evolutionary economics. This is used to build an economic model of the processes of innovation in more detail. For innovation, one does not know beforehand the outcomes and usefulness of a particular innovation, so the processes of producing and optimising an innovation is necessarily an uncertain and thus evolutionary process (Dosi 1988). In this light, an evolutionary perspective would suggest that in this 'information poor' activity, articulation of desirable innovations, as well as the ongoing selection of 'desirable' adaptations is orientated by the norms and behaviours in which innovators are embedded. Here, norms and behaviour are framed within the idea of 'technology paradigms' (the established ways of using or solving problems related to specific technology families) and 'institutions' (in this case the norms and rules which guide innovative activity) (Dosi & Orsenigo 1988). Implied in these evolving processes of innovation and selection is a path dependency of innovation, where present innovation influences the technological paradigms and institutions, which themselves orientate how subsequent innovations are undertaken (ibid.).

Linking evolutionary approaches to systemic innovation models, Nelson argues that the forms of technological paradigms and institutions which guide innovation in this evolutionary perspective are principally national. Thus, national systems of innovation

are defined as the "set of institutions which influences the national technological capabilities of a nation" (Nelson & Rosenberg 1993 p.13), some of which may lead to structures more conducive to economic growth than others (Nelson & Rosenberg 1993). Whilst Nelson argues that there might be potential for driving innovation systems through national policy, his work mainly articulates technological paradigms and institutions emerging from historic circumstances. This is particularly highlighted in his key volume (ibid.) which contrasts innovation systems across multiple countries such as the US and UK, focusing on the resources, crises or circumstances which led to institutional structures which drive innovation, suggesting a largely monolithic character of institutions grounded in historic specificities. This somewhat differs from Freeman's work on Japan who more clearly articulates the state as a driver for technical change, albeit as part of similar institutional structures and constraints[7].

In sum, Nelson's work is more focussed on analysis solely of the core R&D actors and institutions of innovation and less on the non-R&D innovation actors highlighted in Freeman's work. However, Nelson's work is useful by providing a more substantial theoretical perspective to conceptualise the role of institutions in guiding innovation decision making, highlighting the adaptive processes which are central to innovation from the system perspective–the link of basic research into innovation, and of the dynamic feedback in diffusion which feeds evolutionary growth.

3.2.4. Lundvall: User-producer linkages and learning

Lundvall's emphasis related to systems of innovation is slightly different, centralising the notion of interactive learning between different actors to understand innovation (Johnson et al. 2003, Lundvall 1992a, Lundvall 1988). Innovative activity links to where these innovative linkages are thicker, through the practices of learning by 'doing, using and interacting' between a range of actors in the system (Lundvall 1992b). Underlying Lundvall's approach is his previous theoretical work analysing economic transaction relationships.

Economic transactions can be seen to sit between two economic poles, that of neoclassical market economics where actors are assumed to have complete information about goods and each other in transactions, where exchange are solely

[7] In many ways these two approaches can be seen as complimentary in that established national institutions such as in France, US or the UK (as studied by Nelson) may be less susceptible to change, where systems of innovation may be more inflexible.
In countries like Japan, the notion of 'catch up' suggests that where there is lower institutional baggage (and inertia) from the cumulative effects of previous innovations systems, it could result in systems being able to adapt quickly and appropriately to innovations, conceivably allowing these economies to grow quicker than those more institutionally established (Freeman 1995).

based on price signals, and 'transaction cost' approaches where transactions are assumed to be uncertain, often leading to exchanges being embedded within organisational hierarchy (Lundvall 1988). Lundvall's notion of 'organised markets' suggest a gamut of transactions which sit between these two poles as shown in Figure 3.1.

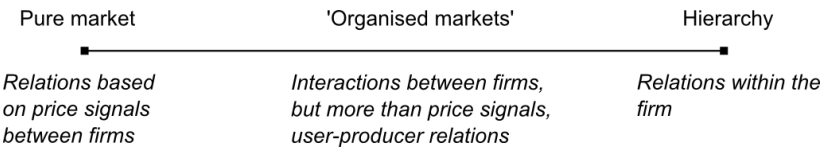

Figure 3.1: Positioning organised markets for innovation.
Adapted from (DeBresson & Amesse 1991, Lundvall 1992c)

Organised markets outline interactions which occur between independent market actors, but as opposed to neoclassical models, are undertaken in uncertainty. In such cases, 'organised markets' suggests the presence of information sharing beyond price signals, feedback mechanisms and co-operation in transactions within markets to reduce risk that comes from this uncertainty (Lundvall 1988)[8].

Linking such theoretical work to innovation, one can argue that economic transactions related to innovation can be seen as an economic transaction undertaken in uncertainty. Users of innovation will likely have incomplete 'upstream' knowledge of the 'use value' of a new product or process. Similarly, in order to build appropriate innovations and to understand needs, innovators are also likely to have incomplete knowledge of needs of their customers 'downstream' (ibid.). Thus, in market-based innovation, transactions will occur in organised markets, where thicker and better established channels of information, clearly shared tacit understandings in transactions, and better trust in interactions will result in more appropriate understanding of innovation (ibid.).

From a systems perspective, particular national strengths of innovation are likely to emerge in specific strong flows of learning in 'user-producer interactions'. This concept can be used to understand how relations can enhance or limit interactive learning outlining the types of relationships that occur between the users and the producers of innovation (Lundvall 1985, Lundvall 1992c).

Specific user-producer interactions occur both from passive factors, for instance from specific national resources, geography, culture and history which enhance certain interactions leading to more established learning and innovation (somewhat in line

[8] In a sense, Lundvall's work sit close to well established work on networks and network relations, particularly Granovetter work on embeddedness and the social elements of economic relations (Granovetter 1985), extending these ideas into the realms of innovation.

with Nelson's institutional perspective). Alternatively, active design of innovation systems might intentionally enhance certain user-producer linkages to push learning and benefit innovation flows (ibid.).

Lundvall's organised market position provides insight through a focus more on the ongoing relationships and a link of innovation into relationships and learning processes located in routine activities. User-producer interaction is able to encapsulate a number of concepts around user innovation, networks and demand orientation in innovation that have been encountered in previous chapters (Nahuis et al. 2009). This work differs from Nelson's evolutionary economics influenced work which emphasises the institutional sources around innovation processes of searching and selecting innovations as opposed to ongoing learning processes explored here. Whilst these two different approaches seem somewhat contradictory they need not necessarily be, as emphasised by Lundvall (1992b). They represent complimentary issues where one aspect (Nelson) focuses on the role of institutions as an underlying driver of innovation, the other aspect (Lundvall) an examination of relationships in production systems which drive innovation (which may or may not directly link to the aforementioned institutional factors).

3.2.5. Regional and sectoral systems of innovation

Beyond these foundational works, a core modification of system of innovation models which is relevant to this thesis relates to the evolving discussion of scope of systems of innovation. One of the commonalities of the conceptions outlined so far has been on taking an aggregated focus at a national level to define the laws, culture, routines or linkages which are articulated to drive innovation. However, other literature has questioned whether national considerations are most appropriate, and transferred systems concepts into different scopes (Edquist 1997b). In terms of geography, the scope of policy making, ways of doing and culture used to define the institutional drivers of innovation may not necessarily be defined by national borders (Cooke et al. 1997, Storper 1993). In particular, in many areas it may be more appropriate to consider the role regional level identities, governance or alliances have had upon institutions, as illustrated by the economic driving force of innovative regions such as Silicon Valley and Italian regions in innovation in production (ibid.).

Similarly, the national scope has also been questioned related to the fact that linkages and institutions of innovation vary across different 'technological systems'. In technological systems, institutions are defined by strategic networks of actors, wider professional competences, norms and common forms of technology and shared

knowledge all which will tend to vary across economic sectors (Dosi & Orsenigo 1988, Metcalfe 1995, Metcalfe 1994).

Technological system perspectives can be considered a more sectorally designated notion of innovation systems, with potentially a range of scopes from local clusters of sectoral innovation to trans-national systems (Carlsson & Stankiewicz 1991, Mytelka 2000). As we will see in later chapters, national sectoral systems of innovation approaches are particularly suitable for this study in that they allow a more granular analysis of the specificities of knowledge, technologies, actors, relationships and institutions that are often characteristic of a particular sector (Malerba 2002). Such an approach also places more emphasises upon dynamic elements, acknowledging that interplay between sectoral elements (Geels 2004, Malerba 2002).

Thus, the importance of these refinements is that this work suggests a more flexible scope in understanding innovation, and that different levels may compliment each other (Edquist 2001). Thus, scope of systems of innovation is not necessarily aggregated to a national level, and scope selection is likely to be made based upon the particular goal, context and system under research.

3.2.6. Systems of innovation as a 'family' of approaches

As can be seen from these descriptions, systems of innovation approaches should be seen as a 'family' of varying approaches, which tend to be complementary. At the core of these approaches are more dynamic models of innovation networks (compared to linear models) which when analysed through aggregated perspectives provide insight on the potential gains that coherent networks of such innovators can make (or lack of gains due to incoherency) (DeBresson & Amesse 1991).

The underlying systems approaches also suggest activity which is not reducible to frameworks of optimum activities (Edquist 1997a). In evolutionary systems, small changes lead to unexpected paths of the innovation system, and the cumulative non-reversible nature of the system requires a more contextual understanding of innovation, given that innovation is determined by structures which have developed in the system over time (Allen 1988). Evidence from this work also suggests that innovation systems can be taken to be both emergent and designed to some extent. Guided strategy, new partnerships and policy can drive change, but this will not necessarily map directly to the innovation system, with often unforeseen outcomes, potentially rejected, adapted or subverted by other actors within the system (Edquist 1997b).

One crucial disparity between approaches is what Lundvall refers to as 'narrow' and 'wider' views of systems of innovation (Lundvall, Vang, et al. 2009). Narrow views are

connected to the type of analysis in Nelson's work, which focuses on the interplay of formal actors of the economy involved in R&D processes, and the conversion between basic research outcomes and innovations. This approach centralises a focus on organisations, rules, and 'formalised institutions' such as universities and extra-sectoral bodies which drive this innovation (Edquist 2001). In contrast, a more holistic understanding of innovation is outlined by both Lundvall and Freeman. In 'wider' systems models, a greater range of processes are of interest, particularly of the ongoing processes of progressive refinement of innovation within systems. Thus 'wider' views locate the role of incremental innovation processes throughout the system - inventions being constantly re-invented in production (Freeman 1995); innovation brought forth in new combinations of existing innovations (Lundvall 1992a); diffusion and innovation processes becoming inseparable, products being redefined and reconfigured by market interaction (Von Hippel 2005, Rothwell & Gardiner 1988). This also implies a wider range of innovative actors is examined, including all those who intensely engage in activity such as developers, marketers, repairers, local configurers and innovative users (Lundvall 2011).

In sum, systems of innovation ideas outline a vastly different approach than previous linear models and provide a useful model for considering ICT micro-enterprise, focussing on the idea of innovation with multiple distributed actors within the system, and a closer link between the three processes of innovation – invention (and reinvention), innovation and diffusion (Lundvall 1992b). However, systems of innovation is effectively a family of approaches with no single clear direction, which can be disorientating as shown by the sheer range of different ideas ecompassed in these models; in terms of underlying frameworks – originating from systems approaches, evolutionary economics, Schumpeterian ideas of innovation and learning models; in terms of the scope of examination – national, regional or sectoral; and in terms of the emphasis of these models – firms, policy, user-producer interactions and institutions which will need to be pared down for specific case analysis.

3.3. Considering innovation systems in low income markets

Systems of innovation approaches can be said to have substantively arisen through historical analysis of innovation cases (e.g. Japan, regional innovation in Italy) (Edquist 2001). So, the models and approaches have become particularly adapted to analysis of innovation, related to domains of manufacturing and industry in developed and emerging countries, and linking this to national economic growth (Johnson et al. 2003).

Thus, there is a question of how such models, refined in these contexts are applicable to analysing the types of innovation elucidated in the previous chapter, local market innovation for low income users in developing countries, which move away from the typical structures of manufacturing that have been predominant in innovation systems analysis (Lorentzen & Mohamed 2009). Thus, there is concern that the developing country focus and core characteristics of these activities might not fit well with conventional models (Joseph et al. 2011, Lorentzen & Mohamed 2009). In this section, the goal is to understand how to apply systems ideas to be of relevance, and to understand how to integrate the types of low income markets and ICT that we seek to understand in this case.

3.3.1. Innovation systems in developing countries?

In terms of applying systems approaches to developing country innovation, there has been debate over how useful systems of innovation models are to developing countries, particularly in nations where industrial sectors are small. This has led to a new set of adaptations which seek to more clearly refine innovation and systems for developing countries. Principally these adaptations emerge from critiques of the idea of conventional systems of innovation in developing countries.

Critiques

Viotti(2002) argues that innovation plays a fundamentally different role within developing countries in comparison to developed ones. In developed countries, innovation has been of central interest as a way of examining how structures capturing technical change at a national level drive national economies (ibid.). In contrast, in developing countries the link between economic development and technical change, if it does exist, is from a perspective of innovation that looks at how nations with low technical capabilities adapt and diffuse technologies in their own contexts (ibid.). Thus, according to Viotti, interest should be on structures which aid 'catch up' and how these nations absorb external innovations as opposed to examining the wider gamut of systems around technical change of conventional models. Hence, he argues that it is more appropriate to talk about a set of structures around 'national learning systems', which conceptualises the ways in which national economies are able to build capabilities and diffuse innovation from elsewhere. Lall & Pietrobelli(2002) follow similar arguments, using the notion of 'national technology systems' to position the technology policies and institutions which allow developing countries to build such capabilities, which will particularly include those which link to global networks (here focussing on manufacturing). Metcalfe & Ramlogan's work on innovation in developing countries follows similar directions, focusing on 'innovation ecologies' to denote the key market actors, division of labour and firms who emerge to link and support

innovation in developing countries (Metcalfe & Ramlogan 2008). In this conception, innovation systems are multiple and are as likely to global in nature where developing countries are just one element of wider systems.

To summarise, these more critical works on innovation systems in developing countries provide important insight. They suggest that focus around innovation is likely to move away from strong supply-side emphasis, to include more prominent analysis of demand-side components of innovation - learning, diffusion, markets and firms. More controversially, in developing countries they also argue that this shifting emphasis around innovation necessitates new core concepts more appropriate than innovation systems.

In some senses this critique move towards perspectives that again disintegrate innovation back down to its separate components (invention, innovation and diffusion) where analysis of systemic elements around diffusion of innovations are most appropriate for developing countries (Rogers 1995): Viotti focusing on institutional elements linked to international diffusion; Lall & Pietrobelli centralising national contexts which support capacity building to absorb innovations as they diffuse; Metcalfe and Ramlogan, the key actors and divisions of labour which will influence the diffusion of innovation. However, this building of alternative core concepts is still a debated one in the literature as highlighted below.

Responses

In a rebuff to these works that move away from systems of innovation towards other frameworks, Lundvall's(2011) in his introduction to a recent volume on innovation in developing countries refutes such critiques, drawing on parallel research which examined innovation and development of Northern European countries.

> "These countries prosper not because their firms develop unique new innovations for the world market but because of a highly developed capacity to absorb and use new technology developed elsewhere… Following Viotti these countries would have learning systems but not innovation systems – perhaps we would end up with innovation systems only in the US, Japan, the UK, France and Germany?" (ibid. p.28)

For Lundvall, who has always adopted 'wider' interactive learning perspectives, innovation systems models have always embedded learning, incremental and diffusive elements as a crucial part of defining innovation systems. This de-linking of innovation in these new frameworks is not only unnecessary but mis-characterises innovation (Lundvall 2011). This is also supported by empirical work on innovation 'catch up' in developing countries which suggests that flows between 'new to the world' innovation

and less dramatic incremental processes are closely intertwined and linked, where capability building, interactive learning, and relations are a crucial element of understanding (Forbes & Wield 2008, Kim 1997).

A second rebuff made against these refined frameworks has also been made, arguing that refined models may have also neglected recent crucial trends. Firstly, this relates to articulations of 'development' that have increasingly moved beyond solely economic growth, towards wider notions of what 'development' means (Lundvall 2011, Sen 1999). In these perspectives, interest in innovation is not only on its role in economic development but also wider benefits such as improving livelihoods, empowerment and security, and this shifts understanding. Secondly, trends around the prevalent flows of innovation and technology, from developed to developing countries can increasingly be questioned. Shifting emphasis toward developing and emerging market sources of innovation implies a potential shift of paradigms around sources, knowledge and flows of innovation. Both these trends lead to arguments that diffusion-focussed system models may be potentially problematic in conceptualising such flows (Lundvall 2011).

Adapted perspectives

In sum, work which critiques systems of innovation approaches in developing countries brings forward two key points, one which is followed, one which is rejected. This work suggests examinations of innovation in developing countries will link closer to markets, demand focussed activities and that innovation systems may still be in emergent and fragile states. Thus, this necessitates innovation models which will require new components and perspectives related to this novel setting.

However, the argument brought forth for moving away from systems of innovation models as the underlying this core conceptual model are rejected. 'Wider' models of systems of innovation highlight the interconnecting nature of components, actors and institutions of innovation. If perspectives are able to embed innovation resulting in wider development outcomes, and able to integrate more diverse markets and the interplays of processes of invention, innovation, learning and diffusion, then calling these innovations systems is not contradictory. Nevertheless it will necessitate adapted conceptions, where innovation is more diverse and emerges from a wider set of actors.

These notions of core, but changed models of systems of innovation for developing countries are explored in more detail to build a more appropriate framework in subsequent sections. With innovation systems maintained work that links between innovation and wider conceptions of development are explored, and following on from this a more detailed discussion of how components of systems models need to be adapted.

3.3.2. Innovation and development

Innovation beyond solely growth

The previous section has argued that innovation system models are appropriate for developing country analysis with some modifications around the nature of these systems to include greater consideration of 'wider' set of actors and activities. Here the discussion is particularly on one element mentioned in the previous section that needs to be more clearly conceptualised, understanding innovation where the articulation of development moves beyond solely a focus on national and economic growth.

Typically systems of innovation models in developing countries have linked to innovation for growing into, or joining global activities. In terms of policy approaches, they look to innovation for driving firms to become internationally competitive, with innovation driving national economic growth. Thus these is a tendency to focus on familiar and coherent production sectors in developing countries, particularly in Asia's emerging economies (Lundvall, Joseph, et al. 2009, Lundvall & Intarakumnerd 2006).

This contrasts to the scenario of more local focussed innovation activities, where networked innovators are competing in low income markets, which low income focussed ICT sectors can be said to exemplify. In such scenarios, whilst innovation can be seen to have links to economic growth (i.e. through job creation and driving efficiency in sectors), development outcomes of innovation are best understood by integrating other contributions - skills, employment and empowerment - which move beyond solely national and economic measures towards more inclusive ideas of growth and equality (Cozzens & Kaplinsky 2009).

Thus, beyond broader understandings of innovation systems outlined in the previous section, models will also need to consider a broader scope in terms of the development outcomes of innovation. Such ideas can be seen to sit better with prevalent positions from development studies which attach importance to a wider set of outcomes of development, building capabilities, securing livelihoods and driving institutional change as much as economic growth, particularly in providing for those close to poverty (de Haan & Zoomers 2005, Sen 1999). Mainstream innovation studies with its predominant economic logic has been slow to examine how innovation relates to these wider conceptions of developments, but there is no reason why such wider positions on development cannot be complementary to existing understandings

(Klochikhin 2011). Thus it is appropriate to revisit the relationship between innovation and development[9].

Inclusive innovation

There is a growing interest in notions revolving around 'inclusive innovation', which considers some of these wider actors and activities of innovation that have been outlined. Inclusive innovation looks to consider locally or indigenously created innovations more centrally within innovation considerations, and to build better analysis of innovation in connection to the large expanses of informal work in developing countries (Cozzens & Sutz 2012). In terms of policy, inclusive innovation looks to push more appropriate and equitable innovation policy in developing countries that moves beyond narrow R&D and technology product focussed definitions (Gault & Zhang 2010, STEPS Centre 2010). Thus literature examining inclusive innovation provides important material for integrating wider forms of innovation for development.

There have been a number of recent works which sit in with this renewed focus on such a conception of innovation (Altenburg 2009, Kraemer-Mbula & Wamae 2010a, Lorentzen & Mohamed 2009, Srinivas & Sutz 2008, STEPS Centre 2010, Utz & Dahlman 2007), as well as empirical analysis using adapted systems models to analyse unfamiliar sectors the developing world, for example, in agricultural innovation systems (Clark 2002, Hall et al. 2001, Knickel et al. 2009) and health innovation systems (Mugabe 2005, Mugwagwa et al. 2010). This work is still in its infancy, labelled in multiple ways such as 'pro-poor', 'inclusive', 'below the radar' or 'base-of-the-pyramid' innovation[10], but each can be said to centralise a focus on understanding innovation and development that moves beyond solely growth and looks towards wider understanding of the relation between innovation and development (Cozzens & Sutz 2012).

Formal definitions of inclusive innovation have so far been varied. Inclusive innovation is hence defined along a number of potential dimensions here (Altenburg 2009, Cozzens & Kaplinsky 2009, Cozzens & Sutz 2012):

- Inclusivity in innovation ownership: Those more marginal groups receive a fair ownership, and share of the benefits for their innovative activities, particularly connected to indigenous and local innovations.

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[9] This is also reinforced by critiques of previous orientations around innovation in developing countries, where it can be argued that the economic effects of such globally orientated, industrial based development has only to be felt amongst a small, often elite strata of society (Fu et al. 2011, Kraemer-Mbula & Wamae 2010b, Mytelka 2000).

[10] In this thesis we use the terminology of 'inclusive innovation' to represent these terminologies.

- Inclusivity of innovation processes: Those more marginal groups are involved as actors as part of the development of innovative goods and services, are able to take roles that build capabilities, and are able/allowed to make substantive innovative contributions to processes.
- Inclusivity of innovation focus: Those problems to be addressed by innovation are of relevance to those faced by marginal groups; innovations are adapted according to the needs of marginal groups.
- Inclusivity of innovation adoption: That marginalised consumers are able to adopt innovations – Innovations are diffused and marketed appropriately to these consumers, and that consumers have the capabilities to use these innovations.
- Inclusivity of innovation impacts: That innovative goods and services have a beneficial effect on the livelihoods of marginal groups.

This general outline of inclusive innovation defines a wide field of focus, and suggests a terrain of inclusivity, where a specific innovation or system may or may not encompass all of these categories. One can also argue that these different 'inclusivities' are somewhat hierarchical, for instance inclusive *adoption* may only require that a specific innovation form be tweaked, compared to *ownership* of innovation which would require radical bottom-up approaches to innovation.

Work on inclusive innovation is complementary with systems perspectives with some literature on inclusive innovation already having used systemic perspectives (Kraemer-Mbula & Wamae 2010c), particularly in terms of adapting sectoral systems (as in work on agricultural innovation systems (Clark 2002, Spielman et al. 2009, Sumberg 2005)). Such inclusive innovation work has thus begun to make the first step to integrate the increasing decentralised and fragmented actors present in these sectors, and to consider the wider sphere of innovation and development (Berdegué 2005).

From the perspective of the subject of this study, inclusive innovation, and particularly the framework above provides a way to integrate the wider development outcomes of innovation outlined of the literature review, related to both production (inclusive processes) and consumption (inclusive outputs) benefits as part of a wider systemic framework. It also provides a more coherent approach which better considers the varying directions of inclusivity within innovation models.

3.4. Systems of inclusive innovation

The previous section introduced some important ways by which systems models will need to be adapted for exploring ICT micro-enterprise in developing countries. In terms of the emphasis of systems models, a focus on innovation for low income users

in developing countries requires an examination of components which are more emergent, demand-led and inclusive of smaller actors. In terms of the links between innovation and development, inclusive innovation models need to consider a wider set of development outcomes, not solely related to economic growth.

This section thus looks to bring together these considerations to discuss in more detail to understand how systems of innovation should be refined, and operationalised in research. This is done through detailed discussion of the five core components of innovation systems – actors, innovation, learning, relations and institutions (Edquist 1997b, Soete et al. 2009) - and of how inclusive innovation systems research is likely to depart from the conventional systems models. In addition to building insight, this also brings up further knowledge gaps which will need to be explored in empirical research.

3.4.1. Actors

Focus of inclusive innovation systems models makes a more explicit connection to the notion of 'demand', in terms of the interplays between innovation and local markets (McCormick & Oyelaran-Oyeyinka 2007). Whilst the notion of 'demand' and interaction between users and producers have been outlined as a key consideration in systems of innovation, certainly within more conceptual discussion (Edquist & Hommen 1999, Lundvall 1992c), such local demand considerations often taken the back seat, assumed to be unproblematic or rather uniform (Edler 2010). As the base-of-the-pyramid literature highlighted in the previous chapter, a demand focus is particularly important in terms of lower income, developing country users of innovation, related to their vastly different (and often heterogeneous nature of) needs, resources, knowledge and market development (Prahalad 2009, Srinivas & Sutz 2008). This suggests that how specificities of demand are met will become a more prominent factor in inclusive innovation considerations.

The importance in capturing these links into low income market demand also suggests inclusion of actors closer to that demand, from intermediaries, suppliers, sellers and lead users who might not generally be defined as innovators (Von Hippel 2005). This is vital from an inclusive innovation perspective to ensure that large swathes of actors who might gain development outcomes from innovation are not rendered invisible (Gault & Zhang 2010). This somewhat fits into core systems of innovation work insights on the involvement of non-R&D actors in systems of innovation (Freeman 1995, Freeman 1988), but extends this further by considering the more marginal actors for these specific developing country settings. Actors tend to operate at a

smaller scale, linking between certain 'core' system functions and peripheral markets or groups (Howells 2006, Stewart & Hyysalo 2008, Winch & Courtney 2007).

Thus, inclusive innovation considerations push focus from solely supply-side to include increasing focus on demand-side actors, less dealt with in traditional systemic perspectives. Given the specificity across sectors, and the dynamism of such actors in a developing country setting, a sectoral innovation system approach might be particularly well suited to such work. This would allow a more specific study of the detail of sectoral actors, firms and relations and link these into a understanding of an evolving sector (Malerba 2002).

This discussion links well with ICT micro-enterprises who can be seen as linking into low income ICT markets. However, a clearer analysis is required for such actors. Are micro-enterprises the only intermediary actors? How do these actors link to demand? How are these actors linked into other elements of the innovation system, and what is their key role within the innovation system?

3.4.2. Innovation

The call for more subtle analysis of system actors pushes the emphasis of systems models towards examining smaller scale and incremental processes around innovation (of which ICT micro-enterprise might be one example). In line with system of innovation work, this will not only be around products, but related to the surrounding activities, processes, organisational and institutional elements (Edquist 2001, Freeman 1995, Geels 2004). This might also be from *embodied* learning and progressively more refined adapted innovation objects, or from *disembodied* learning and better understanding of best practice, positioning, training related to innovations (Rosenberg 1982).

As outlined in the literature review, activity around innovations is likely to be important in how innovation reaches low income markets, where innovations developed elsewhere often initially mismatch needs (Heeks 2002). These processes might be described as innofusion, which initially revolve around the processes of bringing innovation into use as part of diffusion (Fleck 1988). However, this should not isolate study to solely a diffusion-centric analysis. Such activity focussing on local markets in developing countries can also have wider significance as outlined by Fleck.

> "sometimes configurations turn out to have wider applicability beyond the specific contingencies which gave then birth" (ibid. p.172).

Thus, inclusive innovation needs to be aware not only of locally adaptive learning processes but also 'reverse' flows of innovation, from those smaller innovation processes around local demand flowing back to the wider system (Arocena & Sutz

2000, London & Hart 2004). Such flows connect back into an evolutionary perspective of systems of innovation, and an understanding of the key role of evolutionary adaptations in driving innovation over time (Dosi 1988).

Thus, it is clear that an examination of innovation will need to explore at micro-levels these new more subtle types and flows around innovation. However, it is still unclear how such processes connect to more macro-level adaptation of innovations-as-objects in such markets, and more detail is required about the innovative roles played by micro-enterprise actors.

3.4.3. Learning and relations

Systems of innovation describe the interactivity of system actors; specifically how changing relations and modes of learning within the system will orientate innovation over time (Lundvall 1992a). Learning is described to emerge through various categories, both object-orientated and interactive: *learning-by-doing,* learning as individuals accrue experience through engaging in 'production processes'; *learning-by-using,* where learning relates to the adjustment that actors need to make to ensure that complex systems fit into their particular tasks; and *learning-by-interaction,* where learning comes from interacting system actors (ibid.). Such categories are useful in understanding some of the direct ways that incremental innovation emerges, but they are lacking in that they underplay social and non-functional learning, and in that they examine the notion of coherency poorly (Edquist & Johnson 1995, Stewart & Hyysalo 2008, Wenger 1999).

To state this critique another way, learning *related to* the innovation system is assumed mainly to come from activities *within the* innovation system and learning is assumed to link to the goal of directly enhancing the system. However, this may not necessarily be the case in innovation in low income markets where actors are more diverse. For instance, micro-enterprises within low income contexts may learn more around the contexts of local demand or related to securing or improving livelihoods as opposed to the systemic elements. Further, given this wider set of learning directions, which move from systemic learning to consider wider social learning, it is open to question if these learning directions amongst system actors will necessarily be complementary. This might lead to potential mismatch emerging from the difference between profit maximising goals of larger actors and utility maximising goals of micro-enterprise actors. Understanding the relations between these potentially mismatched actors in the innovation system is vital in how different learning trade-offs play out in the system (Edquist 2001, Lundvall 1992a).

In terms of relations, in these unfamiliar low income focussed markets, it is unclear how best to define the characteristics of 'relations' between actors, where links between actors may be are more reconfigurable and occur in the form of extended supply chains. Thus, there will be a necessary first step to understand the nature of relations.

Previous work around innovation and such extended chains has used value chain conceptions to examine relations, where more market-based chains are characterised by structures that allow learning through indirect activities, but which might also allow actors greater independence for learning around local demand (Pietrobelli & Rabellotti 2011). More contractual relationships are likely to be characterised by more guided learning, but there is the risk that this results in a gap between the innovation system and low income market needs (ibid.).

To sum, there is no clear outline on learning and relations and little empirical evidence. How are relations characterised? How do these forms of relation link to learning? Consequently how is innovation limited or expanded in these relationships? To complicate this perspective there is also a dynamic consideration. Given that innovation systems are often in their early stages, and constantly evolving, one needs to also consider the evolving nature of these system to analyse these relations as systems develop or decline.

3.4.4. Institutions

In its general use in systems of innovation, the lexicon of 'institution' is often unclear and has resulted in much 'fuzziness', particularly due to the fact that the term can include both institutional rules or norms, and 'formalised institutions', such as research institutes or business services (Edquist 1997a)[11].

Systems of innovation models typically reference policy in connection to institutions, particularly in understanding how the right combination of institutions pushes underlying growth (North 2009). Thus, rules, regulations and cross-organisation bodies tend to be the predominant vocabularies, seen as economic structures which can enhance the activity and relations within the innovation system (Johnson 1992). From this perspective, in developing country accounts, institutions have mainly been seen as lacking, or inefficiently structured in terms of innovation (Utz & Dahlman 2007).

[11] Often further confused by the fact that larger firms label themselves as 'institutions', a confusion brought about by such use in regular language.

However, in terms of local demand focussed innovation in developing countries, it may be problematic to solely consider institutions in such overarching ways. It has been well established that in developing countries, such overarching rules and regulations are frequently transgressed locally, where informal institutions and norms of behaviour are more crucial in orientating activity (Brinkerhoff & Goldsmith 2005). Analysis of such informal institutions points towards the need to integrate the informal "structure and activities that provide meaning to social behaviour" (Scott 2001a p.33), and the norms and typical roles of activity in these settings (Brinton & Nee 1998, Powell & DiMaggio 1991, Scott 2001a) which can play an equally important role in influencing the directions of policy at the local market level (Berdegué 2005). Again the dynamic aspect of emerging innovation systems complicates this perspective, where institutional factors or policy effects might ebb and flow as systems emerge over time.

In terms of shaping institutions, policy making is likely to influence how institutions of systems of innovation drive inclusivity. However, actors are likely to feel the effects of policy alongside other less formal institutions related to norms and ways of acting. How actors in the innovation system respond to such contradictory institutional forces is important in providing insight into how policy making links into inclusivity. Thus, beyond examining policy making, a focus on aspects of implementation of policy and the role of less formal institutions is essential in order to fully understand how such policy approaches relate to pro-poor innovation.

3.5. Summary

One can say that this analysis goes some way towards answering the first research question. It supports the efficacy of innovation systems as a useful model, clearly linking actors and policy making around ICT innovation into the innovative activities and dynamic settings of actors more focussed on low income customers, such as ICT micro-enterprises.

The core of the systems of innovation model provides a solid grounding in which to conceptualise inclusive innovation. This research fits well into the theoretic origins of systems of innovation thinking, particularly within the underlying model of a more distributed innovation, and incremental learning process.

Beyond this, systems of innovation models require some refinement to better fit with ICT micro-enterprise contexts in developing countries. Drawing on the emerging work on inclusive innovation, and the literature review from the previous chapter, models have been refined into an operationalised systems framework to allow extensive examination of ICT micro-enterprise as summarised in Figure 3.2. This work is not

complete and as shown in the figure there are still a number of knowledge gaps. Thus, inclusive innovation systems notions will need to be refined within empirical analysis of low income focussed ICT innovation, to more clearly answer the first research question.

In terms of the second and third research questions, it can be seen that an examination of relations and learning provides insight into the second question and the link between the types of network related to low income customers and innovation. This closely connects to Lundvall's models that link between relations and the flows of learning and incremental innovation in the system.

Institutional perspectives provide approaches to answer the third research question. An analysis of the institutions within systems of innovation can provide insight into the role of policy, positioning policy as one element that shapes systemic institutions. Given the more complex institutional terrain outlined, policy will need to consider a wider set of factors, particularly the role of less formal institutions upon effective policy implementation.

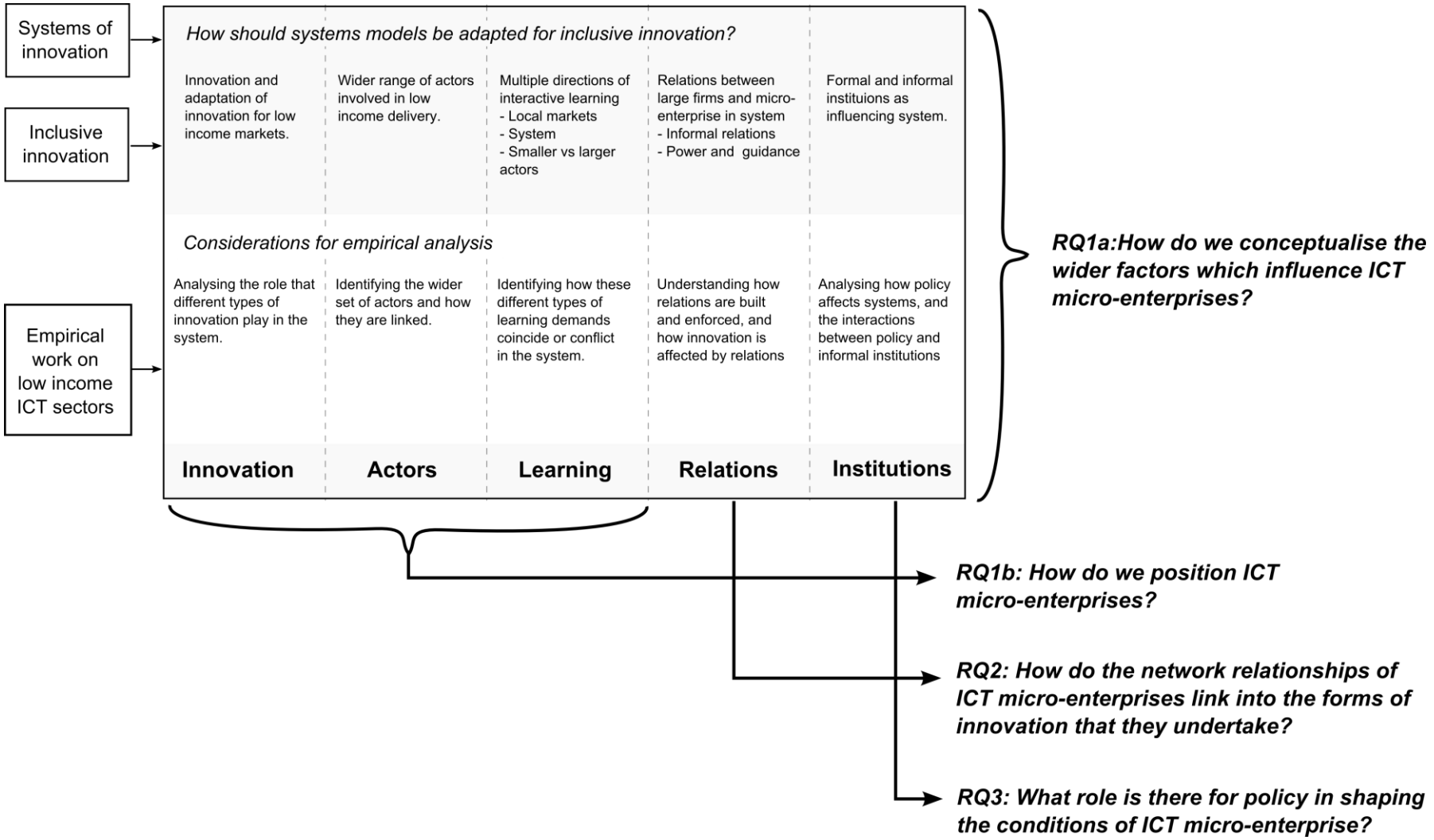

Figure 3.2: Inclusive innovation systems and research questions

4. Methodology

4.1. Introduction

As outlined and justified in the previous chapters, this work focusses on systems of innovation, adapted for inclusive innovation as a way to examine wider actors and policy around ICT innovation focussed on low income actors. This chapter seeks to augment this work through highlighting how such models will be investigated empirically.

Firstly, the overarching philosophical position related to critical realism is outlined, and how this position influences research approaches. Secondly, case study selection is justified in detail, related to both the location of research in Kenya and mobile phone sector. These selections are based around the ideas of *theory*- and *intensity*- based selection to ensure that the cases provide adequate data to answer the research questions. Finally, operational details of the research are outlined, particularly the forms of data collection revolving around semi-structured interviews, supported by observation, and secondary data.

4.2. Research position

4.2.1. Critical realism

Articulating the underlying philosophical position in this work is crucial in positioning how research is conducted. This ensures that the assumptions under which empirical research is undertaken are consistent with the research questions and conceptual frameworks selected.

In this work, a critical realist position is adopted, which departs from the overtly scientific and reductionist approaches of positivist positions, whilst avoiding the traps of relativity that have been connected to more constructivist and interpretive stances.

Critical realism takes a realist view in the ontological domain, whilst arguing for relativism of knowledge in the epistemological domain (Mingers 2004). This is best illustrated by first referring to the realist ideas of stratification of reality in the natural sciences, as represented in Figure 4.1 (Archer et al. 1998, Mingers 2004).

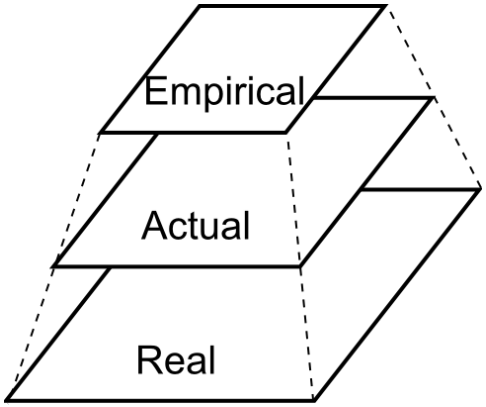

Figure 4.1: Stratified model of realist view

In this stratified model, at the level of the *real*, are the mechanisms and structures that cause events to occur. In the case of the natural sciences this relates to underlying natural scientific phenomena. The *actual* contains all 'events' that are generated by the interactions of this underlying reality. However, not all events will be observed (whether that connects to limit of knowledge or measurement). This leads to a third level the *empirical,* the events which are observed. Thus, the stratified model provides insight to underlying realism, whilst positing incomplete knowledge of this reality (Bhaskar 1989).

This stratified understanding can also be adapted for an understanding of social science. The *real* domain is considered to relate to the imperceptible but underlying social forms which exist, which 'direct' individual agency (Dobson 2001). In social science, a realist position is extended to include the notion of 'transitivity', which indicates that there is a link between the *real* domain, and the events that occur in the *actual*. Thus 'transitivity' suggests that structure whilst being relatively consistent, is influenced - changed or reproduced - by actions in the *actual* domain (Mingers 2004).

In terms of understanding underlying real structures and mechanisms, in a critical realist position, one moves away from the classical 'billiard ball' notion of cause and effect inspired by Hume, where underlying structure A results in observable effect B. Rather, the notion of *causal complexity* is more appropriate, where a single effect originates from an intersection of a number of 'causes', and in addition multiple sets of causes may result in the same effect (Ragin 1989). It has been suggested that causal complexity is best thought of in terms of a 'network' - *actual* events emerge due to associations of multiple structures and mechanisms, rather than cause and effect (Bhaskar 1989, Miles & Huberman 1994). In terms of research, providing explanation for empirical observation is hence more complex, where causal complexity points towards an examination of,

> "the intersection of a set of conditions in time and in space that produces many of the large-scale qualitative changes..that interest social sciences" (Ragin 1989 p.25)

What this quote particularly highlights is that critical realism accounts for an underlying reality, whilst transitivity and causal complexity suggests that there will be variations both spatially and temporally which will affect these underlying structures of reality.

Thus, critical realist positions orientate empirical analysis towards a more contextualised position, moving away from a purely scientific method of deduction emerging from a positivist position. As opposed to a more interpretive approach, the ontological reality of a critical realist view affirms the value in looking at the generalised structures that are real and relevant beyond the local research setting. However, like interpretive positions critical realist approaches posit examination of the localised and historic change, as a way to account for local variations (Guba & Lincoln 1994).

4.2.2. Approaching research

A critical realist position orientates work to move beyond simply documenting observable phenomena towards seeking to account for the underlying causal structures. This outline fits well with the perspectives that have been taken to studying ICT micro-enterprise in the previous chapters.

Critiques of previous literature resulted in research questions which link local contexts of innovation and instability to wider underlying drivers. Thus, systems of innovation models, through concepts such as institutions, relations and learning can be seen as a terminology to describe what might be considered the underlying *real* structures.

This approach allows better scope for work to be transferable, critiqued or modified for other contexts, linking contextual observations into wider 'second order' terminologies which can be applied or considered across these wider settings (Miles & Huberman 1994). Thus, the research goal, embedded within the research questions, and conceptual models, are complementary to critical realist models.

The aim of research is not to follow approaches which build generalisability through completely 'abstracting from context', such as analytical induction or independent variable testing (Mitchell 2006, Yin 1994). Drawing on causal complexity, any empirical findings will inevitably be embedded within an ever-moving terrain of structures and mechanisms, under constant change, and with limitation in empirical

observation. Thus, context is integral in shaping the structure, and it cannot be completely neglected.

> "..there are always factors that are unique to the locale or series of events that make it useless to try and generalize therefrom ..[but].. inquirers are in a position to appreciate such factors and take them into account" (Lincoln & Guba 1985 p.123).

It is hence more appropriate to design research where existent theory and previous literature provide 'working hypotheses' that can be explored, where 'tendencies' are then further explored and refined through exploratory research (Cronbach 1975, Lincoln & Guba 1985).

This clearly fits into the form of research questions outlined, and points towards practical research that begins with an understanding of ICT innovation for low income markets, and the role of ICT micro-enterprise which emerges from systems models. This can be considered to embed 'working hypotheses' linked to the expected forms of actors and innovation, and assumptions regarding relations and institutions in the system. These have been drawn from the literature review and determine the types of actors and questions asked within research. However, as outlined in the previous chapter, these notions are not set in stone, and they will be progressively refined through exploring empirical example(s).

4.2.3. Qualitative, case study research

Given this research orientation, a more exploratory and qualitative approach was selected to help build and expand on the theoretical models proposed (Marshall & Rossman 2010). In terms of the research position, it can be seen as the most efficient way to expand understanding of the real underlying structures and mechanisms. This is not to say that quantitative work is totally redundant in such settings, indeed some quantitative data is used, but being more exploratory and drawing on critical realist positions, qualitative work offers a better basis to provide clear investigation and build better explanation of the research questions.

Research questions:

- *How do we conceptualise the wider factors which influence ICT micro-enterprises? In such conceptualisations, how do we position ICT micro-enterprises?*
- *How do the network relationships of ICT micro-enterprises link into the forms of innovation that they undertake?*
- *What role is there for policy in shaping the conditions of ICT micro-enterprise?*

Figure 4.2: Research Questions (restated for reference).

A case study approach was selected as the most prudent approach to take in line with the research position and the 'how' forms of research question (reprised in Figure 4.2 for reference), which require in-depth examination in order to develop more meaningful understanding (Yin 1994). Where appropriately selected, case studies can provide the researcher with a way to build in depth knowledge through specific example cases and provide the opportunity to use this data to analyse theoretical understandings (ibid.). In addition, one needs to be aware of the time, manpower and budget for doing PhD research work, where more expansive qualitative (i.e. more ethnographic work) or quantitative collection (representative comparative studies) and analysis might be impractical and less well fitting into the research study proposed.

This work is exploratory – in the first place seeking to build more substantial explanations of inclusive innovation and systems models with the aid of theoretical frameworks, and consequently using this adapted innovation framework to explore the latter two research questions. The outcome of this work can be seen within what Yin has referred to as *analytical* rather than *statistical generalisation* (ibid.). There is no attempt to make the work statistically representative. Rather, case study selection is purposively made, and then studied in depth, as a way to expand and understand aspects of conceptual models. In the next sections case study selection is examined in more detail.

4.3. Selection and sampling

Appropriate case study selection is crucial in order to provision of robust and valid data to analyse the research questions. Case study selection is linked to the three research questions (see Figure 4.2). From an initial examination of these questions, it can be seen that each has a slightly different emphasis on using case studies which will influence this selection process.

The first research question uses case studies as an in-depth analytical tool in order to see if the underlying conceptual approach is valid (Stake 1995), and to clarify models outlined in the previous chapter relating to systems of innovation models and inclusive innovation (see Figure 3.2) (Eisenhardt 1989).

The second research question, building on this more refined model, relates to exploring variation of network relations which involve ICT micro-enterprise rich sub-sectors. This suggests a more comparative approach, ideally between broadly comparable ICT micro-enterprises whose relationship forms vary. Thus the second research question implies the need for comparative elements within case studies, and an appropriate selection of these comparative elements to allow analysis of network variation to be undertaken.

In general, empirical research for the third question will follow from the outcomes of both these investigations. For this research question, additional care in case study selection relates to how institutional factors in the innovation system are included. Thus there is a need to clearly understand what is, and is not included within the scope of the case studies to ensure clarity of investigation.

As outlined in the next section the unit of analysis is argued to be variable, generally treated as a 'holistic' case study in order to best utilise innovation system perspectives within the work. However, two 'embedded units' of analysis within the case study are a particular focus for in-depth research, related to the comparative needs of the second research question (Yin 1994).

4.3.1. Case selection: the mobile phone sector in Kenya

Given the aim to examine and refine understandings drawing upon the theoretical models constructed, it is appropriate that case study selection is made through reference to two core criteria which link to theoretical-based case study selection and exploratory approaches (Eisenhardt 1989). In the first place, this work looks towards ICT micro-enterprise cases that are *typical* and clearly sit within the literatures and models that have been outlined in previous chapters. Secondly, selection is based on the notion of *intensity* which looks for cases which have a notable high volume of activity (Miles & Huberman 1994). In this research this will relate to clearly defined low income ICT sectors, with clear presence of ICT micro-enterprise.

In terms of typicality, it is prudent to choose a case study which can provide a view of core issues relating to ICT micro-enterprise within innovation systems, and one of sufficient intensity to provide insight into these investigations, to maximise the learning which comes in case research (Kothari 2008, Stake 1995). This idea of intensity is particularly useful for work which adopts innovation system models which

examine perspectives from a range of different actors. Intensity selections can ensure there is sufficient breadth of data in more vibrant sectors so that key claims, issues and understanding can be robustly linked and resolved (Patton 2002).

The mobile phone sector was chosen as the specific focus as a common, and comparatively more mature sector of ICT activity which has been found to include significant numbers of ICT micro-enterprises (e.g. Ilahiane & Sherry 2008, Lugo & Sampson 2008, Rangaswamy 2010b). This selection meets the criteria for both typicality and intensity, providing insight by allowing more in-depth analysis of models through a study of a mature sector. In terms of policy, mobile sector policy is also clearly delineated and well documented, so can provide a clear outline through which to understand the third question related to institutions and policy.

There are a number of contributory factors for choosing Kenya, and particularly urban Nairobi as the site of this research. In terms of country selection, the goal was to select a developing country from amongst those with lower income. This might initially seem a contradiction in terms of selection based on intensity (i.e. emerging and middle income countries are more likely to display higher intensity in terms of number of mobile phone micro-enterprises and wider number of actors within systems). However, the conceptual work in previous chapters has particularly focussed on innovation systems that are less established and emergent, and on the link between ICT suppliers, low-income entrepreneurs and lower income users. Thus, selection of a lower income country in fact provides more intense insight in terms of the *specific conceptual aspects of interest* at the nexus of innovation, low income markets and ICT micro-enterprise. The UN's Human Development Index Categorisation of 'Low Human Development' and the World Bank's categorisation of 'Lower Income Economies' were used to provide the list from which an appropriate country was selected for research (UN 2012, World Bank 2012).

The choice of Kenya, whilst fitting the above criteria, reflects a relatively advanced position in terms of policy, implementation and customer use in the mobile sector. In terms of policy, Kenya has moved to push local competition particularly through sound licencing practices in the ICT sector (Waema et al. 2010), whilst regional integration has made integrated local markets viable for large enterprises (World Bank 2010). Additionally the strong breadth of ICT for development and other support agencies was useful for building knowledge and disseminating work[12]. Thus, Kenya can be seen as illustrative of a lower income developing country where local market delivery is

[12] In addition the author's knowledge of working in the region provided considerable advantages when undertaking fieldwork in this area.

more mature and scaled up than is the case in other countries within similar development categorisations. As Schofield (2002) argues, such illustrations of 'what could be?' can be useful through expanded analysis of key issues and best practice which can be used to examine more expansively the roles of policy making. Given the future reduction of costs of technology and increasing ICT interconnectivity in developing countries (UNCTAD 2010), Kenya's mobile sector is likely to provide insight for other sectors and nations.

In the literature review of ICT micro-enterprise, examples of ICT micro-enterprise have been mainly found in urban centres in developing countries where the intensity of activity and density of networks make such enterprises viable. Evidence in the mobile phone sector suggests that rural activity emerges mainly when technologies become highly standardised. Often micro-enterprises diverge from the earlier definition of *extensive* ICT micro-enterprises, where ICTs are mixed with multiple non-ICT retail activities in micro-enterprises (Aminuzzaman et al. 2003, Rangaswamy 2010a). These two properties of rural ICT micro-enterprises, standardisation of innovation and more diverse tactics, are problematic in terms of study of innovation. For example, even with the wider systems definitions around inclusive innovation, interpreting evidence around innovation activities is likely to be difficult in such rural micro-enterprises. Thus, in terms of intensity, drawing on models of inclusive innovation and emerging systems in developing countries, rural micro-enterprise may have less to tell us about innovation than other case selections can offer. This does not preclude the potential of such enterprises in rural areas as viable sites of innovation, but at present such enterprises are often limited and with models still in flux, a rural selection would be more amenable to research once underlying understanding of inclusive innovation systems were in place.

4.3.2. Scope: sectoral systems of innovation

Systems of innovation models have moved away from considering the 'system' solely though a national scope only, with potentially sectoral, local, transnational or regional scopes being appropriate. Thus, the selection of scope of research design is clarified.

As alluded to previously the scope of the case study adopted here is that of the sector, in terms of the sectoral innovation system related to the mobile phone sector in Kenya. This sectoral system focus fits to work both theoretically and empirically. Theoretically, as outlined in Chapter 3, models of inclusive innovation, and the need to analyse demand-side actors, and the specificities of innovation suggest a sectoral approach would provide the most suitable scope to clearly understand such processes.

Empirically, sectoral focus emerges from the fact that there are clearly established mobile actors, policy and specific sectoral policy making units in Kenya around mobile. However, there is still overlap here with other scopes. Policy making and the wider institutions relating to the mobile sector are likely to link to more general aspects of ICT technological systems (particularly technological norms). Even more widely, national systems of innovation particularly norms and culture are likely to drive much of the micro-enterprise behaviours of ICT micro-enterprises. The mobile sector was chosen specifically as the system scope drawing on pilot work. It was felt that both national and technological system perspectives offered too broad a perspective in which to analyse the system, particularly with respect to the third research question on building specific policy suggestions[13]. However, aspects of the technological and national perspectives are still integrated into sectoral systems through reference to more overarching institutions at an ICT or national level that might divert this mobile system in unexpected directions[14].

Of course, a sectoral case study approach makes some simplification of the inteprlay of different scopes (Malerba 2002). For example the mobile sectoral and technological elements of interaction are closely intertwined (and in some countries this differentiation may not even exist). Further, the handset sub-sector and mobile sector could both be argued to actually be part of wider trans-national innovation systems, as opposed to national ones. Thus, there is also an element of purposive selection here which relates to an appropriate scope for case study analysis which will lead to more coherent and appropriate (national, sectoral) levels of policy suggestion.

[13] This sectoral selection is also in line with literature that has focussed on inclusive innovation, particularly that which has focussed on agricultural innovation in developing countries (Dutrénit et al. 2012, Spielman et al. 2009).

[14] National and wider technological systems will indeed be important to understanding policy in terms of inclusive innovation which links not just to formal rules, but also informal institutions and the efficacy of policy making .

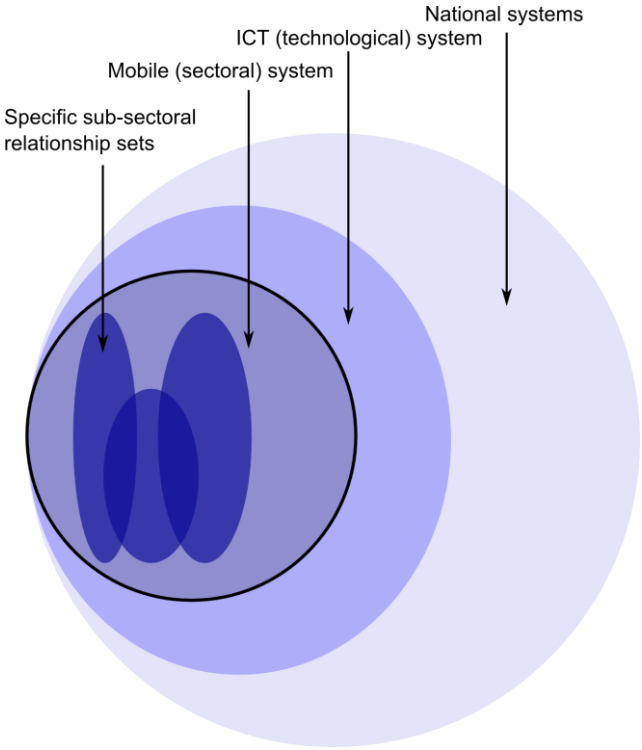

Figure 4.3: Competing foundations of 'systems' within research work.

To sum, the mobile phone sectoral innovation system was selected as the scope of the, but given more overarching institutions will have an effect on this system (in terms of technological factors and wider national institutions) these will still need to be brought into the discussion as part of explaining system divergent and/or emergent behaviour.

4.3.3. Difference sampling: two sub-sectors

The second research question relates to examining the link between networks and innovation (see Figure 4.4) and requires some extra selection within the general case study. Here there is a need for variation, between different types of network relationships in innovation systems, so as to understand how this connects to the locally innovative activities of micro-entrepreneurs. Thus, beyond the case study selection based on a sector and country, this question requires specific sampling based upon network relationships (Flick 2009).

From the literature review on ICT micro-enterprise, one can particularly pick out differentiable forms of networks which provide network variation as shown in Figure 4.4.

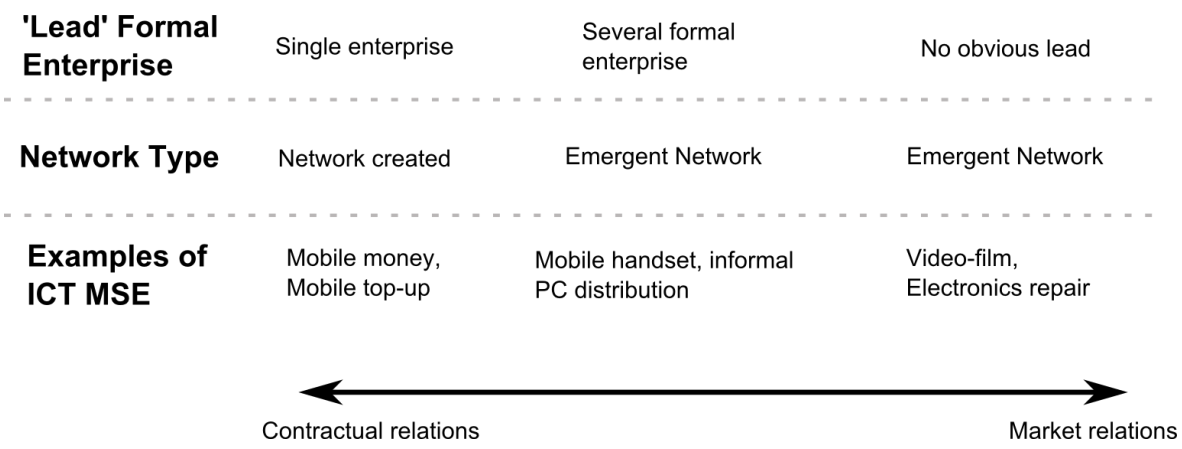

Figure 4.4: Network relation types.
Source: Authors construct based on ICT micro-enterprise literature review (in Chapter 2).

On the right hand side of Figure 4.4, ICT micro-enterprises link through highly informal network relations, with no discernable driving firms in these relationships. Such occurrences particularly happen where ICT innovations emerge informally, with a complex set of relationships emerging typically in market relations. For example, the digital video example in chapter 2 fits into this type of network form.

In slightly more formal relations, networks may initially follow such emergent paths as above, but over time some large firms become part of the networks, typically when sectors are seen as a commercial opportunity. ICT micro-enterprise involvement in PC distribution into SMEs is an example of this, where commercial firms only entered the system later after informal networks were already in existence (Oyelaran-Oyeyinka 2007). In contrast, on the left-hand side of Figure 4.4, are simpler network chains often stemming from single firms who build dedicated channels, typically revolving around larger enterprises who are involved in delivery of ICT products or services to the poor (for example mobile money networks).

Whilst a deeper analysis of how relations are configured and maintained will require empirical analysis, intuitively one might expect that moving to the right in Figure 4.4 relations are more loose and configurable whilst those to the left are tighter, as highlighted by contracts or franchised forms between these micro-enterprise and the lead firm.

Thus, drawing on this outline of different networks, comparative work related to the second question is based upon selecting varying embedded sub-units within the case study, in line with Yin's (1994) notion of embedded case-study design. In this approach, units are selected using the network types of Figure 4.4 as a guide to ensure variation and comparison where the networks related to these sub-units are

examined albeit still within wider system models[15]. Within the limits of time available in PhD research, two particular 'sub-units' were chosen for study following initial research of mobile phone sub-sectors during pilot study in Kenya (see section 4.4.1)[16]. One relates to the market networks but with distinct lead firms of mobile phone handset supply (which predominantly fits into the middle column in Figure 4.4), the other mobile money supply, particularly focussing on the 'M-Pesa' mobile money service (which predominantly fits into the left column in Figure 4.4). These embedded units of case study analysis, introduced in more detail in next chapter, thus provide the empirical data to build insight on the second research question.

4.3.4. Unit of analysis

Given that research questions relate to both a sectoral system (research questions 1 & 3) and elements within a sector at a sub-system level (research question 2), the unit of analysis is not immediately clear in this work.

The unit of analysis can be best clarified by drawing on the difference between holistic and embedded case studies. In holistic case studies, a case study is sampled in a global way, attempting to represent the case through building a holistic picture. In contrast, embedded case studies select specific sub-units of the case study for analysis related to the specific research questions of interest (ibid.). Linking this outline to the specific research, whilst this work is a case study of a sectoral innovation system, the unit of analysis shifts. The first and third research questions take a systemic perspective, and require sectoral innovation system research to be undertaken in a holistic way (this is done in analysis in Chapters 6 and 8). In contrast, as outlined in the previous section, the second research question fits better into the idea of embedded sub-units within the sector that are used for comparative purposes, (this is done in Chapter 7). Thus, in this research, it is argued that it possible to combine these two units of analysis, researching the range of roles and actors in the wider mobile phone sector, whilst specifically focussing on certain sub-sectoral units in more detail to understand activity and relations. Indeed, the study of the two different units of analysis is complimentary. Holistic sectoral work provides an overall understanding of the makeup of the sector and the policies and general actors, whilst sub-sectoral study provides operational detail that may be missed within holistic work.

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[15] In some senses even the embedded case study units might even be considered as systems, in that they include their own policies, rules and practices. However, more generally they are likely to be driven by sectoral considerations.

[16] For clarity, the remainder of the thesis uses the following terminology:

- 'Sector' and 'mobile sector' and 'case study' refers to the mobile phone case study in Kenya.
- 'Sub-sector' will refer to the embedded units within the case study as outlined here.

In sum, the unit of analysis varies across the research questions. The examination of networks and innovation focuses on a selected set of embedded cases of networks of actors within the (generally) constant institutional environment of the sector. Wider work is driven by a more holistic analysis of the sectoral innovation system.

4.4. Case study approach

The research approach - drawing on systems models - questions methods which take communities as a closed set of coherent actors. Rather this work examines a set of divergent actors and locations (Hannerz 2003). Marcus (1995) argues that this will push work away from solely examining 'local truth', rather the goal of the researcher is to build understanding of the links between decisions and actors which may otherwise be unclear (Hannerz 2003). This links into the stratified models of critical realism, and building better models of underlying structures and mechanisms.

Case study research is hence a synthesis of multiple data sources, where a variety of methods is used to explain those underlying realist processes (Eisenhardt 1989). Drawing upon the research position, the case study approach taken is outlined in more detail in this section related to two issues, how the research itself was practically undertaken and a consideration of ethical issues within research.

4.4.1. Undertaking research

The literature on such qualitative research views iterative approaches as prudent, by encouraging a researcher to take purposive decisions, and to ensure that decision making is well grounded within empirical data, where subsequent stages of investigation are dependent on the emerging research (Glaser & Strauss 1967, Maxwell 1998). The research work followed this iterative approach, starting with a more holistic examination of the sector to provide an overview of the mobile system and build contacts, before moving to detailed analysis within each sub-sector later.

Pilot/Holistic study

Early work focussed upon holistic sectoral analysis in the mobile sector and was undertaken in Kenya between October and December 2010. The research undertaken at this stage began to build some insight into the system actors and relationships, particularly through twelve interviews (and several informal meetings) with higher level policy actors, researchers, sectoral support organisations and senior consultants who were able to provide insight into the landscape of mobile (and ICT) sector policy making. Knowledge building and connection to actors also came from attendance at several policy and research workshops related to the ICT sector which provided the ability to more informally discuss and understand the position of policy makers and

actors in larger mobile firms. Some four such events were attended, during the fieldwork. This pilot work (as detailed in Appendix 1) provided confirmation of the case study selection of the mobile sector as an insightful case study of high intensity.

Such knowledge building also led to the identification of 'embedded units' within the case study for in-depth analysis. These were selected in terms of intensity and feasibility, but also with consideration of interviewer safety, ethical requirements and where relevant actors would generally be amenable to interviews[17]. As part of this selection, a number of pilot interviews were undertaken with ICT micro-entrepreneurs[18].

These pilot studies were also used to test the style, length and forms of semi-structured interview which are the core of the research work (detailed in the methods section). Pilot interviews were particularly useful to test various more contentious elements of the interview - the use of recording equipment, translation approaches and more sensitive interview questions for viability. In terms of the latter, some interview questions related to micro-entrepreneurs' financial and tax details were found to be problematic and hence reduced due to this feedback; whilst others such as talking about corruption appeared to cause no problems so were retained.

In sum, pilot study was useful in building an initial holistic picture of the case, and related to the more difficult embedded work, allowed ideas to be tested and refined, building solid grounding on which to build the core research.

Core research

Following the pilot study, more detailed survey work was undertaken between February and early-June 2011. Holistic analysis of the sector was mixed with deeper analysis of the embedded units; examining those units, one at a time. Embedded unit research involved an intensive period of interaction moving through the connected set of actors in order to build a detailed picture of the range of actors, their innovation activities and their connections. Such work was supplemented with additional work of a more holistic focus, as appropriate actors or organisations were revealed within research. Indeed, a number of these actors with whom good rapport was built were interviewed several times as results emerged, providing more in-depth insight.

It was found that in terms of embedded units that 'snowballing' strategies were useful in order to build connections. This was particularly useful through a 'bottom-up'

[17] For instance one potentially insightful area of mobile handset trading was rejected due its high risk nature.

[18] Additional pilot interviews were also undertaken at the start of each iteration during the core fieldwork.

strategy beginning with ICT micro-entrepreneurs and moving vertically up the network. This typically started by selecting street-level micro-entrepreneurs in selected areas, and then snowballing through their intermediary actors (see sampling sections). Where higher policy level actors were identified, approaches were made more directly.

In terms of interviews, this resulted in a wide ranging set of interviews with a number of related actors in the innovation system; micro-entrepreneurs and associated employees, and a range of network intermediaries such as wholesalers, dealers, and head-office managers. In such work large firms such as mobile phone suppliers, their distributors and a number of relevant policy makers and policy focussed institutions were also identified and interviewed. Such interactions also led to discovery of additional data sources and secondary documentation.

4.4.2. Ethical approach

The topic of study requires some care with ethical issues given the informality, in terms of location, licencing or practices that many of systems actors are part of. In general, in line with an 'informal economy' position the aim in this work is less to become embroiled in debates about legality and illegality of such activity but rather to look at the relations and institutions which drive such activity. However, given that much of the empirical research took place within such spaces, it is important to discuss the ethical approach taken in this research.

A utilitarian view of ethics is often taken in social science research which looks towards scientific neutrality and notions of 'do no harm' (Christians 2000, Miles & Huberman 1994). Whilst such a position provides a basis of good standard practices to follow in fieldwork as related to confidentiality and anonymity, informed consent and honesty within interviews (Christians 2000), it does not connect well into the research subject and paradigms taken. Social ethics fits better in that it "situates the moral domain within the general purposes of human life" (ibid. p.142), and thus rather than judging ethics from afar, locates them within specific contexts (Klockars & Finbarr 1979). For ICT micro-enterprise, the principal reason for taking a social ethical position is that it prompts an interaction with ICT micro-entrepreneurs without pre-casting judgement on their behaviour and choices, or avoiding discussion related to 'un-ethical' subjects, which are an essential part of understanding these micro-enterprises. Thus work, particularly interviews with informal entrepreneurs, resulted in discussion and information gathering of activity outside the 'legal norms' (although likely tolerated both socially and by local authorities).

Given the types of respondent being interviewed, it was important to maintain ethical awareness of how information sharing, dissemination and even visible interactions with certain groups in field study might attract attention to such marginal activities. Within highly unstable and often contested social and political spaces this could potentially increasing risks for those who are involved in interviews. Thus, specific methods chosen revolved around the aim to ensure anonymity, and avoiding unbalancing the fragile equilibrium of these groups[19]. In terms of information sharing, ensuring appropriate procedure when engaging with interview participants was one of the main areas of concern. Interviewees were provided full information sheets and signed consent forms to transparently clarify the research and rights of respondents (forms are provided in Appendix 2). Further, many of the decisions in choosing research methods reflect this concern, the interview location within semi-public space, the decision of not using tape recording in interviews, the use of local research assistance, and the limited time periods of studying a single case. Such choices are also supported by similar suggestions from literature on researching such actors (Desai & Potter 2006, Mikkelsen 2005). Full anonymity of participants was guaranteed in this research, and all names and some distinguishing contexts are changed in this thesis to ensure anonymity.

In sum, such ethical and transparent approaches were an important consideration in research design. The selections outlined were also supported through external review of practices and post-interview data handling processes, prior to fieldwork being undertaken, as part of the university's ethical approval requirements.

4.5. Data collection and analysis methods

In terms of data gathering, given the case study form and the need to capture (and hence triangulate data) from a number of actors, a range of methods were used to gain understanding of the case study. The principal data gathering came through semi-structured interviews with system actors, with use of observation and a range of secondary data to enhance this work.

Here the issues involved in gathering data from micro-enterprises in embedded unit research are particularly discussed, which provided more of a challenge for research methods.

[19] For instance, in one early trip to a Nairobi slum area a number of interviews attracted a crowd of observers after some local drunks decided to join in the interview, resulting in these interviews being abandoned. Upon evaluation, it was felt that in this case, poor interview selection of a store and interviews in a more open area had likely contributed to us gaining unwanted visibility and attention. Later selections we made more carefully with respect to such issues.

4.5.1. Semi structured interviews

Interviews sought to gather information in two senses. In a static sense, they related to the roles of actors, with an in-depth discussion of the tasks undertaken by the actors themselves in order to build a picture of practices and innovation that they undertook. In a dynamic sense, data was also sought through eliciting historic-focused discussions with participants, regarding the paths of actors and firms to better understand the ebb-and-flow of emergent innovation systems.

Sampling

In terms of the *population* interviewed, during the pilot study a set of common roles such as micro-enterprises, distributors, sub-agents, employees and master-agents, in both sub-sectors was found to be present in the case. These roles, and the linkages between them, were found to be surprisingly regular in each sub-sector, making them a crucial orientating factor in selection of the interview population.

In addition, in order to ensure generalisability of research outcomes it was desirable to select a range of different mobile micro-entrepreneurs in these sub-sectors (i.e. dynamic or more marginal, different low income focuses). Pilot research suggested that variation for ensuring this generalisability would best come through purposive selection of micro-entrepreneurs based upon location, within selected sites in Nairobi. These site selections were intended to represent a number of different areas which were popular with less affluent consumers and where different specific market conditions might affect the types of enterprise, activity and relations. This selection was undertaken with input from the research assistant and others with local knowledge of Nairobi. From each location selected, a selection of micro-entrepreneurs was interviewed, which (by eye) representative of a range of different sizes of micro-enterprise. In cases where interviews were curtailed or refused, other interviewees were selected and approached. From these interview selections, snowballing was then used to move up into different relationships[20]. This led to a diverse interview population as outlined in the lower part of Figure 4.5.

[20] Snowballing often worked in a more indirect way, less through direct introduction and rather through guidance of specific locations or areas where linked actors would be located.

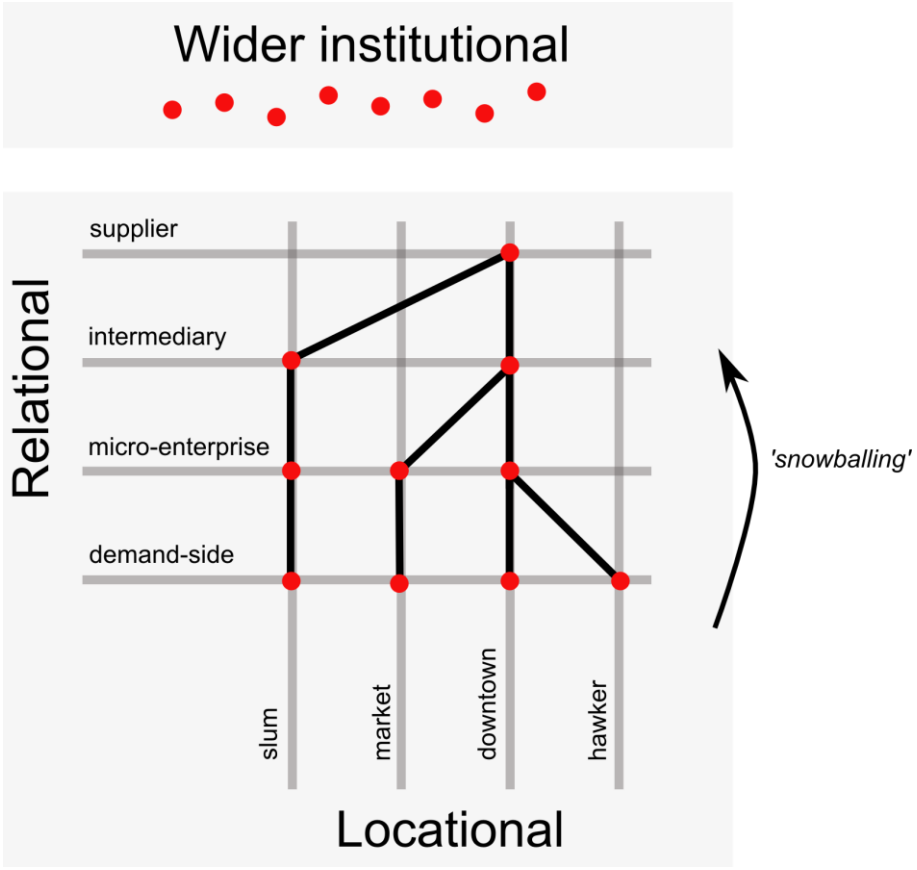

Figure 4.5: Sampling approach for each sub-sector.
Approach included snowballing upwards; where dark lines represent relations; red dots represent interview selections.

In terms of details of the specific sub-sectors, there were fewer locational areas for the mobile handset selling micro-enterprises due to clustering of such firms. Two representative locations were chosen, a highly vibrant central downtown trading area and a large slum area around 10km away from the town centre. Thus, in this sub-sector a higher number of actors were selected from fewer locations. In the mobile money sub-sector, dispersal of agents was wider and thus a wider breadth of location was selected, including the two clusters outlined above, as well as addition locations in markets frequented by low income groups, areas of informal manufacturing, a formal industrial area, mutatu (shared taxi) and transport parks, and other trading areas close to slums.

Holistic interviews with wider actors in the innovation system occurred both during the pilot study and main research period, with policymakers, associated organisations and contractors involved with these sub-sectors in order to provide a more overarching perspective on the system and to triangulate and examine the findings. These interviews followed broadly similar themes and directions as the sub-sectoral interviews, but can be considered more formal and conventional in their interview form.

In total 131 interviews were undertaken as outlined in Table 4.1. These are divided in terms of location and relational sampling as shown below.

Actor	Role	Number
Mobile handset sub-sector		
Handset suppliers	Firms producing handsets (local office staff)	7 (in 6 firms)
Distributors	Local importers	7
Wholesalers		15
Mobile sellers		32
Other system actors	Repairers, mobile airtime, sim, accessory sellers, hawkers	39
Location details of selection: Downtown, Slum area		**100**
Mobile money sub-sector		
Lead firm	Employee/contractor in mobile money firm	2
Mobile dealer	High level aggregator of agents	5
Multiple store agent owner	Multiple store holder under a dealer	4
Single store agent/owner (M-Pesa)	Agent in sub-contracting relation	10
Agency employee	Employees of M-Pesa agents	18
Other system actors	Non m-Pesa single store agents	6
Location details of selection: Downtown, Slum area x2, Market areas x2, Informal SME cluster, Transport stages x2 (bus and shared taxi), Formal industrial area, Hawker market		**45**
Policy makers		**14**
Total*		**131**
**The final total represents that number of interviews undertaken*		
Others sub-totals do not add up to this total, due to the nature of the mobile innovation system which means that some actors take roles across sub-sectors.		
In particular, an 'agent' in the M-Pesa sub-sector is often also an 'other system actor' in the handset sub-sector due to multiple products. This particularly happens in the lower income areas surveyed, in order to allow micro-enterprise income to be diversified (this is discussed in more detail in the analysis sections).		
In these cases, interviews were expanded to include both of the sectors within questioning.		

Table 4.1: Semi-structured interviews undertaken

Structure of interviews

The majority of interviews were undertaken in hand with a Kenyan assistant to provide translation[21]. Initially it was assumed that sub-sectoral interviews, particularly with mobile micro-enterprises would manly be undertaken in Kiswahilli, but it was

[21] The only cases where this did not occur was with holistic sectoral interviews when larger firms and policy makers. These actors typically being professional and university educated were clearly conversant in English as the common business language in Kenya.

found that the majority of interviewees were fluent and keen to be interviewed in English[22]. Whilst using the non-native language may have reduced interviewee ease of discussion of issues somewhat, this was more than compensated by the improved interactivity in interviews[23]. In typical interviews, introduction and explanation initially took place by the research assistant in Kiswahilli to ensure clarity, interviewees were then asked if they minded talking in English, and most of them accepted. Otherwise, interviews continued in Kiswahilli. The research assistant also provided some additional input to the work through provision of contextual information, related to informal sector actors, and specific sub-texts in conversation that may have otherwise been missed.

Interviews with policy makers lasted one-to-two hours. Interviews in the networks were typically a little shorter due to the limitations of interviewing them within their spaces of working (see below), typically around one hour.

Semi-structured interviews were particularly amenable to micro-entrepreneurs being interviewed in their place of work during working hours whether that is in a kiosk of a permanently positioned micro-entrepreneur or a trolley of an informal hawker. These micro-entrepreneurs often found themselves with free time during the working day when their customer volume was lower, providing time for interviews. Being interviewed in their own spaces of work resulted in interviews where the respondents were relaxed and informal and generally more open to discuss issues, such as critiquing their supply chain partners and outlining issues of bribery, corruption, and illegality.

In development research in sensitive settings, there has been debate regarding whether it is appropriate to record interviews or not, this particularly relates to how it might affect interviews and interviewee perceptions, as well as in relation to ethical issues (Desai & Potter 2006). During early pilot interviews when tape recording was tested, interviewees were noticeably less forthcoming with information[24]. Further given that the location of interviews tended to be in dense trading spaces, even when

[22] In some interviews this moved into ‘sheng’ a common street mix of English and Kiswahilli slang which required some partial translation.

[23] Indeed, English is an ideal choice as even the supposed common language Kiswahilli can be considered a non-native language to the majority of these respondents who were observed to converse with each other in a range of regional languages – Gikuyu, Kalenjin, Luo - and even Hindi and Somali in the case of Indian and Somali intermediaries.

[24] In both sub-sectors, monitoring and/or illegality are pressing issues which have often resulted in police raids (in the case of mobile handsets) and forced closure (in the case of M-Pesa). Thus, it is not surprising that interviewees were less forthcoming when they were being recorded.

interviews were recorded, the locations meant that audio was found to be of poor quality subsequent to interviews, interrupted by background noise[25].

A simple approach to documenting interviews was actually found to be most effective. Short notes of discussions and selected quotations were made during the interview context. These were immediately written up in hand with the research assistant subsequent to the interview. It was possible with this method to write accurate notes that well encompassed the discussion and included selective quotations. A sample of such an interview 'transcription' is given in Appendix 3. The downside of this approach meant that in some cases there was some confusion regarding the meaning of a certain discussion or statements post interview (with potentially more subtle themes being overlooked). When this was considered crucial, this resulted in a return to the interviewee for a few points of clarification or detail. Indeed in a number of cases, these clarification discussions resulted in a second more expansive set of interview material. Stemming from not recording interviews, in the analysis chapters 'illustrations' are used, which present interview discussion in indirect ways. This provides the vital local context of research, without having the exact words of respondents.

Interview themes

The content of the interviews revolved around building an empirical understanding of the components of innovation systems that were raised in previous chapters: What types of local activities and innovative practices do ICT micro-entrepreneurs undertake? What relations do they have into the mobile innovation system and how does this affect those practices? How do institutions affect the activity and relations?

Interviews can be seen as semi-structured in that they were designed around a coherent set of core themes that the work was interested in understanding. These themes are shown in bold in Appendix 4. As theorised in previous chapters, drawing on 'wider' models of systems of innovation, innovation is theorised to occur within the learning of daily practice, thus the core interviews particularly revolve around understanding the ICT practices that actors in the system daily undertake, examining ICT innovation through building an in depth knowledge of what these actors actually do. Other core themes sought to build more dynamic perspectives through discussion of business and individual entrepreneur histories. Later themes look to explore more the relational and institutional aspects of the research questions posed.

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[25] In the two cases of testing tape recording, in one case the neighbouring kiosk was selling religious videos where loud broadcasts pull in customers. These broadcasts drowned out voices in the interview recording. In another interview close to a Mutatu stage, words were also periodically inaudible beneath the din of traffic.

Whilst these themes were followed to allow interviews to remain somewhat structured and coherent to the interviewee (Blaikie 2000), specific interview questions can be considered to be highly flexible dependent on the specific actor (micro-entrepreneur, intermediary etc), locality and case study to ensure that questions were relevant and sensitive to the interests and activities of the range of actors who were interviewed. In this way some more room is given; "the respondent is being encouraged to develop the theme in any way that is meaningful to them" (Bechhofer & Paterson 2000 p.66). The unstructured form allowed an easier establishment of rapport, and as interviews progress allows interviewees to become more relaxed with more personal information being elicited (Woodhouse 1998).

4.5.2. Observational approaches

With sub-sectoral micro-enterprise interviews being conducted in the working environment of respondents, if customers or other needs required, interviews were paused whilst business was undertaken. Whilst in some cases this resulted in sporadic, and in a few cases curtailed interviews when interviewees were distracted by work issues, it generally had the advantage in vastly improving significant information gathered in interviews.

This particularly occurred through integrating observation into interviews, both in terms of observing the daily interactions that entrepreneurs undertake, and of their spaces and technologies. This provided many additional insights about innovation as well as provoking a number of supplementary questions in interviews which would not otherwise have been considered.

This is illustrated in one very simple example from an interview with an M-Pesa agent (micro-entrepreneur) below.

> Interviewer: What types of problems do agents have with M-Pesa?
>
> Agent: Few problems….Sometime, they can enter in wrong numbers when they do transfers and it goes to the wrong person. With problems you can connect to 234 *[customer call support]*.
>
> *[A few supplementary questions of a similar type are asked, but the agent continues to repeat the mantra 'few problems'…].*
>
> *[Later the interview is paused when a woman tries to register with M-Pesa….Problems occur resulting in the agent having a long conversation with the customer].*
>
> *[After leaving]* Interviewer: What happened with her?

> Agent: There is sometime delay in the network today. I told them they can go to the service centre in town, and talk to them.
>
> There are problems …There is delay after the rains…*[and]* when there is action at the end of the month when people have more money – around payday the network can be slow.
>
> *[Consequently the agent opened up in more details regarding the growing network problems that are plaguing his business]*

This type of interview progression was quite typical of the interviews, where extra knowledge was often elicited through a combination of observation and subsequent interview questions. This particularly related to asking about customers, or related to mobile technologies, logbooks or other paraphernalia that were often scattered within the kiosks where micro-entrepreneurs worked, seeking to use the forms of technology, the space and social connections as a prompting to allow a discussion connected to ICT innovation and their forms of enterprises.

4.5.3. Secondary data

A number of sources of secondary data were used in analysis, drawing on a rich vein of material. Secondary data used particularly comes from three sources: news and local documentation related to the case study; macro-level sectoral documentation particularly quantitative statistics; and parallel research and unpublished reports. It should be emphasised that this secondary material is treated as data in a similar way to the interviews and observational material gathered. It is treated sceptically with its own perspectives and potential weaknesses with need for triangulation, but also with potential to provide a clearer picture of the case study.

Documentation of local contexts provided a key source of data. Taking advantage of this secondary evidence was particularly vital in supporting the dynamic accounts undertaken in interviews, and to examine the history of the sector. This particularly related to data coming from news and press articles, where ICT is an area of intense focus, particularly in Kenyan business news. This provided important information on firms in the innovation system, discussion of local activities and new policies and some useful interviews with lead players, all of which were used to build a clearer picture of the innovation system.

Macro-level sectoral documentation provided another source of evidence. This particularly related to two key sources used. Firstly, the enterprise Safaricom which runs the M-Pesa mobile money service provided an invaluable source of information. Publically available data included proposals, a patent and published statistics.

Secondly, the Kenyan government aggregates macro-level statistics for the mobile phone sector which provides additional data related to general adoption of both mobile phones and volumes of transactions in mobile money in Kenya[26]. This material was particularly useful in provision of some limited quantitative data which provided statistics used to triangulate some of the trends emerging from interviews. Such numerical data sources in developing countries are often problematic, and in this study there were problems with contradictory, inaccurate data, or with large periods of time missing in data. Thus, such quantitative data has been used with great care in analysis, and only when well supported by other evidence. Unfortunately this means that a number of other valuable data sources found, such as mobile money agent location data and mobile phone adoption statistics data have not been used in analysis due to the high levels of missing, replicated and/or contradictory data points.

There is a large amount of parallel research material available, particularly in terms of the mobile money sub-sector, which includes a lot of research from various interested international organisations researching mobile money in Kenya (generally publishing their work directly online without full peer review). This work provides a key source of information to understand this specific sub-sector. In addition, parallel research comes from non-peer reviewed research on Kenya which was gathered during wider holistic data gathering relating to two areas: more in-depth analysis of locations, and organisations involved in the mobile sector, and in critical analysis of ICT regulation.

4.5.4. Triangulation and generalisability

Triangulation in this research was particularly crucial; in terms of conventional ways of ensuring that individual respondents' accounts were reliable, and in supporting understanding related to specific historic memories of respondents.

In line with common research approaches, multiple approaches to triangulation were taken in order to improve validity of data (Patton 2002) - *data triangulation* through use of multiple data sources, and *methodological triangulation* through using different methods to support key aspects of research. This is illustrated in Figure 4.6 which adapts the previous sampling approach (Figure 4.5) to include comments on how these selections relate to triangulation.

[26] This information is provided by the Communications Commission of Kenya (CCK) in their ICT sector statistics (CCK 2011a) and through the Kenyan Central Bank's (CBK) monthly reports (CBK 2012a) respectively.

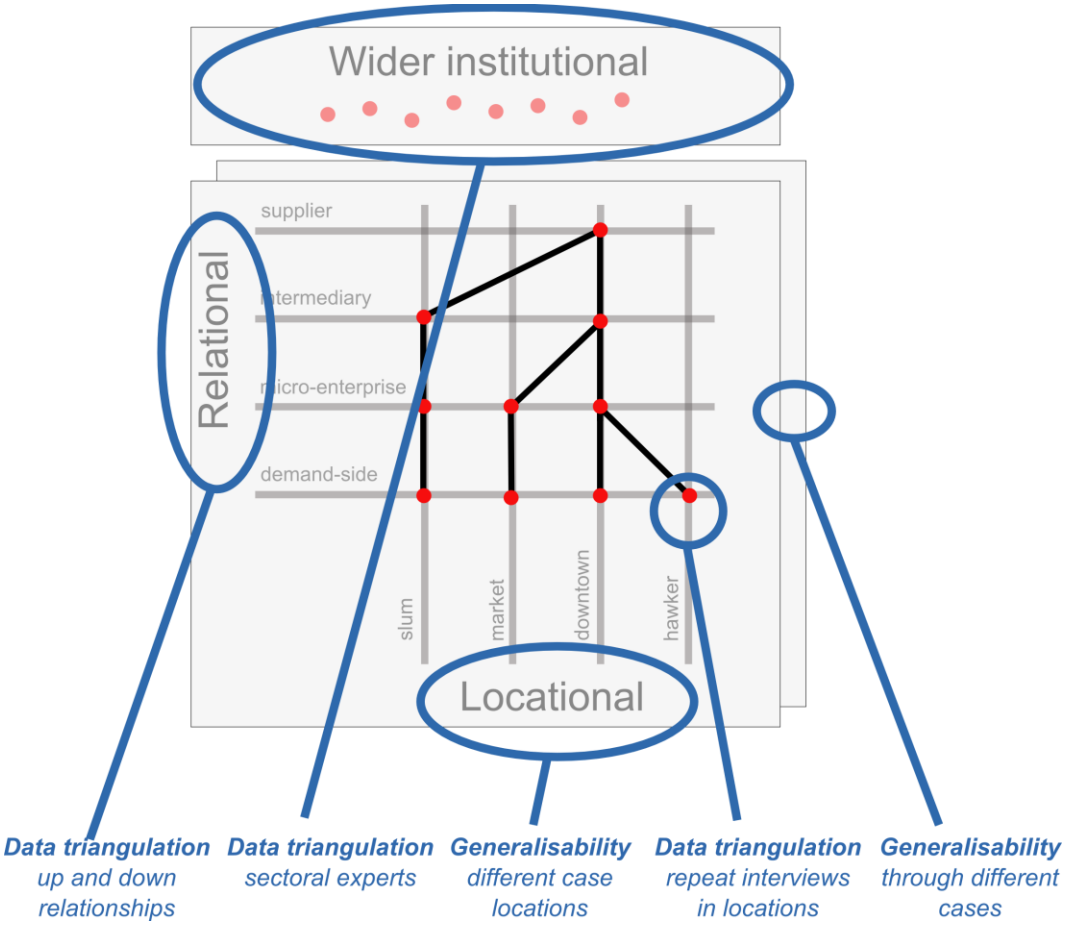

Figure 4.6: Triangulation and generalisability in research.

Data triangulation was undertaken in three principal ways: through multiple interviews with similar actors in locations, in data triangulation up- and down-wards within networks within sub-sectors, and via data verification with wider sectoral interviewees in the mobile innovation system. In such cases, repeated asking of similar questions allowed general concepts to be verified and supported, both in terms of supporting accounts and histories of sectors. As shown in Table 4.1, the number of interviews in respective categories highlights the importance that such triangulation was given.

Methodological triangulation primarily relates to the use of secondary data to support interviews, providing support for the primary evidence obtained. This particularly triangulated dynamic discussions on businesses and individuals through other supporting data. Further, the tactic of combining micro-entrepreneur interviews in their work place and active observational approaches also links into this idea of methodological triangulation.

In addition to triangulation, attempts were made to ensure that triangulated data was generalisable, representative of a wide range of conditions (see Figure 4.6), and hence that the conclusions are well representative of the mobile sector in Kenya. In each sub-sector generalisability principally emerged in the location selection, where the aim

was to introduce variations in micro-enterprises through varying focus on less affluent groups. Such selections were designed to ensure that key issues were not neglected or single contexts skewed findings. The embedded case study design also connects to a generalisability of sorts, through triangulating general conditions within multiple sub-sectors, although as outlined within the research questions there was some expected variation in this dimension.

In sum, specific care has been made to ensure triangulation and generalisability of data for this specific case, although it should be acknowledged that this is limited by the resources and time available. This is particularly true in terms of generalisability, where a wider analysis of other ICT micro-enterprise sectors and within a range of countries would enhance the generalisability of research findings for mobile micro-enterprise (this is discussed in more detail in the conclusion chapter). This is not to say that findings here are not valid, but future research will be essential to support generalisability where in the language of critical realism, further insights within a range of contexts at an empirical level, can sharpen the way that the real structures of theory are outlined and characterised.

4.5.5. Analysis

The analysis of interviews and documentation occurred both during and after the fieldwork. During fieldwork, the goal specifically related to building a simple dynamic view of the case study and specific sub-sectors, understanding the relationships and actors involved in the innovation system over time. These simple accounts were constructed and then verified with sectoral level actors in the later stages of the fieldwork, with any confusions clarified through further interviews.

Subsequent to the fieldwork, semi structured interview data was coded to examine the case study in more detail. In line with the general goal of the research, whilst analysis gave precedence to more frequently occurring data, the goal of analysis was not to fully quantify descriptions or issues, as is common in some coding approaches, but to look across the core themes using interview data (Stake 1995). This would aid subsequent descriptions in analysis, supporting data generalisability by allowing better insight into the similarities of such cases clearly, whilst being able to highlight differences that may require further explanation.

Transcripts were digitised and coded in Nvivo 9 qualitative software. Drawing on innovation system models, the core coding from interviews revolved around the five general components of the systems of innovation (relations, institutions, innovation, learning processes and actors). Each interview was also coded with specific characteristic attributes: enterprise type, location, sub-sector and some interviewee

demographics (age, sex etc) in order to provide the ability for themes to be analysed across sets of interviews, location and sub-sector.

The data being quite rich was further sub coded in some cases, to allow more granular analysis of common themes (for example in terms of institutions different sub-categories - formal bodies, rules and informal institutions where delineated within the analysis). Each theme was then analysed and compiled in detail and where appropriate, secondary documentation was also introduced and coded as part of the triangulation process to produce an initial analysis in each of these themes.

Additionally, free coding was also used to allow more intuitive empirical themes to emerge which might have been missed within theoretical models. After consideration, some of these issues were later integrated into the core themes, others rejected as being beyond the scope of this research.

In sum as this section illustrates, the use of a combination of coding methods and of qualitative software ensured that beyond the *quality* of data gathered, the data was *utilised* as efficiently as possible. This helped make findings more robust and more generalisable through a more logical in-depth analysis of the interviews, and in line with the best practices of data coding and analysis.

4.6. Summary

Drawing on the research questions and the proposed conceptual approach, this chapter has outlined in detail how the research was undertaken. Starting from outlining a clear methodological position for this research that well fits with the nature of the proposed investigation, it is argued that research was best suited to qualitative case study approach that fits with the explorative nature of this work. A single case study revolving around both embedded units and holistic case research was chosen as suitable for answering research questions. The case study specifically focuses on a sectoral innovation system related to the mobile phone sector in Kenya which provides a case of a mature sector where ICT innovation are focussed on low income consumers, which additionally includes a large number of micro-enterprises. Within this two embedded units, mobile handset and mobile money networks, selected to provide comparative analysis of network relationships within this case study.

In terms of how case study research was undertaken, the iterative mode of investigation drawing on best practice in research methods was highlighted, which provides an expansive way to study these cases. At a micro-level, given the marginal nature of the ICT micro-enterprises who will be the core of research work, ethical concerns led to methods that aimed to be informal, transparent and minimised the

risks to enterprises that were interviewed. This position also led to research methods being selected revolving around triangulated semi-structured interviews with systems actors, combined with observation and secondary data which provides a strong basis to support the findings of this research.

5. Kenya's mobile phone innovation system

5.1. Introduction

This chapter outlines the case study used in analysis in subsequent chapters. Following a brief overview of the Kenyan context, an outline of the mobile phone sector is presented, particularly highlighting the main elements of policy and regulation. From here an overview of the two mobile sub-sectors researched, mobile phone handset selling and mobile money networks, is presented.

A dynamic description of these two sub-sectors outlines the development of innovations from introduction in Kenya to their increasing use amongst lower income users. The two sub-sectors tend to move through growth 'stages' which can stay comparatively constant over a period, where changes are linked to responses from innovation system, contextual factors and policy.

5.2. Kenya and Nairobi

Kenya is located in East Africa (as shown in Figure 5.1), with a population of 41.6million (UN 2012). The economy is still predominantly agricultural, contributing around 23% of all GDP (in 2011), and an estimated 61% of all employment (in 2009) (ILO 2011), although this is a downward trend from higher levels during the 70s and 80s.

Figure 5.1: Map of Kenya with major cities.
Source: Open Maps (Wikimedia 2012).

In terms of its' developmental position, Kenya is classified as a country of 'Low Human Development' in the UN's Human Development Index (UN 2012) and within 'Lower Income Economies' as classified by the World Bank (World Bank 2012). This indicates that large amounts of the population still live in poverty, with the World Bank calculating that in 2009 67% were living on under $2 a day, with 43% living on under $1.25 a day (World Bank 2011a).

However, like many other countries in sub-Saharan Africa there are some positive signs in recent years, as illustrated in the GDP and growth data shown in Figure 5.2 below. Notwithstanding the fallout of global crises, there has generally been a steady upwards trend in national growth in the previous decade.

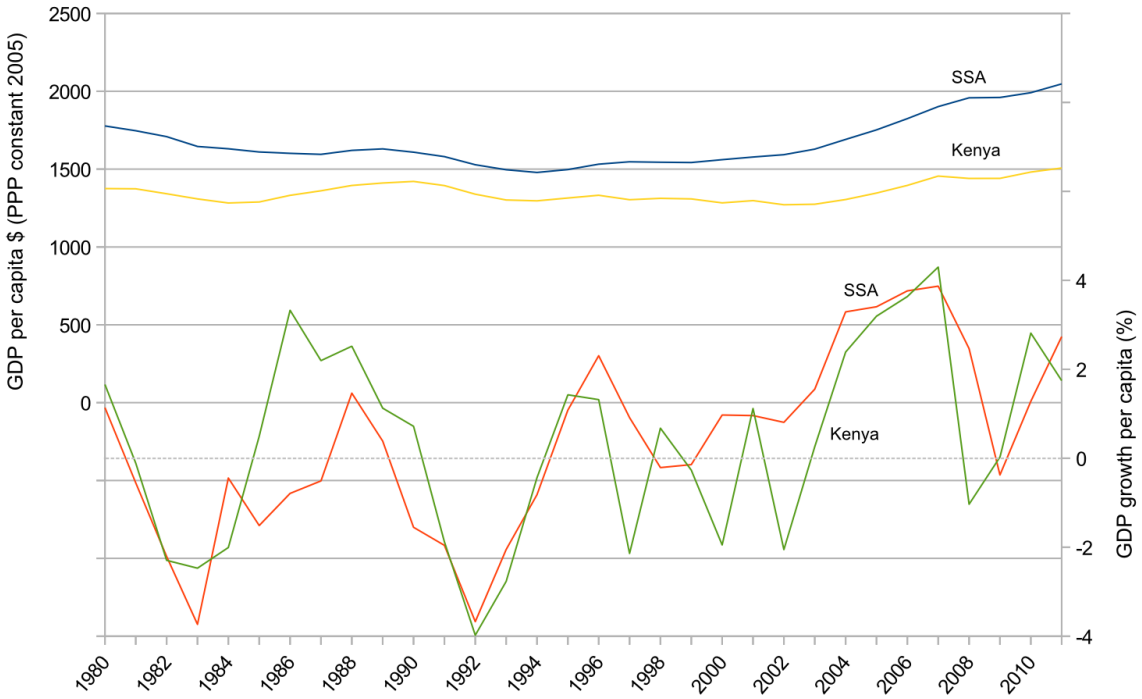

Figure 5.2: GDP and Growth in Kenya and Sub-Saharan Africa (SSA - developing only).
Source: World Bank global development indicators (World Bank 2011b).

Whilst Kenya is still predominantly rural, as with many developing countries there are rapid moves towards urbanisation, with some 32.3% now living in urban areas according to the 2009 census (KNBS 2009), up from 16% in the early '90s[27]. Statistics indicate that there is a lower chance that urban dwellers are likely to live in absolute poverty than rural dwellers (34% compared to the national average of 46% (World Bank 2011a)). This figure is still high, and it does not fully account for conditions of low income urban dwellers in Kenya, who even with a better core income tend to be prone to high vulnerability in urban areas, linked to unstable living and working conditions (UN Habitat 2001). Thus, studies of urban areas in Kenya are as appropriate for studies of low income and the marginal groups as much as rural ones.

5.3. The ICT sector and mobile

Kenya's ICT sector has been attracting growing interest. This particular connects to the increasing take-up of mobile phones and the emergence of mobile money from Kenya in the form of the M-Pesa service, an iconic service that has been replicated (with varying success) in a number of other developing countries.

[27] Likely this also underestimates the real urban population (Satterthwaite 2007).

5.3.1. Policy and regulation

The conditions of policy within the Kenyan ICT sector have been well researched. This literature outlines that whilst at some stages of policy making has been a slow and bureaucratic, policy formation has generally been effective and followed recommended international good practices (Bowman 2010)[28]. This has led to the formation of appropriate underlying institutions and structures in the sector (ibid.), as highlighted in a summary of their effectiveness by the World Bank.

> "The regulatory environment permitted competition and played a catalytic role in the phenomenal growth of ICT" (World Bank 2010 p.14)

In terms of specific mobile policy, the sector revolves around two crucial policies. Underlying rules come from the Kenyan Communications Act 1998[29] (GOK 1998). The original act initiated the various arms of policy making in the mobile sector, particularly through installing a converged and independent regulator, the Communications Commission of Kenya (CCK) (Waema et al. 2010).

Over the decade following the Act, mobile sector development has particularly been driven by the regulator who has pushed for competitive markets. Regulation such as firm licencing, operator interconnection and converged licencing frameworks have done much to push a competitive mobile environment, and firm innovation (CCK 2008, Waema et al. 2010).

Where mobile policy has been weak, it relates to the underlying stance of policy which places the state as a 'light touch' actor in markets, as opposed to a driver of development (GOK 2006a). In situations where more muscular regulation or intervention might be prudent, challenges are more significant for the regulator. For instance, in the case of the mobile sector this relates to the dominance of the operator Safaricom with over 75% of all mobile subscribers at the time of the fieldwork, and this is a limitation that CCK has struggled to have impact upon (CCK 2011b).

Mobile money regulation deserves some special attention in that beyond sound mobile sector policy, it required integrated early regulation, between the Kenyan Central Bank and mobile policy makers (Calandro et al. 2010). In the Kenyan case, M-Pesa was a frontier innovation with few precursors elsewhere to follow, and the Kenyan government had to be responsive to the changing policy needs over time. Of particular concern was to strike a balance between sufficiently regulating to ensure protection

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[28] Although as Bowman notes, this partially connected to political pressure from donors which drove Kenya to adopt such structures (Bowman 2010).

[29] Later amended in the Kenya Communications (Amendment) Act 2008 (GOK 2009).

for consumers due to M-Pesa's financial nature, but without overly burdening firms with regulatory hoops to jump through which might curtail growth of such a new and risky service (AFI 2010, Calandro et al. 2010, Dias & McKee 2010). Beyond these specific regulatory issues one can also see that in terms of policy making, previous mobile sector concerns – encouraging new firm entrance and competitive markets - pervade mobile money policy making.

5.3.2. Mobile sector growth

Following the instigation of the Kenyan Communication Act in 1998, a true competitive industry can be seen to emerge around the start of millennium. As can be seen in Figure 5.3, over time this has led to accelerating annual growth in mobile subscribers particularly beginning around 2003. Such growth connects with a chain of crucial events and policies such as reduction in price of handsets, competition between firms and tariff reductions, Table 5.1 summarises these key moments.

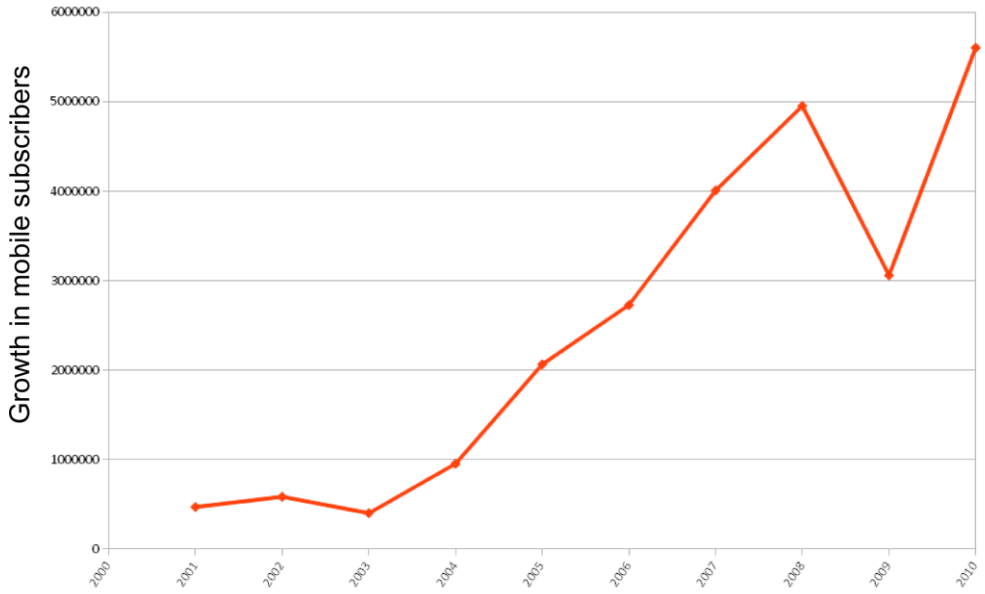

Figure 5.3: Annual growth in mobile phone subscribers 2001-2010.
Source: Authors calculations using Kenyan ICT sector statistics (CCK 2011a)[30].

[30] Statistics in Figure 5.3 do not fully correspond fully to the periods of discussion in this section, due to missing and/or contradictory data.

The reason for the 2009 downspike is unclear, but likely links to the economic downturn in Kenya linked to the global economic crisis (see Figure 5.2).

Date	Event	Outline
1998	Kenyan Communication Act	Competitive market and structures, two operators – Safaricom and KenCell.
2000-2003	Pre-paid, Per-second billing launched (Safaricom in 2000, Kencell in 2003)	Changes have a strong effect in reducing cost for mobile ownership - Moving mobile phones away from being solely a business tool to something available to those in wider society.
2002	Removal of handset duty (5%) in budget	Mobile phones moving away from being seen as 'luxury items'– Reducing cost of mobiles in market and playing a role in enabling branded handset firms to sell in Kenya.
2004	Failed attempt to licence third operator	Operator licensed by CCK, but ongoing disagreements and court actions about fairness stop any rollout.
2004	KenCell becomes Celtel	Strong promotions and price competition connected to rebranding.
2005	CCK head and board removed by Minister of Communication	Assumed to be connected to drive by CCK for competition, in opposition to vested political interests.
2005-	East African Community Integration (beginning with Custom Union Agreement in 2005)	Attraction to multinationals, who can treat region as a more coherent one, particularly mobile handset firms.
2007-	M-Pesa (launched 2007)	Increase of general interest in using mobile amongst some low income groups (particularly post 2008 political crisis). Reduction of motivation of Safaricom customers to switch to competitor.
2007-2011	Move to 'cost based pricing' for mobile interconnection	(see next section).
2008	Two new operators launch – Yu and Orange	Increasing competition in the sector.
2008	Celtel becomes Zain	Strong promotions and price competition connected to rebranding.
2009	Removal of VAT duty (16%) on mobile handsets	Reduction of cost of local mobile handsets.
2011	Zain becomes Airtel	Strong promotions and price competition connected to rebranding.

Table 5.1: Key events linked to mobile sector growth 1998-2012.
Source: Authors fieldwork and sector documentation.

In the early years following liberalisation of the mobile phone sector, mobile phones were seen both by firms and the government likely only of use to elite and business customers. However, following the Communication Act, the competitive operator

environment quickly began to change things. A significant first step was the introduction of prepay in 2000 (Safaricom) and 2003 (Kencell) and per-minute billing which brought about the emergence of the now ubiquitous 'scratchcard' for mobile top-up. This made mobile more attractive and financially manageable where users could now make short cheap calls, and this supported use outside elite and business customers.

A key change related to regulation shown in Table 5.1 is the significant drop in mobile tariff from 2004 to 2008, driven by the regulator setting competitive mobile network interconnection rates in the sector between mobile firms, driving down prices (Calandro et al. 2010). Alongside ongoing mobile competition, the regulatory driven mobile tariff reduction is generally considered to have been a crucial driver of reduced mobile tariffs over time (outlined in Figure 5.4) (ibid., Waema et al. 2010).

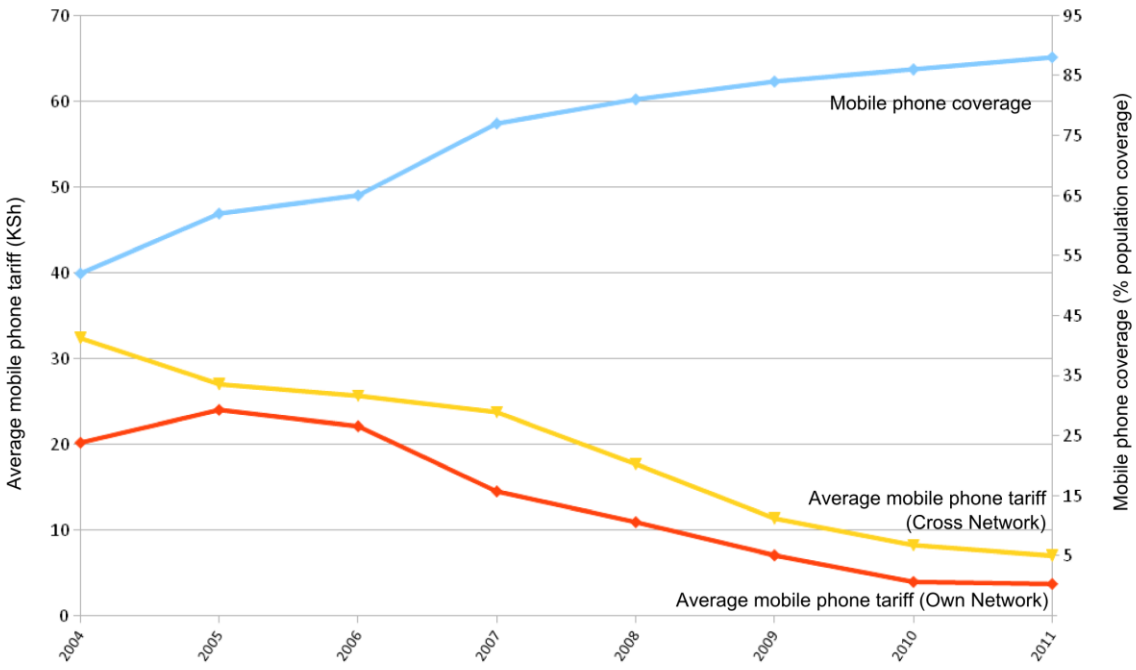

Figure 5.4: Tariff levels 2004-2011, % population coverage of mobile.
Source: Kenyan ICT sector statistics (CCK 2011a)[31].

Whilst there is still some way to go to be completely ubiquitous, mobile handsets are growing in availability. In a 2010 government survey, 60% of the population now had access to a mobile phone (KNBS 2011), with an increasingly competitive market attracting less affluent users (World Bank 2010). In terms of mobile money, figures indicate the service now has over 14 million registered users (Safaricom 2011)

[31] Accurate tariffs records were only available post-2004.

(equating to 70% of Kenya's 16-65 population (KNBS 2009)), with 85bn Kenyan Shillings (Ksh) (~$1.02bn, £637m) moved in the system in April 2011 (CBK 2012a).

5.4. Mobile innovators: two sub-sectors

Following on from this more general outline of mobile sector growth, the two specific sub-sectors, mobile phone supply and mobile money, are introduced.

5.4.1. Mobile phone handset supply

Whilst mobile handsets are sold through formally designated shops in large towns (generally focussed towards more affluent users), lower income users tend to purchase phones through alternative channels, a growing industry of 'informal' handset sellers in trading areas, markets and kiosks. In Kenya, such sellers are often independent micro-enterprises, who link to mobile handset suppliers and operators, through further intermediaries such as phone wholesalers and distributors. The dual channels of mobile handset supply and relations are illustrated in simplified form in Figure 5.5.

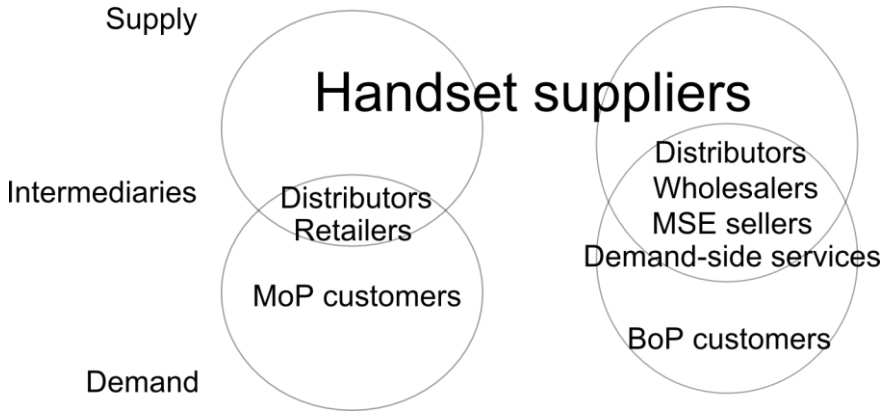

Figure 5.5: The dual channels of Kenyan mobile handset supply.
Source: Authors fieldwork.

The left hand side shows the channels which reach more affluent 'middle-of-the-pyramid' (MoP) customers. Here branded mobile devices are sold through official distributors of handset suppliers into formal retail stores in Kenyan towns and cities. On the right hand side, are less formal channels which focus towards less affluent 'bottom-of-the-pyramid' (BoP) users[32]. This channel involves a more diverse set of

[32] Prahalad(2009) defines the bottom-of-the-pyramid as those living on $2 a day or under and middle-of-the pyramid as those living on between $2-13 a day. Although specific income measuring was not directly done in this research, this categorisation is in line with the general profile of the channels found in research, particularly the language that one of the largest handsets supplier characterised these channels during interviews.

handsets including both 'branded phones' (i.e multinational handset brands[33]), 'grey market' imported branded phones[34], second hand phones, and 'China phones'[35].

Intermediaries are also more diverse in this low income channel, particularly revolving around informal wholesalers of various sizes, who buy phones from the diverse handset distributors and suppliers. Below these intermediaries, are the ICT micro-enterprises, mobile sellers who are focussed on consumers. There are also other entrepreneurs close to markets, who provide other related mobile services, such as repairers. A more detailed outline of the emergence and evolution of these channels is discussed in Chapter 7.

At the time of fieldwork, some branded handset suppliers reported that BoP channels accounted for at least 40% of their mobile sales[36], but in some smaller handset brands competing on low price sales, up to 90% were sold through these channels.

5.4.2. Mobile money

'Mobile money' refers to mobile phone based money transfer services, seen to potentially allow previously 'unbanked' groups to have access to money and banking services. M-Pesa is the first, and leading international example of a successful mobile money transfer service. It was launched in Kenya in 2007, but it has rapidly grown.

M-Pesa is licenced by the Central Bank of Kenya, as a 'non banking financial service', so whilst not subject to the level of regulatory oversight that a bank would be liable to, the Central Bank still maintains some regulatory control and financial oversight of the service (AFI 2010).

M-Pesa transfers

M-Pesa allows mobile money transfers by sending virtual 'e-cash' through SMS. M-Pesa involves two elements: a transfer *infrastructure* to integrate the mobile money system into a mobile phone network, and *conversion services*, to connect between virtual e-cash and real money. *Conversion services* are usually run by 'agents', independent but officially authorised stores such as petrol stations and shops, but also ICT micro-enterprises located in less affluent areas, who undertake conversion

[33] This terminology will be followed through the subsequent chapters.

[34] Grey market refers to imported phones not officially licensed for country, thus they sit between legal and illegal in many cases. In Kenya this is mainly phones from Dubai and China. In addition many of these grey market phone tend to avoid payment of taxes.

[35] China phone are those that come from Chinese (and other far east) mobile suppliers. This included new emerging Chinese brands (G-Tide, Bird, Wing, Tecno) as well as small scale branded generic phones (in Kenya brands such as Egltel, XyTel, ZTel, Saga and many others) and counterfeit phones.

[36] Estimates from branded suppliers are that 40% of handsets are supplied through MoP channels, 40% through BoP channels, and the remaining 20% through mobile supply to businesses and the state.

services in informal kiosks and containers. Agents provide account registrations, and cash to e-cash conversion for customers receiving commissions for each transaction. As of April 2011, there were 27,988 agents in Kenya (Safaricom 2011).

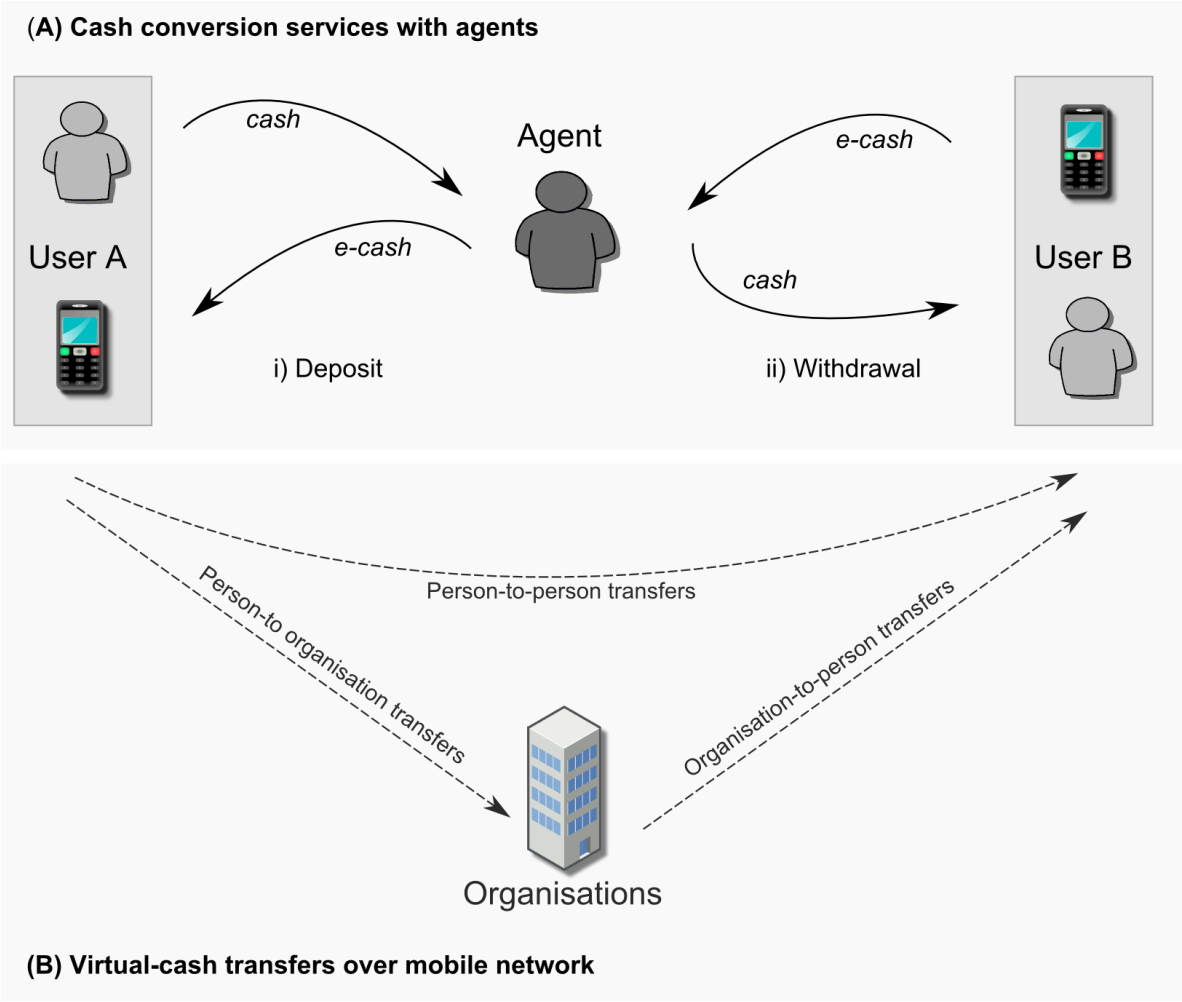

Figure 5.6: Outline of processes of mobile money transfer.

M-Pesa services are outlined in Figure 5.6. All transfers take place over the Safaricom mobile network where the sim card of a registered user (i.e. mobile number) identifies the M-Pesa account.

In terms of conversion services, customers can *deposit* or *withdraw* cash from an M-Pesa agent who converts cash into e-cash or vica versa (as shown in Figure 5.6(i) & (ii)). In terms of transfers, person-to-person (P2P) *transfers* take place directly where a sender will enter the receivers' mobile number (i.e. M-Pesa account identification) and the amount to transfer into their mobile, and sends an SMS to make the transfer. Receivers are not obliged withdraw e-cash immediately on receipt of transfers, rather an M-Pesa account acts somewhat similar to a 'lite' bank account. More recently M-Pesa has expanded focussed to include interactions with *organisations*, as shown in

Figure 5.6(B) to pay for goods or service or to receive payments. A more detailed description of these processes is presented in Appendix 5.

Relationship profile

As shown in the simplified diagram in Figure 5.7, M-Pesa closely revolves around the lead firm, operator Safaricom, although operational activities happen through outsourced operational partners. In terms of MoP customers, M-Pesa use might come through agents located in retail stores or through links with M-Pesa 'payment clients', these new partner organisations outlined in the previous section such as banks or shops.

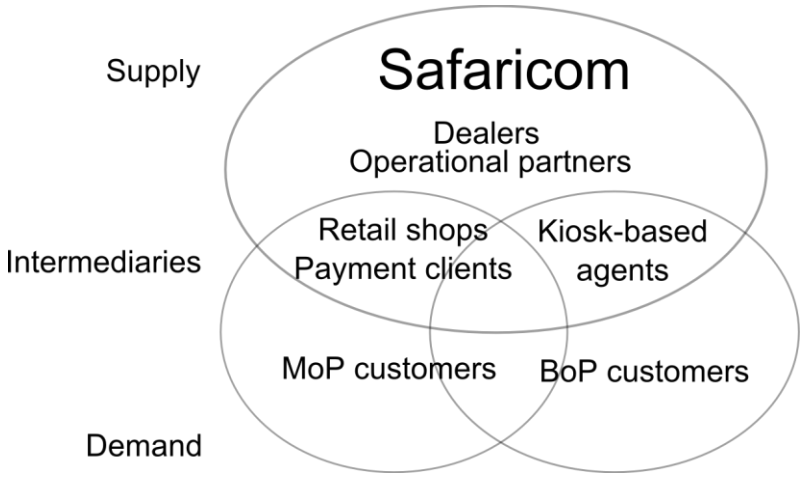

Figure 5.7: The channels of M-Pesa.
Source: Authors fieldwork.

As shown on the right hand side of Figure 5.7, less affluent customers tend to connect into the service in simpler ways, particularly through interactions with smaller agents, typically ICT micro-enterprises based in street side kiosks.

Unlike mobile handset supply, in M-Pesa the MoP and BoP channels are more closely integrated. The service at the agent level is standardised and it is common to see suited businessmen interacting with kiosk agents, and informal workers in retail shops.

5.5. Dynamic views

The previous sections presented a view of crucial policies, and a general overview of the two sub-sectors studied. Here these two aspects are linked in a dynamic analysis of the two sub-sectors. The analysis found that the two sub-sectors tend to move through growth 'stages' where characteristics stay comparatively constant over a period. New stages emerge in response to both factors in the innovation system and other contextual factors as outlined.

Later chapters will look in more detail at how these processes relate to systems of innovation models (Chapter 6), the links between networks and innovation (Chapter 7) and an analysis of the link between dynamic stages and policy (Chapter 8). The goal here is to provide broad characterisation of these stages, from emergence of innovation to the present day. Thus, stages are presented more descriptively in this section, supported by macro-level statistics gathered.

5.5.1. Mobile handset selling

The growth of mobile handsets is closely linked to multiple factors around provision of mobile, particularly mobile coverage and tariff costs. Thus, to understand the evolution of handset activity, growth needs to be interwoven with wider change related to the general mobile sector to build a clearer picture.

Four stages are outlined in Figure 5.8 for mobile handset selling. These closely relate to the mobile sector conditions outlined in the previous section and how handset firms typical responded to these changes.

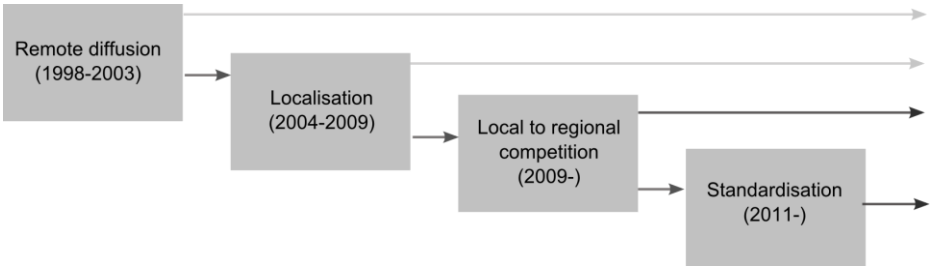

Figure 5.8: Dynamic stages in mobile handset selling[37].
Source: Authors fieldwork.

Remote diffusion

Initially with higher handset costs, tariff costs and tax levels, the cost of mobile was high and mobile phones were seen as mainly a product for the elite where handsets came into Kenya via *remote diffusion*, mainly into the more formal phone stores without much semblance of an innovation system per se. Handset firms placed little direct focus on developing countries, typically assigning large distribution firms the rights to import mobile handsets, with any necessary issues managed from remote offices in South Africa, Cairo or the Middle-East. With this lack of focus, new phones tended to take longer to arrive, often resulting in outdated, unwarranted or overpriced phones being supplied and sold in formal retail shops in Kenya.

[37] The four stages are not fully sequential as some enterprises still stick to previous stages (for instance, some handset suppliers can still be characterised as following remote diffusion who still continue to take a low interest in Kenyan markets, leaving it in the hands of local distributors). The darker arrows indicate the trends which are more prevalent during fieldwork.

Localisation

From around 2004, growing interest of handset firms in emerging markets can be seen to have an effect on handset firm strategies[38], with an increasing trend towards *localisation* with both large and small handset firms becoming more directly active with strategies and marketing in the Kenyan market. In many cases firms began to establish regional[39] and national offices to allow more autonomous local management and strategy in the region from 2004, but particularly in 2005-2007[40].

What also marks this period is how the lower income channels of delivery became established, related to the growing demand for mobile (particularly as tariffs dropped) by taking advantage of high handset costs sold and outdated models often sold through formal shops at the time. Thus wholesalers and informal seller emerged through selling cheaper second-hand, cheap generic handsets from China, tax avoiding 'grey market' phones and in some cases counterfeit phones.

Regional competition

VAT had been applied on mobile handsets up until June 2009, typically adding between 16-20% onto handset costs to branded phone (dependent on rate). Making mobile phones exempt from this duty had a significant effect on the price of local sourced branded handsets. This had an effect on both the branded firms who found themselves increasing their sales as result of this change, as well as some of the local entrepreneurial actors in the informal channels who began to source phones from more reputable local suppliers of mobiles as opposed to grey markets. Thus, the number of such sellers grew significantly, as informal selling became more viable and products more reliable.

With a growing vibrant market competition, and with the present of vibrant formal and informal channels and handset firms both large and small, Kenya increasingly became a hub of *regional competition*, with many of the informal actors becoming focussed on wider selling, both nationally and into other East African markets such as Malawi and Somalia.

Of particular interest in this period of regional competition, is the increasing interconnection between the formal and (previously vilified) informal channels. The larger handset firms looked to ensure that as mobile reached increasingly less affluent

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[38] With entrenched markets in developed countries, growing market share in developing and emerging markets was becoming a prudent business choice.

[39] Further, inertia towards regional integration may have had an effect (particularly the East African Community Custom Union Agreement in 2005) providing the ability for handset firms to connect into the regional market coherently.

[40] In Kenya, LG arrived in late 2004/2005 and Nokia in 2006.

actors, who likely would be purchasing phones that had passed through the informal channels of wholesalers and retailers, they became more involved with these channels so customers would be able to still purchase branded (as opposed to generic) phones. This network adaptation is explored in more detail in Chapter 7.

Standardisation

As the more official firms found their branded handsets increasingly in competition with less formal brands, *standardisation* led by both the government and handset firms has looked to remove some of the Chinese and 'grey' mobile handsets from the market using the rhetoric of illegality and crime. This stage can be seen to emerge following the writing into law of the 2009 Anti-Counterfeit Bill in Kenya (GOK 2008) which instituted enforcement by anti-counterfeit bodies. From here, one can see increasing anti-counterfeit rhetoric in the Kenyan market, raids of informal wholesales and subsequent to the fieldwork more draconian network level blocking of counterfeit phones.

Review

Thus, over time mobile telephony and handsets have become increasingly available to low income users. This is supported by a sample survey of citizen 'access' for different ICTs in Kenya, shown in Figure 5.9, taking the measurement 'level of education' as a loose proxy for income levels.

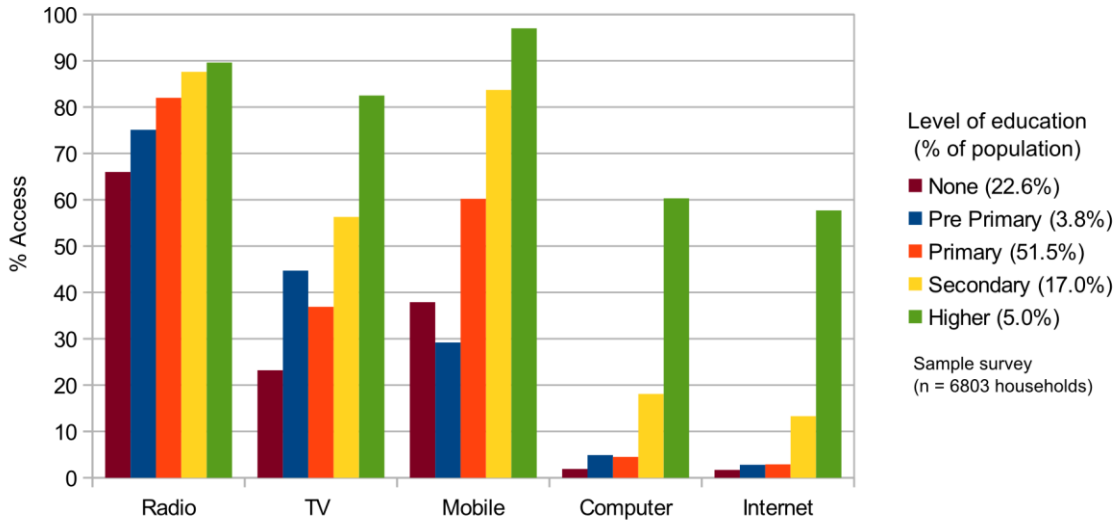

Figure 5.9: % of access to ICTs by level of education[41].
Source: Kenyan National ICT survey 2010 (KNBS 2011).

[41] Access here is defined "as possession or availability (e.g., through home, office, school or public location) of ICT equipment" (KNBS 2011 p.20).

For mobile, prices reduction and availability of mobile coverage can be seen to have made mobile use increasingly attractive. However, even with this increasing accessibility, there is still a way to go for certain groups. For those with no education and pre-primary education, which make up over a quarter of the population, only a minority describe themselves as having access to a mobile phone. Even for those with a primary education only about 60% describe themselves as having access.

Figure 5.10 illustrates that for those who describe themselves as having 'access' to mobile, household mobile ownership is vastly the norm, in both rural and urban scenarios. Low levels of non-household mobile use in Figure 5.10 suggest that handset prices are now less a reason for non-access (otherwise we would expect to see many accessing mobile through non-household methods). More likely this relates to certain strands of citizen having less interest and lower use for such technologies.

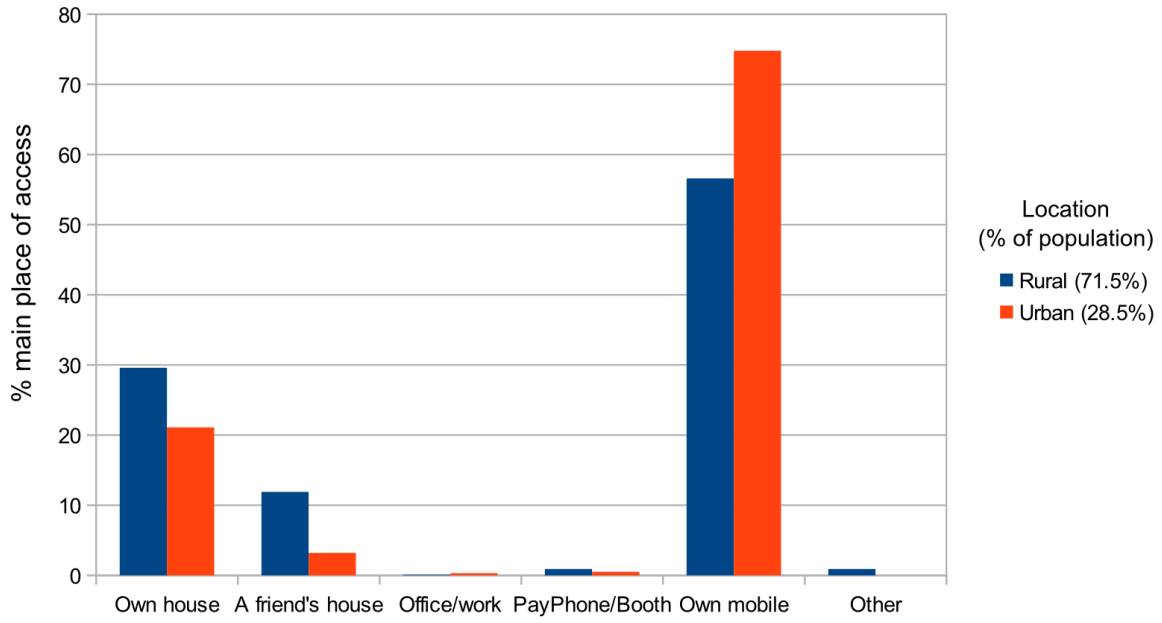

Figure 5.10: Main place of access to mobile for those with access.
Source: Kenyan National ICT survey 2010 (ibid.).

5.5.2. M-Pesa

Analysis of M-Pesa suggests growth over time has also benefitted from the wider growth of the mobile sector, but it also links to a number of specific service factors. With consideration for these factors, analysis of M-Pesa suggests that scaling can be split into five distinct stages as shown in Figure 5.11.

This model was derived from examination of the literature and fieldwork discussions, particularly adapting Flaming's(2011) discussions around M-Pesa agents growth within a two stages (early and aggressive scaling). It also somewhat aligns with the four-step

mobile money 'lifecycle curve' (design, launch, scale-up and diversification) (Cohen et al. 2012), although we argue that that work follows an naïve diffusion of innovation model without offering deep insight into the stages.

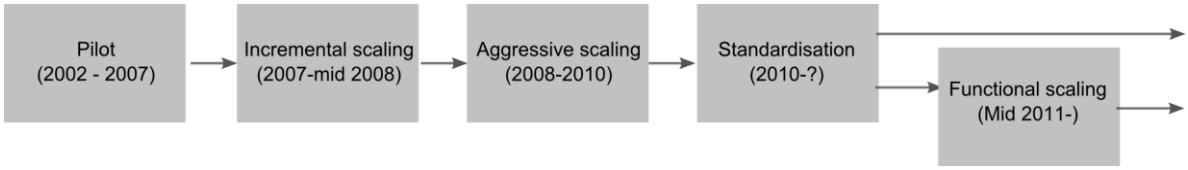

Figure 5.11: Dynamic stages in mobile handset selling[42].
Source: Authors fieldwork.

The stages of M-Pesa are particularly highlighted through to two key statistics (in Figure 5.12), percentage of Safaricom revenue from M-Pesa and monthly growth in local agents.

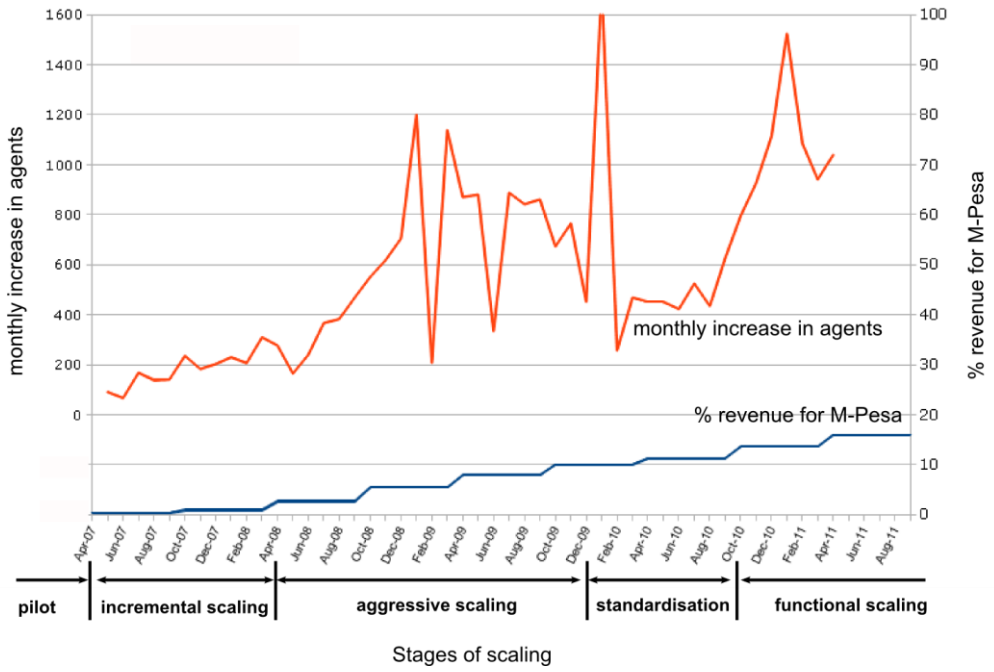

Figure 5.12: Scaling periods of M-Pesa.
Source: Authors calculations adapted from Safaricom M-Pesa statistics and quarterly results (Safaricom 2012, Safaricom 2011)[43].

[42] Being run by a single firm, the transition of M-Pesa stages is more sequential than the mobile handset case. The final two stages can be seen to be occurring in tandem, as outlined in chapter seven in more detail.

[43] Additional commentary on statistics: **Number of agents**: Late growth spikes comes during scale-out comes from signing an agreement with various banks and service providers to use their networks, (i.e. Jan 2010 spike comes from over 500 Equity Bank ATMs becoming electronic 'agents').
% revenue: Graph draws on 6 monthly revenue results.

Pilot

Initially M-Pesa began as *pilot* led by the UK Vodafone Group focussing on micro-finance initiatives in 2003. Following the outcome of this pilot, direction changed somewhat, which led to the M-Pesa form, with the innovation being launched in April 2007.

Incremental scaling

Given the pilot outcomes, *incremental scaling* began with Vodafone's Kenyan subsidiary, Safaricom becoming the lead actor in the project, and positioned the product under the 'send money home' moniker, pushing P2P remittances, particularly longer distance remittances between urban and rural areas as outlined in the early firm advertisements shown in Figure 5.13.

Figure 5.13: The initial 'send money home' proposition of M-Pesa.

As can be seen in this image, strategy particularly focussed towards an active 'middle-of-the-pyramid' urbanite conveniently transferring money back to rural relations, with early customers more affluent as shown by results from a sample survey during the first year of M-Pesa. It was found that,

> "M-PESA users have typically completed a higher level of education: for example, 46 percent of users have completed secondary school, and 10 percent have a university degree" (Jack & Suri 2009 p.13).

> "…most of the early adopters of the service already have a bank account" (FSD Kenya 2009a p.3).

As outlined previously, a core element of M-Pesa service was the agent structure. To satisfy regulatory requirements regarding cash agents, agents were initially chosen from Safaricom's existing networks of airtime resellers known as dealers where these already established networks, mainly more formal retail stores, were used to provide the cash to e-cash conversion to customers. Thus, during the first year of the service incremental growth occurred as the innovation was slowly refined and agents recruited.

Aggressive scaling

As illustrated in terms of agent growth in Figure 5.12, in mid 2007 M-Pesa can be seen to begin to more dramatically grow. This change emerged in the unstable national conditions that arose in widespread insecurity in Kenya following election violence in Kenya. This began in Dec 2007, but tensions remained high for a number of months subsequent to this. During this time, M-Pesa was not only able to continue to run during this period of tension[44], but evidence suggests that for some, M-Pesa transfers provided a lifeline during this period (Morawczynski 2010, Morawczynski & Pickens 2009). Whilst it would be hasty to attach a significant national relief role to the presence of the service, the crisis can be seen to have built awareness of the potential uses of M-Pesa as an important medium for remittance, not only for the middle-class but involving less affluent groups[45].

During this aggressive scaling stage, as supported by the Jack and Suri's(2010) update on their previous sample survey, M-Pesa can be seen to move towards a more intensive focus on BoP users.

> "the earliest MPESA users were the wealthiest and most educated, but that over time, it is being adopted by people of more varied socioeconomic levels" (ibid. p.4).

This is also illustrated in the slow change of tone in advertising as shown in Figure 5.14, where increasingly the articulation of the service included a focus on low income users, those working in informal jobs – a car washer in Machakos, a shoe retailer in a

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[44] Bank of Kenya's statistics on total M-Pesa transferred do not show any indication of significant changes during this period (CBK 2012a), although in some areas M-Pesa were targets during the violence (i.e. Morawczynski & Miscione 2008 in Kibera slum).

[45] Even as the political crises settled down in late-2008, Safaricom continued in aggressive growth as competition emerged from the second mobile operator Zain introducing their own 'Zap' mobile money service, which in its early growth seemed like a genuine competitor to M-Pesa (Mas & Morawczynski 2009).

slum market in Nairobi, a clothes repairer in Naivasha – espousing the benefits of the service for them.

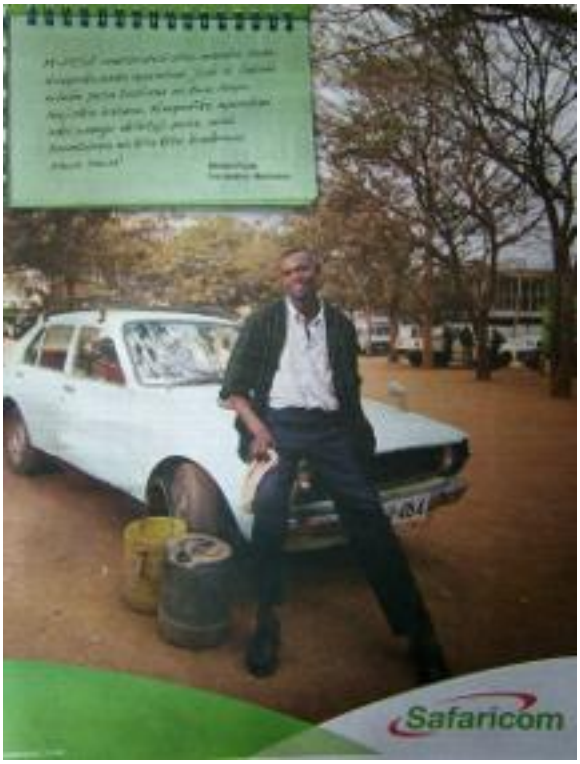

Figure 5.14: A later advertisement for M-Pesa.
An informal car washer in urban Machakos describes (in Kiswahilli) use of M-Pesa.

In the case of agents, this aggressive growth can particularly be connected to the growth of less conventional agents through the so-called 'sub-agent model'. The main change was that dealers (and increasingly over time many other successful agents) began to sub-contract M-Pesa agent duties to entrepreneurs from outside the approved dealer networks. As described by one of the early implementers of the project, this sub-contracting allowed increased reach by allowing micro-enterprise agents to more easily enter the emerging innovation system[46].

> "the only suitable outlets to become M-PESA agents are often small family-run stores...*[but]*…it is not commercially feasible for M-PESA to have a direct business relationship with thousands of "Mom-and-Pop" shops across Kenya " (Lonie 2010 p.2).

Thus, the more pronounced hierarchical 'sub-agent' model emerged. In early 2009 there was over 300 'master-agents' with varying geographic spread with sub-

[46] This is supported by a comparative study of M-Pesa, Kenya and Tanzania. Camner and Sjöblom(2009) argue that the sub-agent model, not established in Tanzania, can be seen as one of the principal factors that has pushed the growth of the service, particularly into poorer areas in Kenya.

contracted 'sub-agents' acting underneath then, from two or three smaller entrepreneurs, up to potentially hundreds.

Standardisation

Around the start of 2010, revenue from M-Pesa broke 10% of total revenue for Safaricom, (see Figure 5.12). M-Pesa can be seen to move from being a peripheral product for Safaricom to one at the core of the firm's future growth.

A new stage thus began in January 2010 when Safaricom announced the 'Aggregator model'. In an interview with an M-Pesa manager, this shift in strategy particularly connected to the feeling that the hierarchical sub-agent model was becoming problematic in terms of management and control. Thus, in the new aggregator model a hierarchical structure would continue, as with the sub-agent model, but with a reduction of top-level agents from hundreds of 'master-agents' previously to just 8-10 'aggregators', who would take increasing professional responsibility for selection, quality monitoring and training, each responsible for 2,000 to 4,000 agents (Mas & Ng'weno 2010).

However, strategic changes seem to have been widely problematic. Whilst there is no doubt that Safaricom's diagnosis of problems has some veracity, the new strategy led increasingly problematic organisational structure as outlined in Chapter 7.

Functional scaling

In the most recent stage of *functional scaling*, M-Pesa service continues to grow by moving away from solely P2P transfers to focus on 'organisational' transfers outlined previously, particularly connected to payments and banking integration.

The move to functional scaling connects to the fact that new registrations were declining, as M-Pesa users become saturated[47], as shown in Figure 5.12. As outlined by the M-Pesa manager interviewed, growth was now seen in increasing the average revenue per user (ARPU) as opposed to adding vast numbers of new customers. The new phase also connects to Safaricom responding to a second wave of competition stemming from the governments publication of 'Agent Banking Guidelines' (CBK 2010). These permitted Kenyan banks to operate agency banking services (in a similar way to M-Pesa) to reach wider populations, and presented a threat to Safaricom's market position.

[47] Only Safaricom subscribers can actively use M-Pesa. As of Feb 2011, 78% of all Safaricom users have M-Pesa (Safaricom 2011); 68% of all mobile users in Kenya used Safaricom. Thus, a competitive market, the most dramatic M-Pesa growth in users is unlikely to be over.

An increase of focus on organisational transfer can be detected from May 2010, when Safaricom launched M-Kesho, a service which allows connection between M-Pesa and a bank account. From then on they have continued to secure an increasing number of organisational partnerships, which are summarised in Table 5.2.

Organisation Type	Transfers
Business	Very much growing but mainly focussed on more affluent users: • Bill payments (water, electricity) • Banking, loan and other financial services • Payment in large shops • Using ATM's as alternative agents
Civil Society	Growing interest, particularly amongst NGOs but still only limited and small scale examples such as: • MFI loans and repayments (sometime occurs informally) • Pension payments for groups (e.g informal workers) • Crop insurance and payout scheme for farmers • Small scale use in social transfers in some projects
Government	'Last frontier' of organisations to adopt, generally ad-hoc. Examples include: • School fees (ad-hoc) • National Health Insurance Fund (NHIF) • Public hospital payments

Table 5.2: Typical organisational transfers in M-Pesa.
Source: Authors fieldwork.

The types of organisational partners that are presently common are those in the top row in Table 5.2, in the domain of businesses and more affluent users. This is emphasised in more recent Safaricom advertisements such as that shown in Figure 5.15, with middle-class consumers using M-Pesa in payments.

Figure 5.15: Advertisment highlighting elements of functional scaling.
Tagline reads 'Nunua na M-Pesa' (Buy with M-Pesa) highlighting the new mobile payment options through M-Pesa, particularly linked with the urban middle class embracing consumer activities.

Adoption from civil society and government to organisational transfers, that might be more relevant for lower income groups has been slower, and this suggests that at present, organisation transfers are mainly focussed toward middle-of-the-pyramid customers. Lower income remain focussed on simple P2P remittances, as supported by a detailed financial diary study of M-Pesa users by Stuart & Cohen (2011) which suggested unchanged activity from earlier stages for lower income users.

> "M-Pesa is still primarily used to send money home, usually from urban to rural, and cash out almost always happens quickly, often the same day the remittance is received" (ibid. p.2).

Review

The growth of M-Pesa can best be summarised through a World Bank sample survey on mobile banking in Kenya in 2011, shown in Figure 5.16 which surveyed use of mobile money by income. As can be seen, there is still a noticeable difference between lower income and higher income use which betrays the initial middle-of-the pyramid focus of the service.

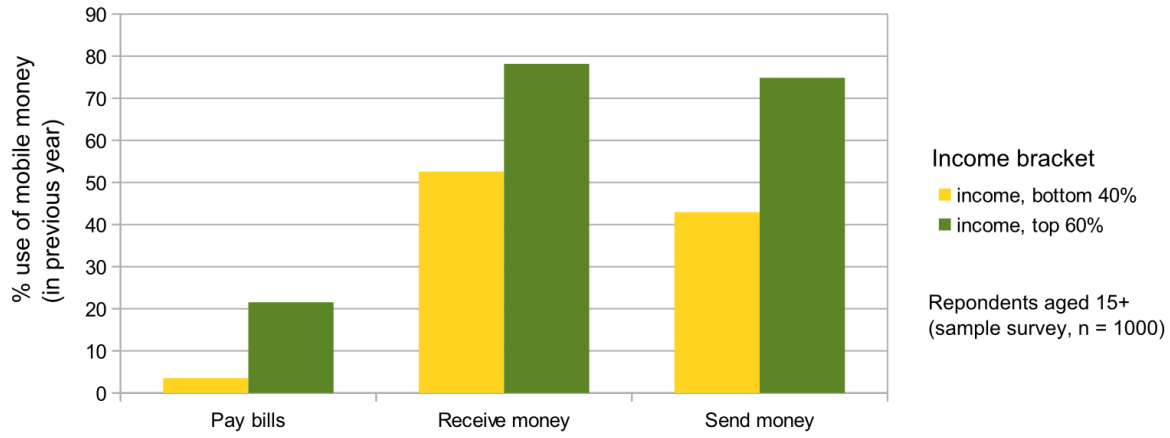

Figure 5.16: % using of mobile money in Kenya according to income brackets[48].
Source: World Bank Global Financial Inclusion Database- 2011 (World Bank 2011c).

However, low income use has grown to be significant (although as shown by the disparity in sending and receiving generally still as receivers of P2P remittances). The 'pay bills' element is more stark; and supports the previous assertions that functional scaling has nearly exclusively been used by more affluent groups.

5.6. Summary

As shown in both sub-sectors, the growth of innovations towards low income groups should not be taken as inevitable, it is often sporadic and has the potential to become 'stuck', as shown in the mobile sub-sector where low income users are not extensively included for a long period until the aggressive competition stage, and in the lack of low income take-up of M-Pesa in organisational payments. There is evidence that this links to both internal firm strategies and wider policy and contextual changes.

This intuitively suggests that a systems approach, examining innovation as the outcome of multiple interactive actors within an institutional setting is appropriate, where this wider and richer perspective enhances understanding of how innovation evolves beyond solely lead firm strategy. As most vividly illustrated in the M-Pesa advertising, innovations can adapt as they grow, evolving according to the changing propositions, audiences, and network actors. Growth is also closely related to the wider policy conditions, which acts as a key element in these transitions.

[48] The World Bank data focuses on mobile money more generally than specifically Safaricom. However, taking March 2011 statistics, M-Pesa has 79% of all mobile money customers in Kenya (CCK 2011b, Safaricom 2011), so these statistics largely reflect M-Pesa usage.

6. Examining inclusive innovation

6.1. Introduction

As introduced in Chapter 4, the nature of systems being explored in these cases diverges somewhat from those typically analysed by systems of innovation models. This work takes the frameworks of inclusive innovation in Chapter 4 as a starting point for analysis, and discusses how system models need to be adapted for such scenarios.

First, a summary of the findings drawing on empirical work on the mobile phone sector case study is presented. This highlights the activity around innovation involving not only larger firms, but also intermediaries and ICT micro-enterprise who are part of the emerging system. Second, referring back to the previous definitions of inclusive innovation, the extent that innovation in these cases might be though of as inclusive is discussed. Thirdly, extending this discussion, the core *components* of systems of innovation outlined in Chapter 3 – actors, innovation, learning, relations, and institutions – are used to examine in more detail how inclusive system perspectives differ from more conventional systems models.

This analysis particularly highlights the wider gamut of actors and a range of activities around innovation which contribute to inclusivity. With this more complex system of actors, further questions are raised regarding how these actors, large and small, and in highly informal relations, interactively learn and what this change of configuration means for the underlying rules and institutions that exist in the system.

6.2. Findings on innovation

The empirical data which builds a picture of activities throughout the innovation system highlights three core processes around innovation. First, innovations related to the products which were mainly driven by lead firms. Second, adaptations to innovations in more socio-technical ways that link to local 'demand', undertaken mainly by intermediaries in the innovation system. Thirdly, ICT micro-enterprise driven process or organisational activity which related less to how innovations works, instead revolving around continued survival or growth of micro-enterprises, through risk reduction and diversification tactics.

In line with the aim of this research, for each of these three processes, not only are the findings around direct innovation activities discussed, but also an examination is made of the relations and rules which indirectly guide, aid or limit these processes in order to build a clear picture of these wider influences.

6.2.1. Technical focussed product innovation

Lead firms

Mobile handset supply

For lead firms, having the goal of reaching lower income users of mobile phones has only slowly emerged as mobile costs have come down and coverage has expanded. This has led to gradual adaptation of the technical elements of ICT innovations to make them fit with lower income communities.

In interviews with handset suppliers, activities which focus specifically on the unique needs of low income users, and building understanding of how innovations need to be adapted to those needs, were prevalent. For instance one regional office manager outlined a range of low income focussed phones that his firm had rolled out in Kenya. Certain models and campaigns were specifically tailored for low income customers.

> "One of our recent campaigns, *[campaign name],* targeted poor mobile phone customers who were buying a phone for the first time. We partnered with *[Kenyan mobile operator]…*and the package included a start up sim and top-up".

> "*[talking about the specific phone]*…is for a rural farmer who has no electricity in his home. He will go to the market to sell his goods once or twice a week, and he will recharge his mobile when he is there".

Stemming from such increasing awareness of the needs of low income users, it was found that phones models were becoming more adapted towards lower income users in a number of elements over time. Table 6.1 presents a list of such adaptations, that emerged from discussions of low income models with handset suppliers, and inspection of these models.

Actor/Sub-sector	Product adaptations for low income users
Branded Handset Suppliers	• Improved battery life, useful in areas with poor electricity. • Increased sensitivity of aerials, allows better coverage in rural areas. • Simpler interface design (larger keys, simplified menus). • More rugged/protected design to shield them from the elements (waterproof, unscratchable casing). • Additional hardware elements (LED torch). • Additional software elements (Nokia life tools). • Reducing price (simple design and finishing, models had green or b&w screens).
Chinese Handset Suppliers	• Dual/Tri/Quad sim cards (to allow calling on multiple networks). • Local language translations of interface. • Local content (music on phone). • Simplifying core services (for using M-Pesa).
M-Pesa	• Increasing national reach of service (more agents). • Reduction in lower limit for M-Pesa payments. • Some minor changes of service boundaries and commission costs for lower limit transactions. • Updated sim cards to reduce typing errors during transaction.

Table 6.1: Lead firm product adaptations for low income users.
Source: Authors fieldwork.

As can be seen from this evidence, the forms of adaptation occurring can be seen as a set of incremental improvements to handset models for low income customers, with simpler user interfaces and phones made more rugged to environmental conditions than their predecessors. By keeping models simple in other aspects, prices are also kept lower.

However, for the branded handset suppliers, evidence suggests that such changes tend to be quite minor. Whilst branded handset suppliers are increasingly aware and understand the need to make adaptations for specific needs of lower income users, basic handset models tend to be designed and constructed to serve diverse markets and demographics across multiple continents, and this somewhat limits the potential for more radical changes and specific local adaptations.

In the competitive handset market in Kenya, this 'innovation gap' for more adapted low income focussed models has provided space for competitors to enter. The emergence of Chinese mobile handset firms into the Kenyan market has been significant in this respect. The profiles of two Chinese handset suppliers interviewed one large and one small, illustrates this:

Cloud Com

Cloud Com is one of the largest Chinese manufacturers in Kenya. A Chinese operation manager Yang was interviewed.

Whilst Cloud Com has a range of 35-40 phones that they sell for all types of customer, they particularly focus on low priced phones for low income users. Their cheap phones are very simple phones which retail for $20-30 and hence are very competitively valued for the price.

Low cost phones are particularly designed for Kenyan, Zimbabwean and Nigerian low income markets that the firm focuses on in Africa. Two particular emphases have been made. One is to include dual sim cards even in the lowest cost phones, which Yang outlines as being very important, allowing low income customer to save money by being able to own multiple sim cards and make calls on the same network which typically accrue lower call rates.

Secondly, the firm tries to emphasise quality, to differentiate itself both from the counterfeit Chinese firms, and as a competitively response to branded firms, offering a 15 month warranty on their phones, intentionally outdoing the branded mobile firm typical 12 month offering.

FastNets

Asif is an Indian director of a small handset firm based in China, FastNets. FastNets mainly imports phones into Congo (both DRC and Brazaville) and Nigeria. Asif was interviewed at a trade fair in Kenya having recently begun to sell his phones into the Kenyan market.

He describes his phones as "providing more for less" and his firm currently has five models in it range. His cheapest phones which are the ones he sells most of in Africa, are focussed toward low income users and sell for around $30. Specific features which have been added to these low cost phones to fit with these markets include: FM radio, a loudspeaker on the phone unit, SD card (which allows users to store music and pictures) and 'dual torch light' (twin LEDs for a brighter light), and these features are included even in the lowest cost phones. Like CloudCom, Asif also emphasised durability of his FastNets phones in response to demand from customers.

"we do a lot of work on quality control, I have 3 or 4 staff working in the factories in China… my units cost $1-2 more than other Chinese phones".

In the fast moving competitive market, Asif is aware that he needs to constantly adapt his models to keep up with demand. For example, with the recent increase in mobile operators in Kenya, tri- and quad- sim phones are now in demand for those looking to save on calls. Asif is currently in the process of testing a quad sim phone,

> *which he hopes will be popular for low income users, in hand with operator expansion in Kenya.*

As can be seen from these examples, Chinese firms interviewed tend to be more focussed and responsive to less affluent users, typically selling through informal channels of delivery (see previous chapter). The outcome as shown in Table 6.1 is major changes to phones, such as multiple sim cards, local translations of interface and creation of dedicated interfaces which makes these models significantly more relevant to lower income groups. This emphasis in innovations also spills into wider elements surrounding products as shown in Chinese firms less mainstream marketing approaches, as described by a general manager of another large Chinese firm Shanghai Fone.

> "Our strategy is interested in selling to people upcountry, and the man in the street *[i.e low income users]*….To market we have many billboards in downtown areas *[central lower income trading areas]* and use advertising on Citizen *[popular vernacular TV channel]*. As well, if you walk around you will see many people with posters, stickers and caps from us. We hire marketers to go to small shops and push to make the brand known"

The outcome of the growth of Chinese mobile phone firms and their focus on low income users is growing ownership levels of these Chinese phones. This trend is considerable, particularly bearing in mind the reputational problems and tiny budgets that such firms have for marketing, compared to the more established handset firms.

M-Pesa

In contrast to the gradual evolution towards low income users of mobile handsets, M-Pesa became very well adapted to low income groups as a direct outcome of pilot research.

M-Pesa[49] emerged initially as a far different innovation to its' later form, as part of a three year research project entitled "mobile micro-finance" funded by the UK Development donor (DFID) through their Financial Sector Deepening Fund (FSD). The focus of this work can be seen to be very different from the present form of M-Pesa, revolving around FSD's ongoing interest in adapting ICT solutions to increase access to financial services, particularly rural banking. The original project proposal reads as follows:

[49] In fieldwork, we were only able to elicit second-hand accounts of the pilot stage and thus the work mainly draws on some early literature, a patent and unpublished project reports from this period to support this.

> "The objective of this project is to deliver data communication solutions that meet the needs of the micro-finance community in east Africa" (Vodafone Group 2002 p.12)

The difference is also outlined in Vodafone Group's patent for the proposed service which emerged early in this research (Murdoch et al. 2007). As shown in Figure 6.1, the patent presents a vision of an account management system for micro-finance institutions (MFIs) which would allow them to split a single bank account into multiple 'virtual' accounts for MFI loan receivers, administered by MFI staff. As micro-finance loans were repaid SMS interactions would result in adjustments of these virtual accounts. Later core person-to-person (P2P) transfers and micro-enterprise agents are present in this structure (in the bottom third of Figure 6.1), but these are only one type of transfer envisaged, and a peripheral one at that.

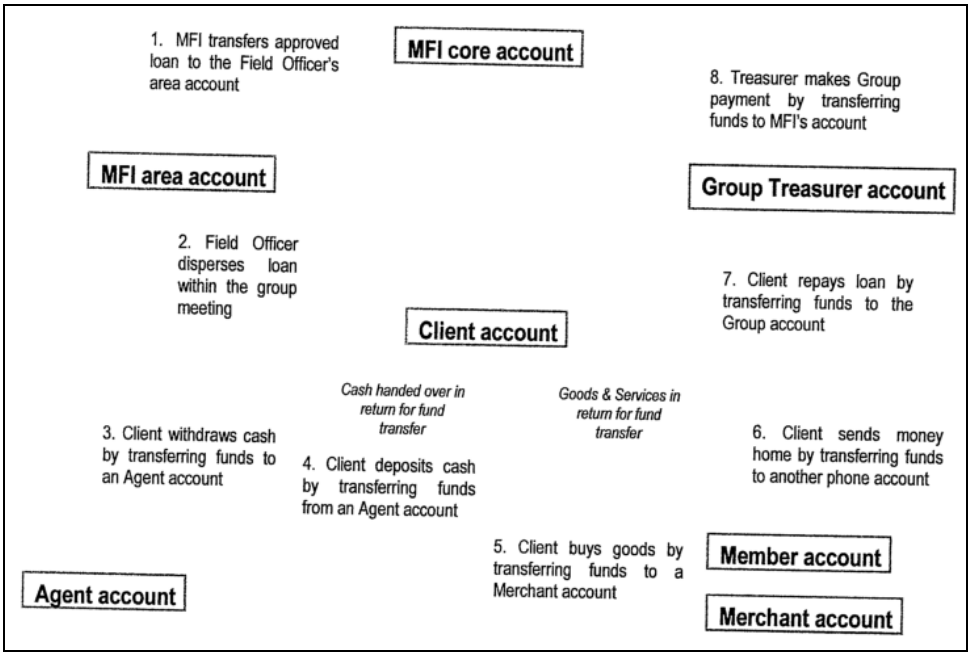

Figure 6.1: Innovation as initially outlined in original Vodafone patent.
Source: (ibid. fig.4)

However, the goals of this project changed dramatically following trials of the system undertaken in Kenya, led by Kenyan mobile operator Safaricom (the Kenyan subsidiary of Vodafone Group), where 'agents' were recruited from existing airtime seller partners, and a large Kenyan micro-finance institution (MFI) was involved as the trial MFI[50].

[50] Here kept anonymous.

During the trial, those aspects of the system in which the MFI were involved can be considered unsuccessful. For the MFI, the new system had detrimental effects on disbursement of funds, reducing attendance at MFI meetings (Hughes & Lonie 2007), and there was a lack of core integration with the service, as described in a DFID project managers' report.

> "..integration – with the MFI partner's back office systems would be crucial to any scale activity (this was not completed in the pilot and resulted in *[MFI name]* effectively running two record keeping systems)" (FDCF 2006 p.4)

At the same time as the failure of MFI elements, a notable volume of emergent activity occurred in the pilot, what the DFID project manager describes as "non-essential transactions" (ibid. p.5) - pilot activities not directly related to the core goal of loan repayments to the MFI. These transactions particularly linked to the way early agents and other entrepreneurial actors adapted the service autonomously for their needs. Examples include (Hughes & Lonie 2007, Kwama 2006):

- Converting cash into e-cash solely for secure travel.
- Use of the service to convert e-cash into mobile phone top-up.
- Non-trial users receiving e-cash during the trial (up to 600).
- Trial users becoming involved in small scale entrepreneurial selling of mobile airtime.

In sum, these dual outcomes of the pilot led to an adaptation in the structure and goal of the innovation. Poor MFI adoption and internal MFI resistance suggested that,

> "The pilot experience had shown that a mass market launch with an MFI would be too complex, so we needed to find a compelling consumer proposition around which everything would be based" (Hughes & Lonie 2007 p.77)

Meanwhile, the service was being increasingly used in interesting but unexpected ways by actors on the ground, suggesting adaptations which centralised the idea of P2P transfers of e-cash, which had been so popular in the trial. Consequently the P2P elements were taken up under the 'send money home' proposition (FDCF 2006).

Given the outcomes of the pilot study, M-Pesa pilot emerged as an already quite adapted innovation for low income users. Thus, as the service launched and moved from the initial middle class early adopters towards lower income users, ongoing incremental changes to the innovation were less prevalent. This is outlined in Table 6.5 where it can be seen that lead firm product changes were low. Even those

mentioned in the table might be said to be more minor improvements to the service more generally than being specifically related to driving towards low income users.

Other system actors

Lead firm(s) were the principal actors in product innovation. Some micro-enterprises were found within the innovation system who might undertake minor technical product adaptations, but these actors were rarer.

In Nairobi, this was only found in the mobile handset sub-sector where a few skilled phone repairers interviewed were found to undertake more technical adaptations. One pair of repairers Augusto and Dennis in a tiny wooden kiosk in downtown Nairobi demonstrated the use of the 'infinity box', a PC hardware product that allowed 'reflashing' of the embedded software of mobile phones. Augusto, describing the process showed how this allowed phone models to be upgraded and unlocked through use of 'flash' files that he had previously downloaded through online mobile repair forums in his local internet cafe. Another handset seller/repairer Sylvia whose kiosk was located in one of the 'corridors'[51] in a similar area, had become renowned as a 'battery expert' due to her knowledge of battery voltages and polarities, and had become able to adapt and switch batteries for customers between phones models, reducing costs.

However, even for the most skilled repairers, handset technologies can be said to have low 'malleability' – ICT components are complex and require high skill levels and persistence to technically modify – and generally this locks out other actors in the innovation system from product changes post-manufacture.

6.2.2. Socio-technical focussed product innovation

Beyond the technical focussed innovation, other actors more typically tended to be involved in a wider set of minor adaptations to elements of innovation. The terminology 'socio-technical' here refers to how such adaptations were typically not purely technical ones, but related to changing the processes and activities around innovation. In particularly in the mobile sector this linked into the ideas of micro-enterprise linking between mobile innovations and local markets.

Mobile handset supply

In the mobile handset sub-sector, socio-technical adaptation that were found mainly related to 'configurations' and how elements of mobile were set up for specific customers. For instance, mobile sellers were observed setting up the radio

[51] Repurposed old building in downtown Nairobi, now massively subdivided and housing hundreds of small business kiosks.

functionality of phones for purchasers, and configuring phones for mobile money usage for a user purchasing for a rural family member.

Beyond 'configurations', in interviews, a number of micro-entrepreneurs also discussed their activities of linking innovations to low income users' needs which can be thought of as more cognitive, albeit still linking to the notion of socio-technical change.

> ***Alice***
> *Alice is a mobile phone and accessory seller located in the slum area researched. She runs her micro-enterprise from a small wooden kiosk, located on the main road which traverses this area.*
>
> *Like several other micro-enterprises interviewed, when Alice was asked about how she sold mobile to her customers she discussed some elements of activity under the terminology of 'customer service', and adhering herself to customers.*
>
> *In fact during our interview this was observed when a customer approached who was thinking about buying her first mobile. Rather than simply showing the features, Alice embarked on what, at the time, seemed like an overlong drawn out personal story about how she bought her rural elderly relations a mobile phone in order to stay in touch during family crises, and how she was also able to begin transferring money to them through mobile money transfer, demonstrating the exact activities she undertook.*

Such 'customer service' activities were repeatedly seen in interviews and also described by many others. More than a configurational adaptation of products such activity was important in demonstrating 'use-cases' and 'domesticating' products, aligning services to more tacit elements for low income customers.

M-Pesa

For system actors, like the handset sub-sector, agents were found to be heavily involved in adapting socio-technical elements of the innovation towards local market needs. This is illustrated in the cases of two micro-entrepreneurs who made adaptations around the often problematic float operations in the M-Pesa service for their specific low income contexts. The concept of float in M-Pesa is outlined below, followed by illustrations of how agents have adapted such activity.

> *An M-Pesa agent will often find themselves predominantly depositing (turning cash to e-cash) or withdrawing (turning e-cash to cash) due to their location. Hence over a number of transactions, agents find themselves with float problems - an excess of cash float and shortage of e-cash float, or vica versa.*
>
> *When supplies of float are too low then no more transactions are possible (e.g. a lack of cash float would mean that no more withdraws are possible at an agent) and*

this results in the need for 'float balancing'. This requires a trip to a bank or agent to swap between float forms, to bring float levels back to a balanced level.

For agents, efficient float management is an essential part of their activities. Agents want to manage float levels that minimises both refusal of service due to low float or unexpected need for float balancing.

One element of float management is the level of float which agents carry. Increased levels in float allow higher or more transactions to be undertaken at an agent without float balancing, but it also means more working cash tied up in daily operations, as well as increased risk around security.

Muchemi

Muchemi is a former goods trader and the owner of a single M-Pesa kiosk located in a farmer's goods market on the outskirts of Nairobi. He is also the chairman of a small local SACCO (Savings and Credit Co-operative), whose members are mainly made up of traders who buy and sell goods from rural farmers. Muchemi sees the M-Pesa store as an essential service that he runs for the SACCO members.

Unlike neighbouring agencies who typically keep 50,000Ksh ($600) as float, Muchemi has increased his float over time and now keeps 300-400,000 KSh ($3500-4500). In terms of operations this means that the large sums collected and transferred in market trade by his SACCO colleagues can be transferred in bulk without the customer having to worry about a dwindling of float at his agency. Thus, nearly all transfers will be accepted within Muchemi's agency. Elsewhere, customers would typically have to either split their payments down at multiple agencies, so incurring multiple commissions for these large transfers, or travel to town to a large agent with adequate funds.

In terms of Muchemi's business, holding high levels of float to allow high payments is somewhat insecure in terms of safety, and inconvenient as it requires his staff to float balance higher volumes of money, but this is part of Muchemi's commitment to his SACCO members and it requires considerable extra work and costs.

There is no great gain in terms of commission from this sacrifice and his actual profit is low. He describes it as "difficult to keep M-Pesa as a viable business on its' own". Muchemi's M-Pesa agency can be said to continue mainly through his commitment to the SACCO.

Catherine

Catherine is an employee for an M-Pesa agent, employed for around a one year in an agency located in a 'jua-kali' (informal trader) cluster of woodworkers located 4km from central Nairobi. Although she is an employee she effectively runs the

agency rather than the absent owner, enduring the daily risks that come from such a role but with very little reward.

What is particularly interesting in Catherine's case, is how she has nurtured and relied on her local connections to support the survival of the agency. Her agency is located in a particularly insecure area and this leads to some local jua-kali entrepreneurs holding very small levels of cash in hand and using her store for withdrawals three to five times a day to get small amounts of cash when it was needed.

Catherine has used these networks in a dynamic way. Catherine's agency is a perilous one hour round walk to a bank, so with no other staff it is costly and risky when she needs to float balance. She avoids this by using her local network as float balancers, calling up local jua-kali workers nearby who will, off their own back, deposit cash or e-cash into the agency (and incur commission) to help her avoid any need to undertake float balancing.

Like the handset sub-sector, these examples highlight how agents adapt elements of innovation for specific low income contexts. Such adaptations were found to be quite common amongst agents. They tend to be quite subtle, only being visible when one has a clear understanding of the full operations, nevertheless they are crucial in ensuring that such agencies are useful in certain areas and offer service to customers.

In M-Pesa the scope for such socio-technical adaptation by agents was found to be more limited compared to the handset sub-sector. This particularly related to the centralised service, and monitoring of the innovation. Agent level quality of service is tightly controlled by the lead firm, including a monitoring firm whose role was described by the M-Pesa manager to,

> "make sure that agents operate in assigned areas and that they are compliant….a TDR *[monitoring actor]* will normally visit agents once per week to check that requirements are met and to follow up any customer complaints"

This means that agents who look to adapt certain elements of service according to local needs can come up against problems as illustrated by the case of Beatrice below:

Beatrice

Beatrice is an agent located in a small M-Pesa kiosk the heart of a slum area 5km from central Nairobi.

In her interview, Beatrice discussed the problems of operating in this area. One of the biggest related to the identification requirements in all M-Pesa transactions[52]. The problem is that many customers in this highly insecure area do not carry their ID card for fear of loosing them. Other even more marginal actors do not have, or cannot obtain an ID[53].

Further, a common practice amongst such low income groups is that younger family members carry out tasks for older working members of the family whilst they are busy working. However in the case of M-Pesa this is not possible as the identification of the M-Pesa accounts and the family member would not match. This is not permitted in the service and the transaction should be refused by an agent. Hence this rule limits this type of traditional activity.

To counter these dual problems around identification, Beatrice informally adapted the service to begin to allow trusted customers to transact without an ID, to better fit in with such customers who were highly common in her area. However when the M-Pesa monitoring firm sent an officer posing as a customer, she was caught.

For this breaking of the rules, Safaricom closed her kiosk for 1 month, nearly bankrupting the business. Now that she has reopened, she says that her customers are frustrated and frequently threatening when she refuses to transact without identification, but she cannot risk another forced closure.

As in this example, close attention to service compliance through monitoring and inspection means that certain adaptations may be risky for agents. In the above example of Beatrice, the agent is looking to adapt the innovation to make it more relevant for her local customers, the extremely marginal users who do not have identification, but this hits wider regulatory limits around anti-money laundering.

Other limitations to adaptation of M-Pesa were found to link to service structures. In interviews with agents, certain agent-led service adaptations were found that might be considered visions of wider use of the service for low income groups. These are considered as adaptations in that these scenarios revolve around 'use changes' where M-Pesa service is used in ways that depart from how the service is predominantly positioned and marketed to users, as P2P transfers.

Examples of such 'use change' adaptations include storing money as e-cash for very short periods as a safety measure in insecure areas, such as micro-enterprises who

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[52] This was one of the measures introduced into the service post-trial as part of Central Bank 'anti-money laundering' and 'know your customer' rules, and now a core element of agent service.

[53] This includes those who cannot afford the fee for identification, those who do not have documentation such as birth certificates, and those who are illegal immigrants.

use M-Pesa as an 'overnight safe' for their cash floats; using M-Pesa for direct micro-payments to informal stores and businesses which simplifies the need to hold cash on both customer and business side; and in using M-Pesa as a way to build very small levels of savings, particularly amongst slum dwellers.

A set of the most common agent 'use change' adaptations that were found during interviews with agents are outlined in Table 6.2. They particularly relate to how SMEs can use the service in more expansive way.

Scenario	**Description/Typical Transactions***	**Monthly Commission Costs (for Sender)**	
		Ksh	**£**
P2P Remittance (Core case)	Individual payment or remittance to another person. *1 remittance of 5,000 Ksh per month.*	30	0.22
Secure Savings	Individual puts spare money into M-Pesa and withdraws aggregate when needed. *Multiple deposits, 1 withdrawal per month @4,000.*	45	0.33
SACCO/ ROSCA/ MFI Repayments	Individual puts savings/earnings into M-Pesa and transfers a repayment weekly to a savings groups as part of repayment. *Multiple deposits, 1 remittance of 500 per week.*	120	0.88
SME to SME Payments	SME use M-Pesa to pay remote suppliers for goods. *2 remittances of 7,000 Ksh per week.*	240	1.76
Secure Wallet	Individual uses M-Pesa as an alternative to a wallet. Withdrawing small cash sums when needed. *Multiple deposits, 3 withdrawals per week @200.*	300	2.21
Micro-payments	SME customers using M-Pesa as a way to pay for goods and services in informal sector. *3 transfers per week*.	360	2.65
Night Safe (low sum)	SME uses M-Pesa. Deposits cash into M-Pesa at end of trading and withdraws the next day. *Multiple deposits, 7 withdrawals per week @1,000.*	400	2.94
Night Safe (High sum)	As above, but business has higher cash sums. *Multiple deposits, 7 withdrawals per week @3,000.*	1260	9.26
Safe SME float	SME near M-Pesa agent, repeated daily visits to M-Pesa when cash is needed. *Multiple deposits, 3 withdrawals per day @300.*	1800	13.24
** Commission costs assume all transactors are registered with M-Pesa in these scenarios*			

Table 6.2: Typical non-remittance transactions in M-Pesa and costs.
Exchange rates from Bank of Kenya (CBK 2012b) (on 1st March 2007): £1 = 136Ksh.
Source: Authors fieldwork; M-Pesa pricing drawn from tariff list, shown in Appendix 6.

Whilst agents tend to drive and encourage these 'use changes', the problem limiting their wider growth is that they can hit service barriers, technical limitations of the service or service rules. This is illustrated in Table 6.2, in the case of commission cost (in the right hand columns). As can be seen, whilst some approaches are viable, others increasingly accrue very high commission costs.

In some cases, utility benefits from using the service outweigh service costs, as one agent located close to a large number of street hawkers explained, the expensive 'night safe' option can be worth the commission costs.

> "..traders in the local area close at 6 or after, then they need time to count their money and cash it *[through converting money at the agent]*……traders are happy to pay the commissions, it is much better than loosing all your money! M-Pesa is part of the running costs".

However in other cases, commission costs reduced the potential of certain 'use changes'. For instance in an interviews with an agent involved in SACCOs and micro-finance, he suggested that use of M-Pesa to support such services had been disappointing due to costs. This is supported by other research in Kenya which has done more in depth calculation of costs.

> "If they *[MFI clients]* used M-PESA to send in loan payments, it would cost KSh 600 (USD 9.69) over the life of an average 20 week loan. That's equal to 69% of the interest paid on that loan! Another way to express the added cost is an increase to the interest rate paid: using M-PESA would be like raising the interest rate from 12.5% to 21% on the average Jamii Bora microbusiness loan. That's costly" (Pickens 2008).

Thus, 'use change' adaptations often led by agents can hit up against service barriers which can limit some of these tactics. As in this research, one can still finds cases of such use changes where utility benefits outweigh costs. Nevertheless service structures reduce more widespread use.

6.2.3. Process and organisational focussed elements

Other elements of process and organisational tactics surrounding innovation were found in this research. Such tactics were led by micro-enterprises and aided their ability to negotiate and survive within innovation systems. Whilst interlinked to the previous category, they can be differentiated in that these activities did not (or at least only very indirectly) have an effect on ICT and service innovations from a product perspective.

These tactics are argued to be within the remit of this analysis of innovation in that they sit within the definition of inclusive innovation, particularly in terms of "inclusivity of innovation processes" that was outlined in Chapter 3. These activities (or lack of them) play a significant role in entry, learning and survival of ICT micro-enterprises making analysis of these processes essential to understand the nature of what it means for an innovation system to be inclusive. Thus, changes around processes and organisations are important in that whilst they do not lead to dramatic evolutions in innovation they are crucial in making processes more inclusive for low income actors, and thus indirectly very important in driving growth of innovation towards low income groups.

As these processes were more common across both sub-sectors, they are dealt with together in this section.

Embedding

It is important not to understate the crucial role that ICT micro-entrepreneurs being 'embedded' within local markets plays in the reach of innovations to low income groups, where ICT micro-entrepreneurs were found to often originate themselves from these localities (or are at least closely linked) where ICT micro-enterprises tend to be located within kiosks, shacks or market areas, blending in with wider informal retailing. The images shown in Figure 6.2 shows examples of some of those that were encountered in the fieldwork and below two cases of Muhammad and Hope are presented which illustrate the importance of embedded micro-enterprises.

Figure 6.2: Some examples of embedded micro-enterprises.
1) A portable mobile phone and sim card hawker using a table.
2) A small M-Pesa and mobile seller booth uses a tiny room located in a small trading area.
3) One of the clustered streets in central Nairobi where building have been repurposed into mobile selling 'corridors'.
4) Informal mobile repairer located in a set of tiny wooden kiosks on edge of downtown area of Nairobi.
Source: Authors fieldwork.

Muhammad

Muhammad's mobile selling operation is highly unconventional, selling phones outside a very large hawker's market within walking distance of central Nairobi. He sells from a van, reminiscent of the type of van used for election or public

information campaigns in rural areas in Kenya, covered in advertisements for mobile phones and including loud hailers from which an 'MC' is constantly advertising his wares.

Originally Muhammad, after completing secondary school started to work as a mobile phone and sim card hawker. He worked for a boss who sold from 'tents', basically temporary erected gazebo's run by one 'owner' who grew a profitable business by moving them to unused spaces in busy areas, selling generic phones and phone airtime. This was a highly successful business, with the former owner making 'agreements' with local authorities to ensure that such unconventional forms of business survived. However, when the owner passed away, and without his leadership the 'tents' system declined, particularly with growing demand for payments from local police and enforcement. But, the approach inspired Muhammad to start his own unconventional hawker operation through vans and cars.

Muhammad is now the owner of three vehicles which sold mobile phones around locations in Nairobi, with each car employing a team including five or six sellers, selling cheap but branded phones. He outlined that two cars make approximately 6000Ksh ($70) and one 12,000Ksh ($140) profit per day making this operation extremely profitable.

This operation has only been possible through arrangement with the authorities, as he understatedly revealed,

"before I started business I went to the council askari's office and told them what I was going to do…we came to an agreement and they said I could go ahead"

Thus Muhammad's operation can be seen as a highly risky and unstable handset business, but at present by selling to customers closer to their living places and work areas, and in a style that is familiar to many, at first seemingly unconventional approaches can be highly profitable.

Hope

Hope was a mobile handset seller of sorts, but in a highly unconventional way. She comes from a highly marginal slum area in Nairobi and acts as an informal mobile 'fixer'. This consists of her buying phones from wholesalers and then selling them into her local community, as well as giving advice and helping her contacts in the slum area with any queries surrounding both mobile phone and wider ICT needs.

This approach started for her when she helped some family members secure appropriate products at a good price through a friend who worked in a wholesaler, but it has now grown so that local slum dwelling consumers, who lack confidence and knowledge, come to her to buy the phones due to her reputation.

> *This 'fixer' role is a highly marginal one, and Hope only has enough money to afford to buy one or two phones at a time, so she is at constant risk of hitting problems. Nevertheless the service that she provides is a considerable part of her income, and she hopes that she will be able to grow and eventually afford to open a mobile phone kiosk in her slum area.*
>
> *It is unclear how widespread the 'fixer' role is, during research we came across two actors who undertook similar activities, but such actors by their nature are transient and difficult to spot.*

As these cases illustrates, this idea of micro-enterprises being 'embedded' can mean different things in different locations. The commonality is how micro-enterprises adapt to fit with the norms and practices of certain low income groups, and to link to becoming part of the local networks, whilst not necessarily affecting the actual form of ICT innovations.

For Muhammad, this resolved around building new forms of micro-enterprise, moving away from more permanent structures to build portable businesses which intersect with activities of certain types of low income consumer. For Hope, business activities are increasingly linked into social networks and her own good reputation, and this type of embedded enterprise can reach certain customers that a more conventional kiosk might not reach.

Thus, embedding by micro-entrepreneurs links to inclusivity of innovation process, with these embedded roles primarily taken by low income micro-entrepreneurs. But, these embedded firms also affect inclusivity of innovations as objects and services by providing the crucial interactions and diffusion to lower income consumers.

As the accounts above suggest, embedded micro-enterprise whilst important can be more risky and marginal. Thus, beyond the actual act of embedding, inclusivity around embeddedness was found to link to specific risks, adaptations and support that orientate embedded survival and growth (or not). These issues are thus covered in the next sections.

Risk reduction

As highlighted in the two empirical illustrations in the previous section, micro-enterprise being embedded leads to risks, related to the marginal contexts under which they work. Thus, much of the agency of embedded micro-enterprise is focussed on tactics connected improving the ability for embedded enterprise survival and mitigating risks and insecurities.

A typical example is highlighted in the case of Peter, a mobile sector micro-entrepreneur where certain tactics were undertaken to reduce risks that come from the complexities of managing his enterprises.

> ***Peter***
> *Peter in the successful owner of three mobile phone selling kiosks, all located in the central regions of Nairobi. To reduce risk Peter has taken multiple small process adaptations to his stores.*
>
> *One example of this is a 'one phone out, one phone in' restocking tactics, where Peter will restock from the wholesaler after each sale. Given the inefficiency of this approach - repeated visits to the local wholesaler, loosing from not making bulk purchases - buying popular items in bulk and storing them would seem to be more appropriate. However, Peter operated this approach, potentially returning to the wholesaler multiple times a day. When asked why he adopted this approach he replied as follows:*
>
> *"This way you simply have the profit in hand, so you can see if you are up or down. I use this system because I can easily see what is going on if I need to leave the store".*
>
> *In effect, such tactics allows Peter to simplify management of each of his stores and made it easier to monitor what was going on in the micro-enterprise when - as often - it was left in the charge of an assistant that the entrepreneur did not completely trust.*

As shown in this case, tactics can relate to elements around risk in staff, stock and skills as in Peter's case, as enterprises grow these risks can become greater. Thus, organisational tactics can dissipate these problems to some extent.

Risk reduction tactics also occurs related to external factors, particularly where innovations sit less well within local settings as shown in the case of two entrepreneurs below.

> ***Joseph and Badru***
> *The kiosk owned by Joseph and Badru on the surface seemed to be a mobile handset seller, with its prominent display of mobile handsets (shown on the left in Figure 6.3 below). However, upon talking to the owners they recounted that they only sold about one phone per month, and their living was primarily made from mobile phone repair (which took place behind the green wall in the photo).*
>
> *Given that this enterprise was fairly marginal, it was initially surprising that the marginal owners did not sell the phones to upgrade their equipment for their main activity. However, when asked Joseph recounted that their operation has previously attracted attention.*

> *"before we had some visits from askaris [municipal police] who said that we were unlocking Safaricom phones and that unlocking Safaricom phones was illegal, they came and took away our tools [referring to repair equipment], this is why we work in the back".*
>
> *This use of symbols, the phone display, and the 'Yu' advertisement for airtime, one of the four mobile operators that they do not actually sell, reduces risk. Effectively these more legitimate symbols serve to make their risky roles more acceptable, and the costs are deemed a worthwhile investment for the protection it offered.*

In this case insecurity came where certain activities were not officially recognised, and consequently local enforcement sought to take advantage of this. Adaptations in process were around the tactical use of legitimising objects, symbols and technologies that make such firms more 'official'.

Such approaches were found to be quite common amongst embedded micro-enterprises, highlighted in the photos of two kiosks shown in Figure 6.3 below. Examples of *symbolic objects* found included the display of sanctioned technology objects - mobile phone advertising, a photocopier or a standard green payphone now superseded – as well as locally accepted objects - display of local trading licences even when well out of date, wearing official looking name badges and common informal sector work jackets. These are a misdirection where more 'risky' activities, that might attract unwanted attention or stand out as targets for thieves, are thus seen by customers and authorities with higher legitimacy.

Figure 6.3: Use of symbolic objects in embedded micro-enterprise.
(left) Joseph and Badru's kiosk, outlined in the text above.

(right) The use of M-Pesa logos in a repairer - Given the costs and effort in maintaining the service, it was surprising that the store continued to include this element. In fact the main enterprise of this store, cutting-edge unlocking, upgrading and software services for mobile phones, whilst not necessarily illegal, could potentially attract unwanted attention.
Source: Authors fieldwork.

Retail tactics

As outlined in the literature review, where firms embed successfully and build niches, this typically attracts imitation, increasing competition, and potentially saturation where increasing numbers of similar firms embed in close proximity. Thus another risk around embedded micro-enterprise relates to reduced ability to be profitable through single products or stores over time.

In line with the literature review, micro-entrepreneurs tend to be involved in tactics of retail diversification and switching to parallel products and services within ever changing environments.

> ***Peter (part 2)***
> *Peter's kiosks provide M-Pesa services. His three stores are all located close to transport and trading areas, places dense with similar enterprises. But, in such areas competition has become so fierce for M-Pesa that it is no longer viable as the main business focus.*
>
> *Peter recounted that he only undertakes a very small number of M-Pesa transactions, typically only undertaking 5 or 6 transactions each day. The M-Pesa logbook and materials are no longer at the front of kiosk, and with lower attention by him to keeping this element of his business fully efficient (e.g. spending effort in efficient float management).*
>
> *In their prime locations Peter's was forced to diversify his three small stores which now concentrate on selling mobile phones. He has been able to survive and grow as a business and can sell between 5 and 10 phones a day, selling a mix of low priced 'originals', 'China phones' and counterfeit Nokia's, where dependent on brand each sale can reap a profit of $5-15. In interviews, a number of sellers similar to Peter were interviewed who have been able to successfully diversify their kiosks.*

Such retail tactics were ubiquitous amongst mobile sellers, and becoming more common amongst M-Pesa agents as they become more saturated. Table 6.3 shows some of the most common examples of these retail tactics, 'jumping' and 'juggling' found during interviews with micro-entrepreneurs. What was unexpected in these cases compared to the literature is that with the exception of some of the very marginal mobile sellers within the slum area, such tactics were almost exclusively around combinations of ICTs indicating that at present even as specific saturation can

occur in one element of ICT, entrepreneurs can often find new avenues with similar skill sets.

Retail Strategies
Former roles of sellers (jumping)
• Electronics and TV repairs. • Mobile repair for official handset firms. • Sim card registering for mobile operator (employed in early days to register new customers in rural area). • Shared phone and payphone operators. • Phone top-up and scratch cards when prices were higher. • Sim cards sellers when registrations were higher. • Video library, hire and selling. • Cassette selling.
Retail mixing of Products (juggling)
• Combining M-Pesa, mobile, mobile accessories. • Offering printing, photocopying and other office services. • Adding computers to stores to make micro-internet cafes or typesetting stores. • Adding in mobile phone scratch cards, sambaza (over the air phone top-up) and sim cards. • Adding printing cartridges and other peripherals. • Combining mobile selling with repair and/or component selling. • Provision of short term loans on electronics goods. • Some mobile kiosks have used training of repairers successfully (in some examples it was found that the repairing becomes almost secondary to the training of repairers). • Diversifying into multiple mobile money services (although officially this is not allowed under agent contracts). • In the slum areas studied for retail mixing tended to push towards non ICT goods such as clothing, food stuffs, and lottery tickets.

Table 6.3: 'Jumping' and 'juggling' amongst micro-entrepreneurs.
Source: Authors fieldwork. This is also backed up by surveys on mobile agents (focussing on both low and middle income users) (FSD Kenya 2009a p.10)

Guiding and limiting processes on embedding

Findings in the previous sections on technically focussed and socio-technical product adaptations highlighted a number of relational elements – malleability of innovations, service rules and monitoring, service structure – that guide and limits these adaptations. In the same way, one can also detect similar relations and rules which have the same effect in these process and organisational tactics.

Guidance in terms of rules and requirements by lead firms was found to limit some embedded micro-enterprises. This is particularly marked in the M-Pesa sub-sector, where rules and regulations are more prevalent. For instance rules around M-Pesa forms contributed to reduced freedom to embed in certain testing locations in Nairobi.

Similarly, M-Pesa rules which restricted diversification tactics into other mobile money services, reduced the range of tactics that might enable firms to more viably embed.

Other network intermediaries in the system tended to play a more positive role in supporting embedded firms. With handsets suppliers, many interviewees recounted moments where due to instability they had to rely on short term help from mobile wholesalers to ensure that they survived. In a few cases, like Peter's shown below this had been essential element of his firms existence.

> ***Peter (part 3)***
> *Peter came out of school and started work as a Mutatu (shared taxi) conductor. After a friend told his about the potential of mobile selling he started working in an informal mobile phone kiosk.*
>
> *He first worked as a 'runner', a low level assistant job which involves going to wholesalers to collect phones to restock displays for the seller. However, he recounted how he was able to build his networks to become an owner.*
>
> *"I worked as a runner in the shop. So I would go many times up there [the wholesaler] to get phones to restock the display and they became my friends…[after some time] I got some money from a SACCO [financial savings group] and persuaded my friends to give me credit on twenty pieces [mobiles] so I was able to start a business. I have gone from there! Now I have three shops".*

In M-Pesa, embedded micro-enterprise agents interviewed were more reticent about their relationships into intermediaries, particularly master-agents. However, even if there were some vocal complaints in interviews, a deeper analysis of interview scripts revealed that there was a high level of reciprocity between master-agent and sub-agents in these networks as shown in Table 6.4.

Types	**Detail**
Equipment	Master agents purchase, share or bulk buy equipment for sub-agent. (e.g UV devices for detecting fake money, safe boxes).
Loans	Provision of loans to get agent store up to minimum levels – Particularly related to security bars, store structure.
Short term credit	Provision of cash float for agent when cash-flow problems emerge.
Staff	Finding reliable full time staff, and provision of ad-hoc staff when sub-agent staff are ill or unavailable, and during moments of high congestion.
Float balancing	Some master agents take the brunt of work in terms of travel costs and time for agent float balancing.

Training & Mentoring	Sub-agent training is mainly done by master-agents as required by Safaricom. Evidence suggests that this leads to sub-agent staff often using master-agents as mentors when they have problems or business issues.
Troubleshooting	Ad-hoc troubles are often referred up to Master agents to resolve.

Table 6.4: Master-sub agent reciprocity found in interviews with agents.
Source: Authors fieldwork. Evidence also supported by (Flaming et al. 2011).

Thus, there is strong evidence in both sectors that whilst ICT micro-enterprises are often highly unstable, network intermediary activity is vital in allowing better survival of embedded micro-enterprise, making ICT micro-enterprises more viable and shielding them from shocks, both internal and external. Indeed, in the handset sub-sector these relationships were commented on by one branded handset supplier as being a fundamental element of the success of the informal channels in Kenya, "wholesale-retail relations, are unique to the region".

Some lead firms were also fully aware of the importance of nurturing these micro-enterprise actors to reach low income groups in terms of driving growth, and looked to more actively play a role in micro-enterprise survival and growth. For instance in the handset sub-sector, one of the more successful branded firms in reaching low income users outlined that such strategies were central to their position.

> "Whilst other firms use a simpler strategy of piggybacking on the operators or distribution channels we have a wider reach. Distribution is [firms] biggest competitive advantage".

Thus, this work suggests that inclusive processes – in terms of embedded micro-entrepreneurs, but consequently spreads of innovation objects – are fragile, and that micro-enterprises often require support from other actors. As illustrated in this section, the level, or lack, of support around embedding and associated tactics and risk reduction can have a considerable effect of how micro-enterprise embed in local markets.

6.2.4. Summary

This section has particularly concentrated on bringing out key activities that occur in the innovation system, by consideration of a wider spectrum of innovative activities, from technical changes through to adapting practices and product configurations, to the specific process and organisational tactics around embedding, all of which, directly or indirectly, contributed to how innovation is inclusive.

As can be seen from this analysis, the reach of innovations links not only to large firm activity, but to a wider interplay of intermediaries and micro-enterprises, and this

supports the working hypothesis that exploring these systemic activities is crucial in better understanding innovation that reaches low income groups.

As hypothesised in the literature review, ICT micro-enterprise are a crucial part of how innovations reach out into lower income users, but they are also highly unstable and have to be active and supported to negotiate such settings. Socio-technical adaptations and approaches by micro-enterprises can link to increasing inclusivity of the innovation objects that they are involved with. At the same time, micro-enterprises are embedded, and their ability not only to adapt and combine innovations within their local environments, but adapt the ways the form of firms and approaches to ensure that they can survive and grow within the instabilities of embedded environments is crucial.

Drawing on a linked perspective, activities undertaken by micro-enterprises around innovations have been shown not to be 'free' but influenced by a number of different actors and conditions. Particularly highlighted is the varying ways by which lead firms and other system actors can influence and direct micro-enterprise activity which from a system perspective is central to understanding inclusive innovation.

Two linked findings can particularly be seen to extend the previous work regarding ICT micro-enterprise. Firstly, the literature review generally highlighted unambiguous (and arguably context insensitive) descriptions of adaptations by entrepreneurs, for instance clever ways to informally transfer money through adapting mobile operator features or very different forms of customer service for low income customers. These 'headline' type adaptations amongst micro-entrepreneurs were found to be less central in this study. Rather adaptations were more subtle. They related more to divergences from norms of activity for very specific contexts and micro-enterprise led socio-technical, configurational and tacit elements of products, and extensive tactics around processes and organisations to ensure survival of embedded firms.

Secondly, by taking a more linked perspective on these micro-enterprises a wealth of guidances, limits and rules, manifested in a number of different ways and media were found. Sometimes they have negative effects on how micro-enterprises were able to adapt innovation, whilst at other times they refined and pushed activities of micro-enterprise actors around innovations more positively through providing clear rules of engagement and supporting micro-entrepreneurs at times of trouble.

These two key differences are likely to be related, micro-enterprise adaptive activity is not 'free' but comes up against limits, and guidances and in this case study where larger firms are involved quite extensively, these affected the ability for such 'headline' innovations to occur. Appropriation still occurs and is important, but verges

more towards more subtle activities and tactics. Further, these limitations are more noticeable in the M-Pesa sub-sector where network oversight is greater.

6.3. Inclusivity of innovations

In this section, drawing on the discussion from Chapter 3, the extent to which these innovations can be described as inclusive in considered. Inclusive innovation system should be considered within a number of dimensions - in terms of adoption, focus and impact of the innovation-as-object and in terms of innovation–as-process. These dimensions are examined in turn below.

6.3.1. Innovation-as-object

Adoption

As shown in the case of branded handset firms, innovations can begin from a set of standard products, which through a set of incremental adaptations slowly become refined to fit better with the capabilities of low income users and hence become more amenable to adoption.

As outlined in the analysis, adaptation of innovation objects can be seen on a scale, relating to both more technical and service adaptations, down to subtle socio-technical elements surrounding innovation and embedding.

More technical and service element are mainly led by the ICT suppliers as they become aware of low income capabilities, as shown for instance in the adaptation of mobile handset product where elements such as simpler models and local language interfaces make innovations more relevant and are important in driving adoption. Socio-technical adaptation can also relate to ICT suppliers, in how they appropriately advertise and position products, where articulations of how low income groups can use such innovation can be a driver to adoption.

It is no accident that micro-enterprise actors exist in such emergent innovation systems and they play a key role in driving adoption through socio-technical adaptations and configurations which make innovation fit with low income customers (for instance, in both M-Pesa and mobile, low capability customers will get micro-enterprise to set up specific services that might be beyond their skills to configure). Further, by their embedded nature, micro-enterprises guidance and articulation of the potential of innovations for low income users is also vital in driving adoption.

Adoption can be less inclusive where these processes do not occur. This was particularly shown in examples where innovations remain complex and seen as irrelevant by low income consumers (as in the early days of mobile handsets), and in

cases where lead-firm strategies around low income innovation have had detrimental effects on micro-enterprise embedding and innovative tactics, where embedded firms are limited by rules, technical limitations, and excessive monitoring.

In sum, even where ICT innovations begin as more generic forms, low income adoption can be driven through providing some incremental adaptation and marketing of these innovations towards low income users, and supporting embedded ICT micro-enterprises. However, as illustrated in the longer timescale for mobile handsets to push to low income users compared to M-Pesa, driving inclusive innovation solely through progressive adoption can be a long path to inclusivity[54].

Focus

Inclusive focus implies innovations with a more central aim of reaching less affluent groups. The M-Pesa sub-sector is particularly insightful in terms of inclusive focus, as this innovation has been created with a lower income user focus in mind, from its inception in trials in low income areas, to its articulation of sending money home to low income users, to its growth of agents into ever less affluent areas (even if some stages this goal has drifted a little). M-Pesa is a rarity in being a novel innovation refined in a developing country with low income users in mind.

Yet, even where innovations have more of a precedence of use elsewhere, innovation can still be inclusive in focus. An argument can even be made that some of the Chinese suppliers, with their more incessant drive towards less affluent users of innovation (and within the surrounding articulation of innovation and the actors involved) display growing inclusive focus which is driving low income growth.

In these cases of inclusive focus, innovation aligns to more of a commitment, particularly from ICT suppliers, to lower income users - within management, research and marketing, on one hand and in stronger nurturing embedded micro-enterprises on the other hand, and the outcome of this is products and channels potentially leading to innovations that emerge may somewhat depart from previous precedents, as attested to in the M-Pesa sub-sector.

Impacts

Notions of inclusive impact of the ICT innovations are less clear from these findings, mainly because having only recent scaled to lower income populations it is difficult to ascertain large scale impact of these innovations. In both mobile and M-Pesa sub-sectors, there is an ongoing debate around understanding the impacts of these

[54] This is in line with other literature (Anderson & Billou 2007).

innovations both economically and socially, which is beyond the scope of this research (Duncombe 2012, Jack & Suri 2010).

What can be said about impact relates to insights that this work gives about scaling of innovation (which is an important element of impact). What this work suggests is that *adoption* and *focus* need to work in tandem for innovations to scale. Even where innovations emerge with a more inclusive focus, this does not mean that such innovations will be developmentally impactful unless they are scaled. This is shown in the outline of M-Pesa where even this more inclusively focussed innovation needed to drive inclusive adoption processes led by micro-enterprises as part of scaling.

6.3.2. Innovation-as-process

Process

At the core of inclusivity of innovation-as-process is the ability for low income entrepreneurs to be able to become part of emerging innovation systems where there are roles with low entry barriers, and the ability for entrepreneurs to learn and build capabilities through their activities. Involvement in this case principally occurs through employment, where these micro-enterprises are driven to engage by the ability to earn small income and to conceivably grow into larger firms.

In the Kenyan case study there is little quantitative work examining the extent of such low income actors[55], but it is clear that mobile phone innovation system does provide significant opportunities for low income groups to become part of innovation processes, entrepreneurs who often tended to be technically-savvy youth from low income slum areas in Nairobi.

Beyond, solely providing a low barrier to entrance for low income entrepreneurs, for processes to be inclusive implies a graduated set of roles which allow less affluent innovators first join an innovation system, and then viably grow within it, particularly in allowing tactics around embedding considering the unstable settings and fast changing nature of ICTs. Thus, systems in which micro-enterprise have room to embed and tactically adapt in such settings, and provides a vibrancy of available roles which can be juggled and jumped by entrepreneurs will be more inclusive than those that don't.

[55] During research work in a dense Nairobi mobile trading area, a street-to-street estimate found 2000 micro-enterprises all connected to activities in the mobile phone innovation system. However, such figures are highly tentative, in that more informal actors were likely missed, and it is difficult to extrapolate them nationally, given the often urban clustering of such micro-enterprise.

Mobile handsets have been more inclusive in this sense, where the requirements to start a business, the lower capital to begin, the growing range of ICT based innovations to mix and match, and potential ability to get support from intermediaries provides quite flexible entry points and learning paths. In contrast more recent entrants to M-Pesa agencies found lead firm rules to reduce the range of adaptations, and location saturation and start up costs create entry barriers, preventing the sector from any longer being as inclusive in terms of innovation processes.

As highlighted, inclusivity of process is a relational one – related to the conditions which define instability and stability of enterprise, the relations which determine the level of agency that these micro-enterprise have, and the structures which support or reduce such activities. Thus, for instance in the mobile handset sub-sector, whilst a few examples of exceptional entrepreneurship were found which led to dynamic growth of entrepreneurs, typically growth of enterprises came not only from dynamic micro-entrepreneurs, but those who also rode the wave of moments where inclusive systems allowed gradual learning and improvement of roles. In the case of successful micro-enterprises like mobile seller Peter outlined in the text, whilst one could not deny that his skill as an entrepreneur was impressive, his ability to grow revolved as much around the inclusive system, which increasingly drove growth in mobile handsets at the time, as his skills.

Ownership

The concept of 'ownership' is perhaps the least clear of the dimensions of inclusive innovation related to research findings.

At a macro-level there is no sense of low income innovators being able to substantially drive directions of innovation systems, nor evidence of many new high technology firms or ICT suppliers emerging from micro-enterprises. Thus, in this case, there is sparse evidence of inclusivity in terms of increasing control of innovation directions by lower income users, likely related to the uneven nature of actors involved.

Taking more micro-level perspectives, a more positive picture emerges. Where micro-entrepreneurs are able to grow more dynamically they can gain both in terms of financial benefits and position in their communities, and thus there is no doubt that micro-entrepreneurs can accrue benefits, particularly financial one from being actively involved in innovation. Indeed, these concepts of local ownership and control are very crucial in driving micro-entrepreneurs activities, where moving from a handset selling employee to an owner to a dealer, or from an M-Pesa sub-agent to a master-agent, and the additional benefits and position these will bring were a crucial driving force in entrepreneurial processes.

6.3.3. Summary

In the case of innovation in the mobile sector, there are clear indications that both cases can be considered to be inclusive in a number of dimensions. In terms of innovation-as-object, whilst it is difficult to qualify inclusive impact, growth towards low income users that will lead to impact links to the interplay of adoption of innovations by low income users, driven particularly by micro-enterprises; and inclusive focus, of large firms. In terms of innovation-as-process, it has been argued that in terms of process, favourable system configurations supported by relations are likely to lead to more widespread inclusivity than focussing on individual entrepreneurship scenarios.

For the task in hand, adapting system of innovation for inclusive innovation, this examination of inclusivity highlights a number of aspects to explore. It highlights the importance of incorporating a wider understanding of innovation, and including a wider set of actors and their role in innovation systems into these models. These elements will be explored in later sections in more detail.

6.4. Components of inclusive innovation

A focus on inclusive innovation for low income markets in developing countries requires an adaptation in core innovation systems models. This case does have elements of inclusivity, both as an object and a process, and thus it can be used to provide insight on how systems of innovation systems need to be adapted to examine inclusive innovation. This is explored in more detail in subsequent sections by revisiting the components of systems of innovation from Chapter 3.

6.4.1. Actors

It was hypothesised that conventional systems of innovation frameworks needed to be broadened to incorporate demand-side actors if one is to understand inclusivity. The findings in this case provide more detail on the exact nature of these actors in systems of inclusive innovation.

Evidence suggests that intermediary actors between the demand and supply-side (both micro-enterprises and other actors) play a more active role in the channels into low income groups, where the gap (cognitive and institutionally) between supply and demand is higher. For instances in the middle-of-the-pyramid channels outlined in the two sub-sectors (shown previously in Figure 5.5 and Figure 5.7), a relatively simple and un-innovative set of intermediaries arose. However for the low income channels, a

much richer network of intermediaries existed; a network that produced a whole set of minor adaptive innovations and demand-side services in order to ensure inclusivity.

These intermediaries fall outside the typical notions of knowledge and R&D brokers that have been the preoccupation of the innovation literature (Howells 2006, Winch & Courtney 2007). These actors tend to be far smaller but far more numerous and often marginal. Nevertheless, ICT micro-enterprises can be seen as innovative actors, who refine innovation around lesser known markets who,

> "attempt to configure the users, the context, the technology and the 'content', but they do not, and cannot define and control use or the technology" (Stewart & Hyysalo 2008 p.297).

Micro-enterprises can be seen as neither completely formal yet nor are they completely informal. What they do is not illegal and many have official business licences and formal recording systems, yet they can stand outside labour, financial and other regulations; they can be unrecognised by others; they are tiny in size; and they can mix a business and social orientation.

Beyond micro-enterprises, ICT supply chain actors - wholesalers, dealers, and distributors - played a role in inclusivity through intermediate activities and relation building, which whilst not directly innovative in supporting inclusive innovation, are vital for inclusive processes, connecting those who design and redesign the technology – the producers – with those who understand how that technology needs to be used in practice. Thus, they too are important actors for low income markets that need to be considered in models.

6.4.2. Innovation

The findings confirm the earlier proposition that the nature of inclusive innovation system is rather different from that traditionally conceived by systems of innovation frameworks. Some crucial elements around innovations were identified that were relatively minor and incremental and often quite specific to the localised needs of low-income customers. These are often taken with constrained resources, and many relate more to the social systems and supporting the new technology than to the technology itself. Table 6.5 summaries these processes, splitting the system actors into two groups, innovation intermediaries and lead firms.

	Micro-enterprise (and other network intermediaries)		**Lead firms**
Technical/ Product ↕ Socio-technical/ Process	• Appropriations (Dourish 2003): minor changes in the products, such as modifications undertaken by phone repairers. • Configurations (Fleck 1994) – Aligning innovations to local demand. • Use variations (Edgerton 1999): variations from the anticipated uses of the technology, such as guidance on beeping. • Domestication (Stewart & Hyysalo 2008) - Articulation activities that link innovations to local embeddedness within networks. • Adapting processes and organisational forms for embedding and risk reduction.	→ Reverse innovation →	• Adapting products for local demand. • Adapting processes/service delivery for local demand. • Advertising and lower income focus.

Table 6.5: Summary of innovation activity in research.
Source: Authors fieldwork.

What this work particular highlights is that ICT micro-enterprises not passive diffusers of innovations. Adaptation within their intermediary roles, and processes and organisational innovation which drive their ability to survive and embed in unstable low income markets highlight them as more active players. The literature review previously highlighted the very suitable term *innofusion* to label this activity, when

> "user needs and requirements are discovered and incorporated in the course of the struggle to get the technology to work in useful ways" (Fleck 1988 p.3).

The key phrase here for inclusive innovation is "work in useful ways". Often for bottom-of-the-pyramid markets, poor knowledge of needs or lack of adaptation renders new technologies less useful to recipients.

As alluded to in examples of wholesaler feedback to Chinese firms, and how some of the embedded adaptation of M-Pesa have become part of core structures, these locally adapted elements and practices around innovation can be taken up by higher-level actors (as shown in the next chapter) and on occasion scaled across the innovation system more broadly. These can be seen as reverse flows around innovation. They differ from previous work on 'reverse innovation'. This concept has previously been used refer to the movement of innovation objects, either from user innovators towards larger firms or movement of innovation from developing to developed countries (Prahalad 2009). In this work, reverse flows related to a circulation of socio-technical elements around innovation, albeit still in a similar upstream path, emerging from

non-lead firm actors particularly micro-enterprises and flowing towards lead firms as shown in Table 6.5.

In terms of the actual innovation dynamics it was seen that by taking a systems perspective, micro-enterprise activity both in terms of product, process and organisational adaptations was linked to a number of elements - the malleability in innovations; service limitations, rules and enforcement and some capacity issues. This suggests that this adapted activity around innovation also requires wider considerations around learning and relations which guides these activities.

6.4.3. Learning

As outlined in the literature review, with the more unequal nature of actors in the innovation system, there are fewer guarantees that learning in such systems will be coherent. This is supported by the case study where one can see contrasting and potentially contradictory learning processes.

For micro-enterprise actors, learning is multi-dimensional as shown in Figure 6.4. Firstly, it is guided by understanding demand and building networks within the low income markets, the demand-based innofusion processes described previously. Secondly, learning relates to interactions around configuring and interacting with ICT suppliers, partners and other system intermediaries. Thirdly, learning around process, which push embedded, diversification and risk reduction related to how micro-enterprises securing livelihoods in unstable environments. (Though not analysed in detail, one might also add other directions of learning - wider learning for livelihoods, and in imitation of business practices of micro-enterprise peers). In all, there is a very rich set of interactional bases which orientate the learning of these actors.

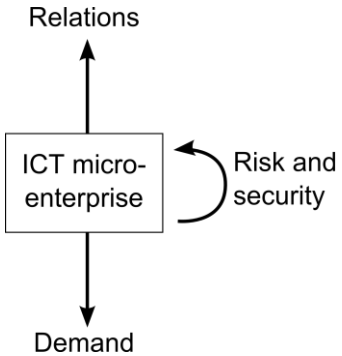

Figure 6.4: Directions of learning amongst demand-side micro-enterprises.

Having multiple directions of learning of actors is not controversial to systems models, but in this case they do support the critique that systems models tend to assume coherence and systemic instrumentality over learning mismatches. The most vivid example of this is the illustration of M-Pesa agent Beatrice where market learning and

subsequent adaptations to the M-Pesa service around ID requirements allowed the innovation to better fit locally with very low income users, but this mismatched with wider service learning from the top down.

In previous work, focus would be to analyse the system, particularly relations and institutions with the idea of enabling and maximising learning, particularly in interaction between system actors. However, in these low income demand focussed systems, other questions for learning arise, related to trade-offs between actors, and coherency between different elements of learning.

6.4.4. Relations

In terms of such mismatched learning paths, systems of innovation models and particularly Lundvall's interactive learning models have focussed on examining firm linkages as a way of driving coherency of systems, particularly focussing on maximising 'user-producer interactions' in systems which allow the better signals between markets and innovators (Lundvall 1992a).

In this case study, understandings about relations are more complex. In both sub-sectors, 'relationships' in terms of directly linked communication between demand-focussed ICT micro-enterprises and lead firms were limited. Nevertheless, notions of user-producer interactions are still useful, in highlighting that when more coherent, and clear flows are present between lead firms and demand-focussed ICT micro-enterprises, this can drive interactive learning. Such elements of systems are still important in this case, perhaps even more so where interactive learning between innovation producers and unfamiliar low income markets can enable innovations to become inclusive.

However, with a few large ICT suppliers and many small and often transitory micro-enterprise actors there is a tendency for large firms to have greater power and control, which is transmitted through supply chains from ICT suppliers to intermediaries to ICT micro-enterprise. This occurs both in terms of products and processes. This form of 'indirect' interaction is the link between large firm strategies and the freedom of small firms to build innovative tactics. Thus, relational analysis needs to extend analysis of 'relations' to elements that embed (or dissipate) power and guidance. This work particularly highlighted rules, objects, monitoring, reciprocity, malleability of technologies, intermediation and disintermediation as crucial features as shown in Table 6.6.

Type	Description	Examples from cases
Technical objects	Black-boxed and low 'malleability' of technical objects makes it difficult for all but the most skilled micro- enterprises to adapt innovation.	• Low malleability of mobile phones reduces ability to technically change.
Product-based guidances	Products and services have specific designs, service elements, innovation structures, packaging or guidance which push certain ways of using innovations and restrict others.	• M-Pesa service commission structures guides how viable certain adaptations will be. • Packaging and trust between cross country wholesalers.
Rules	Micro-enterprise has to conform to certain rules from supply firms in order to undertake service.	• Rules in M-Pesa agents outline how they interact. • Rules in M-Pesa limit certain embedding strategies such as not allowing multiple mobile money services under one roof.
Other objects	Additional non-ICT objects provided by lead firms which guide how socio-technical elements of innovation occur.	• Logbooks in M-Pesa which standardised processes around engagement with customers.
Direct Training	Relationships and roles are standardised through training which outlined the standard processes and ways of doing things.	• Required training for M-Pesa.
Monitoring & quality expectation of micro-enterprises	Supply chain monitoring of micro-enterprise for compliance of rules and/or by other performance measures.	• Monitoring in M-Pesa reduced small adaptations of products.
Norms of use of innovations	The way that lead firms position innovations at a wider level guides activity of micro-enterprise.	• How mobile services are advertised, effected the types of adaptations that micro-enterprise look to.
Support relationships (from intermediaries, supply chain)	Supply actors provide additional skills, knowledge, finance or objects to micro-enterprise which lead to increased links.	• Role of mobile wholesalers in supporting mobile sellers.

Table 6.6: Influences on adaptation of micro-enterprises from other actors.
Source: Authors fieldwork.

One can also see differences between the two sub-sectors studied, where these elements of relations differ. A richer analysis of these aspects of relations will be explored in the mobile sub-sector in more detail in the chapter 7. Here it is enough to say that this exercise is less about identifying an optimum configuration of relationship for innovation, these relationships being embedded in context and actions that

constrains change, but more about highlighting common innovation outcomes and potential pitfalls that come from configurations.

6.4.5. Institutions

Systems of innovation frameworks have tended to focus on formal institutions, particularly those which deal directly with innovation. In this work, respondents rarely identify state institutions of this type as playing a role, but analysis indicates that policy can indirectly support for inclusive innovation. For instance, as will be outlined in Chapter 8, competition policy induced handset producers to take note of low-income markets, enhancing the ability of other actors to address those markets and to innovate. Basic business rules and banking reforms and systems reduced instabilities, gave embedded local actors more security and predictability, and lessened the extent to which they needed to engage in uncertainty-reduction innovations.

The other institutional story highlighted is the rich and highly complex institutional terrain including not just rules but also informal institutions; micro-entrepreneurs' own practices and cognitive understandings; local markets and their customs; and the rules, legitimacy and practices encapsulated within innovations. In particular, there was a prevalence of informal institutional forces. These helped, for example, shape the emergence of adaptive innovations like the case of Hope and her local 'fixer' role, the use of short-term credit, but also the insecurity and lack of trust that shaped restocking behaviour of Peter. There is evidence that local informal institutional norms also subverted formal rules, and pushed entrepreneurs to innovate in rather inefficient ways such as the use of symbolic objects in order to reduce their uncertainties.

So the ideas from the literature review are supported: formal state institutions and policy do play a role in inclusive innovation but much less directly; those formal institutions are also dissipated within low-income markets, where innovation systems are likely to be less comprehensive. In terms of policy the link between policy and the rich informal institutional system need to be analysed to understand the role of policy in these markets. These issues will be explored in more detail in Chapter 8.

6.5. Summary

The case study illustrates that it is entirely appropriate to use a systems of innovation framework to understand inclusive innovation: emerging from a view of multiple interacting actors, who are linked in relationships as part of a wider institutional setting. In Chapter 3, this framework was broadened to consider some of the divergent aspects of systems of innovation for inclusive innovation, and these have here been systematically extended based upon empirical work.

The literature review indicated that the component placeholders of the innovation system would likely be the same when analysing inclusive innovation, but that the contents of each component would be rather different. These differences first set out in Figure 3.2 were validated by the case study, with additional detail and augmentations made. Table 6.7 presents the overall summary of the differences between conception of a conventional system of innovation and those consideration required as part of inclusive systems of innovation as part of low income, developing country market activity.

Micro-level analysis has shown that inclusive innovation included extensive, complex, volatile and embedded networks of actors to ensure low-income consumers can access and use new goods and services. As in this research, these processes and actors are likely to be highly specific to a particular sector and thus sectoral approaches to innovation systems are well suited. Interactive learning processes of such actors will not necessarily align with those of large firms within the innovation system, where micro-enterprise actors, embedded within low income markets, tend to have unstable livelihoods, both in terms of the peripheral position in the innovation system, and in wider contexts related to their lives and goals which are often marginal. Yet they underpin the performance of the whole innovation system, and require us to move beyond conventional conceptions of innovation components and processes. This also further problematises relations which are increasingly linked to control, and institutions which require a deeper concern in understanding institutions which are emergent, informal and often incomplete.

A clearer understanding of adapted innovation systems models can now be used to analyse this case in more detail. In subsequent chapters, these more refined characterisations will be put to use, particularly in examining the user-producer interactions between system components, as well as considering elements of institutions and their links to policy.

	Conventional systems of innovation	Adapted for low income demand focus
Overall scope		
	Connected to economic growth • National, sectoral and regional drivers • Macro-level analysis	Inclusive benefits of innovation system - input and processes • Link between national and local • Micro-level analysis of livelihoods, likely sectoral
Components		
Actors	• Institutional Actors (support, training etc) • Firms	'Innovation intermediaries' linking to low income demand. • Small firms, embedded in markets and informal. • Linked to ICT supply through intermediaries.
Innovation	Processes of innovation and innovative activity in key sectors • Drivers of growth	Focus on incremental innovations for low income markets. • Socio-technical innovation, configuration, domestication. • Context driven process and organisation adaptation. • Reverse flows.
Learning	'Functional' • Learning by doing • Learning by using • Learning by interaction	Wider learning directions and mismatches. • Local market learning, process learning, livelihoods and security. • Trade off between learning of actors.
Relations	• Formal relations • Networks and social capital	Interactions in informal relations. • Two way flows between demand-side and core actors. • Power and control in relations.
Institutions	Institutions - relatively static, overarching • Rules & Regulations • 'Formalised' institutional bodies	Terrains of formal and informal institutions. • Core economic institutions often with direct impact. • Institutional complexity in local markets.

Table 6.7: Modifying systems of innovation to encompass inclusive innovation.

7. Innovation forms in emergent systems

7.1. Introduction

Whilst the previous chapter has refined models of inclusive innovation based upon the case study, and posited the influence of relations, these links have not been examined in detail.

Drawing on the empirical work, the two sub-sectors (which were purposively selected as contrasting cases of network relations) and their innovation forms are compared in this chapter, and this work forms substantive evidence to answering the second research question. This is achieved through defining five key stages of growth that these two ICT innovations dynamically pass through which is used for comparison between network relations and innovation.

In line with the previous chapter, it was found that system actors play varying roles in innovation in these stages, but across both sub-sectors where lead firms enable, nurture and respond to innovation activities from the wider systems often involving embedded actors, then inclusivity is more likely. Comparative analysis closely links such activities to relations, particularly related to ICT supply networks which provide flows around knowledge, and aid interactive learning.

User-producer interaction models are used to provide clearer insight on the link between learning flows and relations through comparison between the two sub-sectors. First, given the uneven and disconnected nature of relations, it is examined how one can best define the ideas of relations in such systems, and what this means for general directions of innovation. Second, a more comprehensive analysis of user-producer interactions highlights some more specific elements of relations: demand 'sophistication', user capability and distance that provide further insight on how specific elements of relations can affect how responsive learning is lead firms and low income focussed micro-enterprises.

Whilst findings suggest that network forms are in some sense path and innovation dependent (in agreement with innovation systems literature) user-producer models provide knowledge on how configuration of both general and specific elements of relations might enable the maximisation of potential for inclusive innovation in such systems.

7.2. Dynamic understandings

Drawing on empirical study, a comparative analysis of the two sub-sectors is made. This is done from a dynamic perspective through a five stage iterative model. This model is used as a device to allow better cross-comparison between these two networks, acknowledging that sub-sectors are best compared within parallel stages of growth. This model then provides a standpoint from which to discuss aspects of innovation systems and relationships. .

7.2.1. Deriving the dynamic model

The five-stage model is principally derived from empirical analysis of the two sub-sectors. Interview histories, documentation and literature elicited within research are used as the core foundation to build this model, linked to core sectoral and specific conditions within each network. Chapter 5 provided a more detailed explanation of the lineage of the sequential stages outlined in the two sub-sectors and how they were derived. Here, this work is taken one stage further by combining these two separate stage models into a single model based upon common themes in each of the two sub-sectors.

For the purpose of this thesis, the specifics of the model are considered to be unique to this sector[56]. However, taking such a staged approach to examining innovation is well in line with previous innovation literature that has made dynamic analysis of innovations (Abernathy Kim & William 1985, Misa 1994, Utterback 1996). This work has highlighted that as an innovation develops over time, the general nature of innovation as well as the actors and relation within systems varies. For instance, this work closely connects to Rip & Schott's (2002) work on contextual stages in 'innovation journeys', and Utterback's (1996) models of dynamics paths of innovation. Such a dynamic approach is also compliments more dynamic perspectives that have been advocated by sectoral innovation system scholars (Malerba 2002).

7.2.2. Elements of the model

The five stage model highlight five distinct stages within the growth of these two specific mobile phone sector innovations, as outlined in Figure 7.1 and detailed below. Empricial work suggests that as these innovations grow, not only do the types of

[56] Hence, no claims are made here regarding the wider generalisability of this model, as discussed in the conclusion chapter.

innovation and relationships change, but the key actors and drivers of innovation also vary, between lead firms, other sectoral actors and policy makers.

- *Precursor innovation* is not discussed in detail in this work. This element is included to highlight that new innovations have precursors - existing actors, resources and innovations forms - which drive later innovations.
- *Exploratory scoping* occurs when larger firms looks to become involved with innovations which may eventually reach low income groups. In the case study this took place in user needs surveys and gathering, pilots and coinciding tests of new innovations.
- *Direct rollout* occurs where firms more actively push innovations in a developing country following scoping. In this case, networks normally start from simpler, pre-designed set of relations driven by the lead firm.
- *Aggressive growth* occurs as innovations move towards lower income users, and revolves around increasingly diversified networks of actors.
- *Standardisation* occurred in both sub-sectors and can be seen as a reaction to the previous stage, where relations and innovation have become to complex where more powerful actors endeavour to simplify these relations.

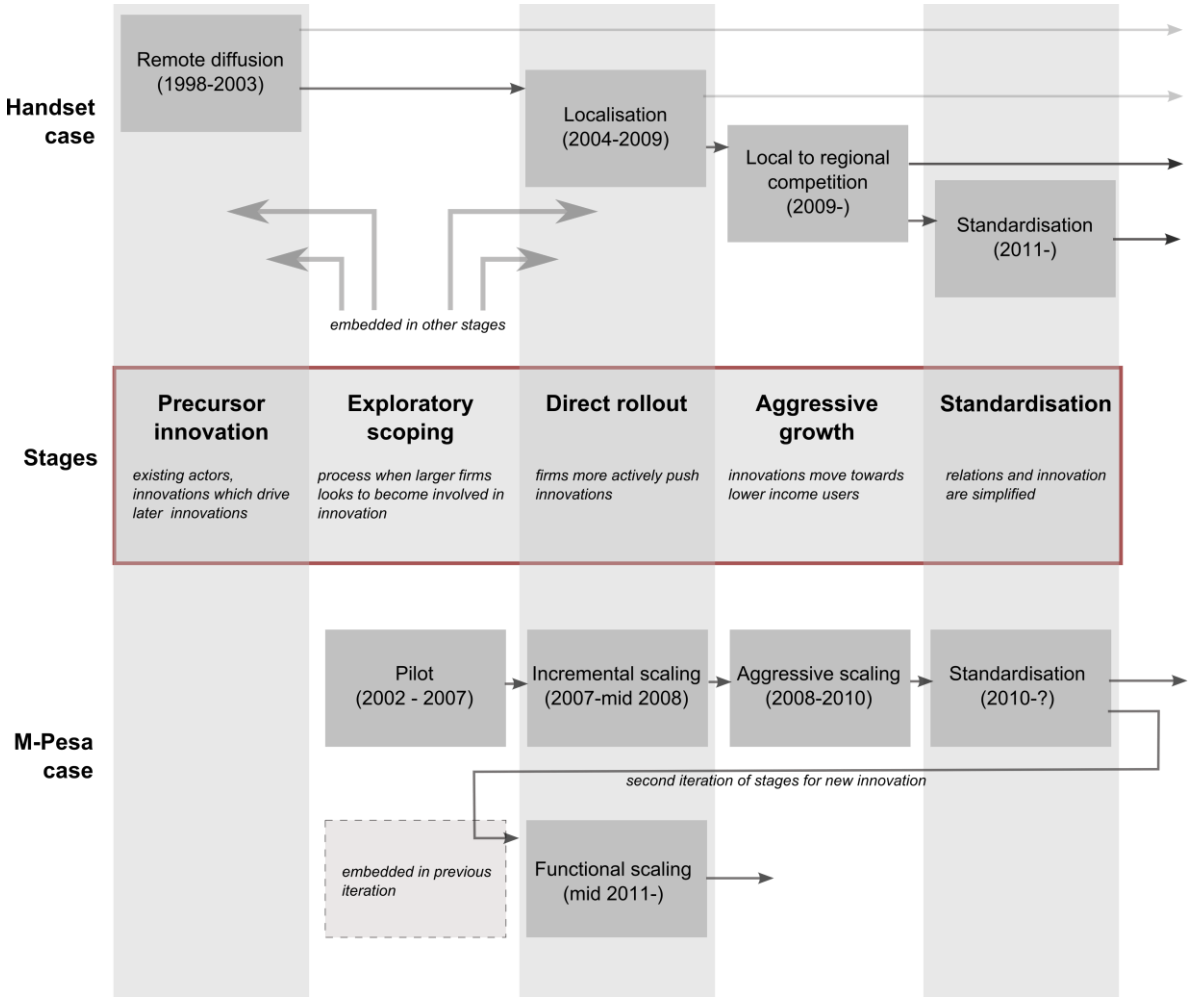

Figure 7.1: Five stage iterative understanding of ICT innovation.
Five stage model (centre), and its relation to dynamic views of the two mobile sub-sectors (top and bottom).

The handset sub-sector included a more diverse set of firms compared to M-Pesa, so the stages are indicative of key directions of the sector over time. As shown in Figure 7.1 (top), and outlined in the previous chapter, exploratory scoping and direct rollout are more closely integrated and this has led to a longer period of slow adaptation towards low income users before aggressive growth (with some handset firms arguably still not having passed this stage).

In the M-Pesa sub-sector, two loops of this five stage model occur, with the second iteration running somewhat parallel to the first as shown in Figure 7.1 (bottom). The first iteration relates to mobile transfers, which moves from direct rollout to aggressive growth stages quite quickly. The second iteration relates to the functional scaling of M-Pesa with a wider organisation focus. At the time of research, this second iteration was 'stuck' at the direct rollout stage.

These stages are discussed in more detail in next sections. For each stage the network of actors and their relations are presented, and this is linked to the general types of innovation found, for the two sub-sectors.

7.3. Examining emergent systems

7.3.1. Exploratory scoping

Exploratory scoping in these sub-sectors related to how large firms examine the viability of being part of innovation, and if (and how) intended innovations should be positioned.

Scoping has taken place in diverse ways in this research. It took place as a pilot study in M-Pesa, as more direct user research in handset selling, as well as concurrently as more experimental aspects of other services. Whilst these contrasting approaches make it a little more difficult to be comparative between sub-sectors in this stage, the contrasting approaches to scoping can still provide insights about the nature of relations and innovations.

Methods of scoping: relations and networks

Branded phone firms

In terms of handset firms, exploratory scoping has been an ongoing iterative activity, gathering an understanding of innovation needs and requirements for lower income groups. As outlined previously, such needs predominantly emerge from commissioned user research amongst low income users.

Low income handset models from branded firms do not solely link to Kenya, tending to be distributed in multiple markets. User research for low income users often emerged from combined clusters of research at a global level rather than specifically country related. Thus, in this period, focus on lower income citizens did not necessarily occur in user research in Kenya, rather being linked to global level CSR or low cost handset research elsewhere.

Over time, with localisation of handset firms, local offices themselves became more involved in commissioning user research and survey activities that link to the lead firm adaptive activities outlined in the previous chapter. One handset firm manager described the more intricate structures and relationships that his office has built over time to better link to these requirements,

> "we have a research team who study the trends and activities…these feed into the R&D process and influence the models that we are getting….we

> also recently ran a 'think tank' to see what innovations were needed to increase our presence in the East African region".

However, formal handset firms still often found themselves somewhat disconnected from the operational details of the informal channels of trade. Whilst firms began to open offices in Kenya, distribution and operations were still mainly done by outsourced firms. This continues up to today with all interviews with branded firm staff occurring in offices in plush business districts in the better suburbs on the edge of Nairobi.

Such a network structure simplifies management away from complexities of operation and has managerial advantages in terms of costs and efficiency. However, it also means that in terms of relations, firms were quite disconnected from the everyday details of low income micro-enterprises and customers involved in mobile, even if over time they have improved how they gather insight through 'intelligence' activities.

Chinese firms

For Chinese handset firms, gathering requirements for low income groups in scoping was far more ad-hoc as compared to branded suppliers. One larger firm outlined that they had commissioned some user research in Kenya, similar to branded firms, but this was uncommon. Others particularly highlighted regular feedback sessions between Kenyan employees of their firms and head office in China which influenced new models. One smaller firm was also notable in that they mentioned that "agent feedback was passed to China" ('agent' here refers to the very large wholesalers who buy phones in large bulk and sell into ICT micro-enterprise). This indicated at least in some cases, network intermediaries closer to markets, and with links into low income groups have some rudimentary relation into centres of technical innovation.

As part of this ad-hoc user gathering, Chinese firms' structures were well suited to building closer relationships and learning as part of their daily activities and this was the core of user gathering in Chinese firms. Unlike branded firms, all Chinese firms were located close to key districts of the informal mobile channels - some with offices, and some located on slightly larger stalls (which in some cases could even be mistaken as wholesalers). Such handset firms also all had operations staff who were involved in micro-managing distribution of their products into wholesalers, and in some cases even down to smaller micro-enterprise sellers. This led to interviewees in Chinese firms having a notably more intricate working knowledge of low income channels and customers, where one could see the effect of these closer operational relations had on their understanding.

M-Pesa pilot

In terms of M-Pesa, scoping principally came in the inception of the M-Pesa project, occurring during early research in a comparatively short (2-3 month) pilot period outlined in the previous chapter. Two important elements of this pilot relate to understanding relations, the selection of low income communities as the focus for research, and the open relations that enabled agent-led adaptation to be tracked and occur during the trial.

In terms of the pilot users, it is clear that pilot pushed well beyond middle class users, with this goal being stated as one of the key objectives from project inception,

> "..increase access to poor people to financial services through technology" (FDCF 2006 p.6).

In implementation, as recounted by an M-Pesa manager, this led to two sites being selected for the pilot - a slum area in Nairobi, Mathare, and a medium size town some 25km from Nairobi, Thika. The selection of Mathare, one of Nairobi's largest and unstable slum areas, particularly highlights the nature of the trial which attempted to include more complex locations, customers and micro-entrepreneurs in places of high poverty and high vulnerability.

In terms of open relations it is also important to highlight that whilst lead firm adaptation and emergent activity that occurred during the pilot (as outlined in the previous chapter) was crucial, so was the way that 'slack' was 'built in' by pilot designers which allowed users, particularly agents, to use the service in a variety of ways. This related both to the product design (e.g. enabling non-MFI P2P transfers in the core system design) and in wider deployment (e.g. not punishing unexpected uses of the system). Intentionally integrating this slack in the system allowed such emergent activity to occur (Hughes & Lonie 2007) and with pilot activity tracked, both through wider user surveys and with the ability to analyse per-user usage statistics (FDCF 2006 p.4), such emerging trends were visible to the pilot designers.

M-Pesa functional scaling

The scoping of the second iteration of the five stage process in M-Pesa, in functional scaling came within existing businesses. One consultant who had worked with the project outlined that this functional scaling, which later became the growing organisational set of transfers had been introduced concurrently with the M-Pesa transfers service as it grew. Organisational transfers were first introduced and adapted in an ad-hoc way, as an extra feature with which to sell M-Pesa P2P transfer service, as opposed to initially being a core concern. By testing a few such offerings within the working service environment and beginning to build interactions, knowledge was built from this operation.

However, as shown in the types of payment that were introduced in such concurrent scoping - mutual funds payment, pensions, pay TV, formal bank transfers, supermarkets – the types of relations and learning being built here were minimal in terms of inclusive focus, and the nature of the markets tested is contrasting to those in the M-Pesa pilot. Thus, relationships in this sub-sector were unlikely to accrue much detailed information about low income user and payments from the relationships built.

Innovation Forms

The selection of scoping seems to be quite specific for individual moments and conditions, but the contrasting relational approaches in these very simple networks do provide insight on innovations and relations. Three particular elements of relationships can be observed, all which are fairly obvious, though still not necessarily followed in all these sub-sectors.

First, where lead firms have a goal of innovations being used by low income groups, firms can interactively learn more and thus innovate more inclusively when they are actually focussing on these groups in exploratory scoping processes, as in the M-Pesa trial.

Secondly, as the shift in focus of M-Pesa after the pilot attests, when such relationships were appropriate, it can reveal key points around success and failure of innovations, but only if lead firms are able and adaptable to the learning that comes through these relations. In the handset scoping example, where relations from ad-hoc user trials to the core technical innovators were longer and disjointed, and where learning was aggregated across many regions throughout the developing and emerging world, learning was not particularly interactive, and adaptations were minor.

Thirdly, innovation is not solely related to the technical product, but also about wider processes, actors and issues. Thus, ad-hoc 'user surveys' which mainly focus on technology might potentially miss out on wider learning around operations. Chinese handset firms ongoing learning from daily operational relations fed into the centres of production, and was more important than formal surveys or user processes for the Chinese firms interviewed. Such informal relationships can be as effective in learning as sophisticated research programmes.

7.3.2. Direct rollout

The direct rollout stage concerns periods when large firms become involved in more actively pushing their innovations into Kenya. As shown in network diagrams in Figure 7.2, in these early stages networks tend to begin with fairly simple and top-down links, where lead firms have a direct say in their design.

Network forms

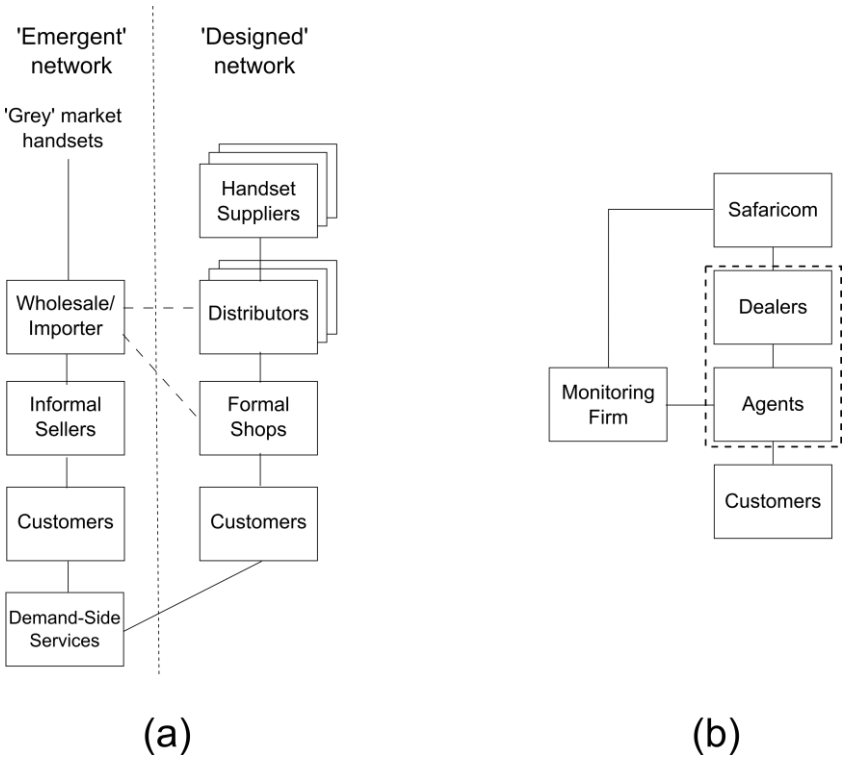

Figure 7.2: Network structures during direct rollout.
Case of networks for (a) mobile handset supply and (b) M-Pesa[57].
Source: Authors fieldwork.

In the mobile handset sub-sector, early 'designed' networks structures linked to predictable partners, with formal retail shops being the designated channel for delivery. Supply relationships were initially distant, with handsets distributed through local distributors, with handset suppliers distant, located outside Kenya and with lower Kenyan focus. Later firms localisation began to establish regional and national offices with local management and strategy in the region, with a realisation that handset firms acting from afar was increasingly problematic, as an executive of LG noted to the local press.

> "You should note that we already have a subsidiary in Cairo which served Eritrea, Sudan and Ethiopia. Another one in South Africa was serving Tanzania, Uganda and Kenya. We realised that you can not develop the market with such arrangement" (Wahome 2004).

The case of the early M-Pesa networks is remarkably similar as shown in Figure 7.2(b). Agents typically came from the already established dealer networks who had

[57] The networks outlined in this chapter are simplified versions of the networks in these two cases to illustrate the key conceptual discussion.

been partnering with Safaricom for some time on mobile airtime selling. In order to fulfil regulator requirements, an outsourced monitoring firm was also part of this network to ensure agent compliance. In both sub-sectors, these relations are incremental and focus is on existing markets and customers.

The significant difference between the two networks is the 'emergent' network in the handset sub-sectors which emerged from non-approved importers procuring alternative supplies of mobile phones (as shown on the left of Figure 7.2(a)). Such actors were the source of later informal channels of wholesalers, micro-entrepreneurs selling handsets and mobile repairs to low income users. During interviews a number of handset micro-entrepreneurs were encountered who emerged in this early period and described this 'emergent' network.

> ***Naicom***
> *Naicom was a wholesaler located at the back of one of the 'corridors' in downtown Nairobi, effectively a medium sized store with many shelves stocked with boxed phones, all behind a set of security bars.*
>
> *The store itself had been around for long period, the owner beginning as one of the earliest informal handset sellers who was part of the informal channels of mobile phone delivery in the early 2000's. In those days, such trading was more small scale.*
>
> *"He [the owner] used to have a small booth here ten years ago, selling these large Motorola's. If he sold one in a week then he would be happy, then he would go and buy another phone to sell".*
>
> *The owner started from a small kiosk in the early days of mobile selling "imported phones" - grey market mobiles which avoided tax, and so could be sold in Kenya for a more accessible price. As demand for low cost phones grew, the owner later expanded into selling refurbished and second-hand mobile phones to meet the rising demand, for those who couldn't afford new imported phones. Naicom original sourced phones through building links with a Somali wholesaler/agent based in Nairobi who would acquire and sell stock supplier from the Middle East.*
>
> *Like a number of stores interviewed, early growth was quite dramatic and came by the owner being able to provide newer and cheaper phones than were available locally through the 'designed' networks of retail stores, where delays, mark-ups and taxes meant that official phones that reached Kenya were often outdated and costly.*
>
> ***Githonga***
> *Gihtonga was part of early demand-side services in mobile handsets which accompanied the emergent networks. Working as a mobile repairer, he now shared*

a subdivided building on a busy street in downtown Nairobi with around five other entrepreneurs.

Originally he was a repairer for TVs, but he became more interested in mobiles in 2001 when he trained for three weeks with another mobile repairer and began fixing early Nokia models such as the 3310 and Siemens phones in addition to TV sets. Over time, learning from simple repairs has helped him build a good mobile repair business. He describes repair as "a profitable business – it has made me enough money to eat - enough to send my 2 children to school".

In the early days, although his skills were quite basic, it was still possible to run a viable repair micro-enterprise. The 'designed' networks channels were often quite disconnected from the ground in Kenya and did not consider the additional service needs of local consumers. This was highlighted in a lack of any official mobile repair centres in Nairobi. In addition many early phones (official and unofficial) imported into Kenya were unreliable and with a high propensity to be faulty on arrival. This state of affairs pushed much business into informal repairers like Githonga. Indeed, his location in close proximity to informal sellers meant that he would often act as an informal 'service centre' for sellers who found that their phones had faults.

He quickly also began to start training other repairers in his store, training each apprentice for three months at a cost to them of 10,000Ksh (~$100). Most of these trainees would go on to start their own repair stores, some in the same areas as Githonga's store, but at least in the early days when repairers were few, Githonga describe such growth as positive, a network of friends who would help him solve problems with phones he was fixing.

As can be seen, these emergent channels came about both due to enterprising individuals expanding businesses to fulfil needs, and in the lack of attention in the formal channels towards Kenyan supply.

The emergent channels emerged only in the mobile handset sector, for a number of reasons. As a decentralised product, mobile handsets naturally provided an opportunity for entrepreneurial actors to enter the market (as compared to the centralised M-Pesa service). There was also the importance of the presence of precursor innovations (existing electronic sectors) and how this led to the presence of precursor actors and networks (electronics importers, repairers and sellers) who branched into mobile phone handset importing as it became an opportunity. Finally, with local supply not initially being well adapted to non-elite users, emergence of demand-side entrepreneurs such as second hand resellers and repairers occurred to fill this gap.

As can be seen in Figure 7.2(a), whilst there was occasional evidence of links between designed and emergent channels, in general one can say that these informal channels operated quite separately during direct rollout, and this carried through to network relations in later stages.

Innovation forms

The focus by ICT suppliers in this stage was to solidify their innovations as they were introduced to these new markets[58]. There is evidence that the designed network relations facilitated this process through operational interactive learning, for instance in highlighting security issues in M-Pesa and repair and warranty issues in handset networks that led to socio-technical adaptations. However in both sub-sectors, with network relations predominantly into the middle class, such learning and adaptation is around more general innovation mismatches than anything specifically related to low income users.

These minor adaptations are highlighted in M-Pesa in Table 7.1, a number of these small top-down adaptations occurred linked to feedback from designed networks.

Adaptation with explantion (status on right)	
a) Unanticipated problems (with innovation)	
High level of balance checks. *M-Pesa balance checks were initially free, leading to high volume of use and network congestion from balance checks. Problem resolved by charging 1Ksh*.	Y
Customer scams (fake SMS). *SMS use in M-Pesa led to fraudulent activity around fake SMS inducing customers to send money. Safaricom made some advertisements, and slightly adapted message forms but this remains a weakness of the system.*	P
Delay in network of M-Pesa (particularly at busy times). *Unexpected volume of M-Pesa use, led to delay in network. Particularly problematic at the start of the month (pay time) and in rural areas (poorly configured systems). Some upgrading has occurred, but still problematic.*	P
Inexperienced users 'short changed' by agent. *Some early inexperienced users reported that agent would fraudulently take higher commission than they should. Safaricom's addition of a fraud reporting line, and increasing awareness of tariffs have reduced this problem to a low level.*	Y
b) Unanticipated problems (for network actors)	
Agency robbery. *Higher than expected use of the service led to risk of robbery at agents.*	P

[58] Notwithstanding that in the mobile handset case, innovation activities in direct rollout merged with scoping activities as outlined in the main text.

Safaricom introduced security advice/requirements – building rules, float monitoring, 'management sim card' (allows agents to transfer e-cash remotely to reduce robbery). Still significant risk for agents.	
Security risks for agents related to logbooks showing cash levels in store *Readable logbook allows thieves to see amount of cash in store. Agent-led techniques to hide logbook data from prying eyes were taken up by Safaricom. Later Sararicom introduced adapted logbooks.*	Y
Registration of customers not completed properly by agents. *High agent commission for registration led to unprofessional behaviour and incomplete registration by agents. In response Safaricom changed registration commission payout to not occur until first transfer had been made by a customer.*	Y
Float/Cash management difficulties for agents. *Higher than expected volumes led to severe lack of cash or float at many agents, crippling their ability to do business. Safaricom has taken a number of measures over time – float requirements, monitoring, float management tools, super-agents – but still problematic in some locations.*	P
Agents emerging who were not officially approved. *Unofficial agents posed risks to service. Problem was reduced due to Safaricom advertisements, fraud reporting line as well as customer understanding of service over time.*	Y
Scamming of agents (fake SMS, fake staff, fake currency). *A range of 'scams' have been used on agents to defraud them. Some adaptation has been made. For instance requiring counterfeit money detectors and training on spotting scam SMS, but this is still a big problem for agents.*	P
c) Early changes to abide with emerging policy	
Agent service delivery to fit with money laundering regulation. *Regulatory requirements, around money laundering rules led to adaptations of interaction between agents and customers.*	Y
Monitoring of agents for quality to fit with banking regulation. *Above regulatory requirements to Safaricom adapting innovation to include agent monitoring for compliance.*	Y
Centralised service structure to fit with regulatory rules. *Some service adaptations before direct rollout related to how M-Pesa funds are centrally stored in system to ensure M-Pesa service was not subject to more complex banking regulation (type of bank account, non-interest accruing).*	Y
d) Customer demands during rollout	
Smaller lower and higher limits for transfers. *Individuals demanded ability to be able to make very large and small transfers. Upper and lower limits changed over time after negotiation with regulator.*	Y
Inability for firms to hold larger volumes in M-Pesa account. *Firms found maximum balance levels too low for their convenience. Increased over time after negotiation with regulator.*	Y
Lack of agents in some areas. *Lack of agent availability in some rural areas. Safaricom actively pushed growth in specific regions, although still areas of lack (e.g. rural North Kenya).*	P

Customer helpline slow to respond. *Customers reported having to wait up to one hour. This was improved over time, but is still a problem during times of congestion.* **Key** Y: Adaptation resolved problem during this stage. P: Adaptations made but issue was not fully resolved during this stage.	P

Table 7.1: Adaptations emerging during direct rollout, in M-Pesa.
Source: Authors fieldwork, with additional discussions and triangulations taken from (FSD Kenya 2009a, Mas & Morawczynski 2009).

In both sub-sectors, established operational relations into designed networks play a key role in monitoring and understanding problems relating to specificities of direct rollout. However, there is little true link into low income groups, and this risks potential stasis in innovation that reduces if such networks forms remain predominant over the longer term.

7.3.3. Aggressive growth

In both sub-sectors, adaptations in scoping eventually led to innovation forms that were reasonably or well adapted for low income groups, and in the direct rollout stage many operational issues have been dealt with. However, in both sub-sectors, limitation in growth related to how innovations were still predominantly focussed on middle class users, unable to readily reach low income actors. This particularly linked into limitations around embedded micro-enterprises. Thus, in aggressive growth, the crucial shift is that network forms evolve to include such embedded micro-enterprises, and this leads to growing volumes of low income consumers.

Network forms

In the handset sub-sector, it was the 'emergent' channels that drove adoption towards low income groups, but growth in these channels was at first limited by the difficulty that low income sellers had to identify appropriate innovations. Such issues were encountered particularly by smaller mobile sellers who tried to sell handsets outside more central trading locations, as outlined in the case of Evans below.

> ***Evans***
>
> *Evans, a handset seller, was interviewed in the slum area surveyed. He owned two small kiosks, one in this slum and another in his rural hometown. Originally he sold electrical parts for nearby informal Jua Kali producers, but he diversified into mobile handset selling which was now his main income generator.*
>
> *To get supply he would go to a wholesaler located in the central districts of Nairobi around 10km away. In describing his interactions with this supplier, Evans outlined how he had run into a number of problems when he began, connected to his*

predominant focus on selling cheaper Chinese and imported phones to low income users.

"I sold china phones but there were problems with faults and warranties…It was costing me time and effort. I no longer stock!"

His principal problem related to supply quality and this was exacerbated by not being closely connected to wholesalers. With a comparatively low turnover in stock due to his location, he had little ability to build thick relationships with wholesalers and secure trustworthy supplies of handsets. This poor link also had a secondary effect in that it reduced his ability to get wholesaler support that could aid embedding.

"I go to just one, and pay in cash. We are far away from the centre and not regular enough to know them or build credit with them…".

As highlighted with Evans, embedded mobile handset trading micro-enterprises encountered limitations when they were less connected (in terms of distance and regularity of contact) and unable to build trust relationships into wholesalers. This was to the detriment to embedded micro-enterprises, particularly those outside more clustered areas.

Whilst those less connected into wholesalers felt the brunt of difficulties, even sellers able to build better networks describe informal channels as still a risky business, particularly any who grew into multiple or larger operations. One seller interviewed even became so frustrated with existing wholesalers that he took the step of becoming an importer himself, providing a weekly 'catalogue' of goods to customers and taking orders from Dubai through SMS and supplying local entrepreneurs.

The key change that occurred in aggressive scaling links to some merging of informal and formal channels. This occurred when some of the large handset firms who had previously focused more on formal retail channels began to connect into the more 'emergent' channels. Here the case of one of these handset firms is presented.

World Tel

World Tel is a large multinational handset supplier who has taken a growing interest in pushing mobile into lower income users. The regional director and the operation manager were interviewed.

World Tel originally followed a similar path to other firms in direct rollout, predominantly supplying handsets through existing distributors into retail stores. As the operation manager outlined, over time these distribution firms became problematic. They tended to be specialists in import/export and dealt not only with phones but many other goods, such as fertilisers, electronics and produce. In

the early days, such actors with experience of negotiating the unfamiliar supply routes were useful, but as mobile handsets became more established in Kenya, distributors became increasingly inadequate for World Tel where goods distribution needed to become increasingly sophisticated, around retail promotion and monitoring that World Tel demanded.

Thus, World Tel partnered with several 'dedicated distributors', new distributor partners specifically focussed on the changing requirements of the mobile sector. These new distributors were more active and more than just importers of goods. Of particular interest in terms of the low income channels is that not only did they sell into formal stores, but also increasingly linked to informal micro-enterprise sellers directly.

As recounted by the operations manager, these dedicated distributors initially had difficulty in gaining leverage in the informal channels, profits from tax arbitrage on grey market imports meant informal mobile channels remained viable, even if supplies were unreliable (indeed one of the dedicated distributors was reported to have stopped operations due to the lack of sales). However in the longer term once local tax levels (VAT) were reduced, mobile devices from dedicated distribution became viable and popular in Kenya, and increased World Tel's sales.

ICT Logistics

ICT Logistics, an East African firm, is one of the 'dedicated distributors' for World Tel. They distribute PC goods, and have an exclusive contract with World Tel in the mobile phone space. The financial director and a manager of one of their distribution stores was interviewed.

World Tel mobile phone distribution is ICT Logistics largest activity with a large dedicated sales force and logistical team. ICT logistics deals with the importing of WorldTel's devices, and then sells them into the distribution channels. They also track and report bi-weekly on the state of operational play to World Tel.

Of particular interest is the increasing volume of goods which World Tel distribute into the informal channels. This is mainly done through WorldTel opening and franchising shops close to clusters of informal handset micro-enterprises.

On visiting one of these ICT logistics stores, on the street they seem little different to the official retail stores one sees in many Kenyan towns, but on entering such stores are different, poorly lit with no real phone displays of advertising and rather a focus on a large stocks of goods.

As the store manager outlined, their main goal is not to retail to 'normal' customers but to provide a place for wholesalers to pick up stock, and for mobile micro-enterprises retailers to quickly purchase mobile phones in small volumes

> *using cash – much in the same way as they would have done with informal wholesalers during earlier stages in the five stage model*[59]*. The difference here is that as opposed to the informal wholesalers, these phones would be 'official', more reliable and with full guarantees.*

We use this notion from the World Tel case of 'dedicated distribution' as a terminology to denote a number of strategies by mobile phone firms which relate to adding new links between 'design' and 'emergent' channels, pushing more trust in innovation into the informal channels as shown in Figure 7.3(a).

This dedicated distribution occurred in slightly different ways amongst the different branded mobile suppliers interviewed. One other supplier broadly replicated World Tel's dedicated distribution model, a second firm brought a significant amount of such local operational activity in-house in order to enhance its focus into less affluent channels, whilst a third partnered with one of the informal wholesalers who became their advocate in informal channels. Whatever the method, what is significant is that in terms of network structure and relations, informal channels were no longer ignored where micro-enterprises but became part of the branded channel strategies of selling mobile phones to low income users.

[59] As outlined in the case of Peter previously, micro-enterprise sellers tend to operate with very low stock level, to reduce enterprise risk. Thus, on selling phones quick restocks are necessary, and in some places this was found to occur up to 4 or 5 times a day. Thus, the form of local wholesalers is not a peripheral need for retailers, but central to the way that they conduct their business.

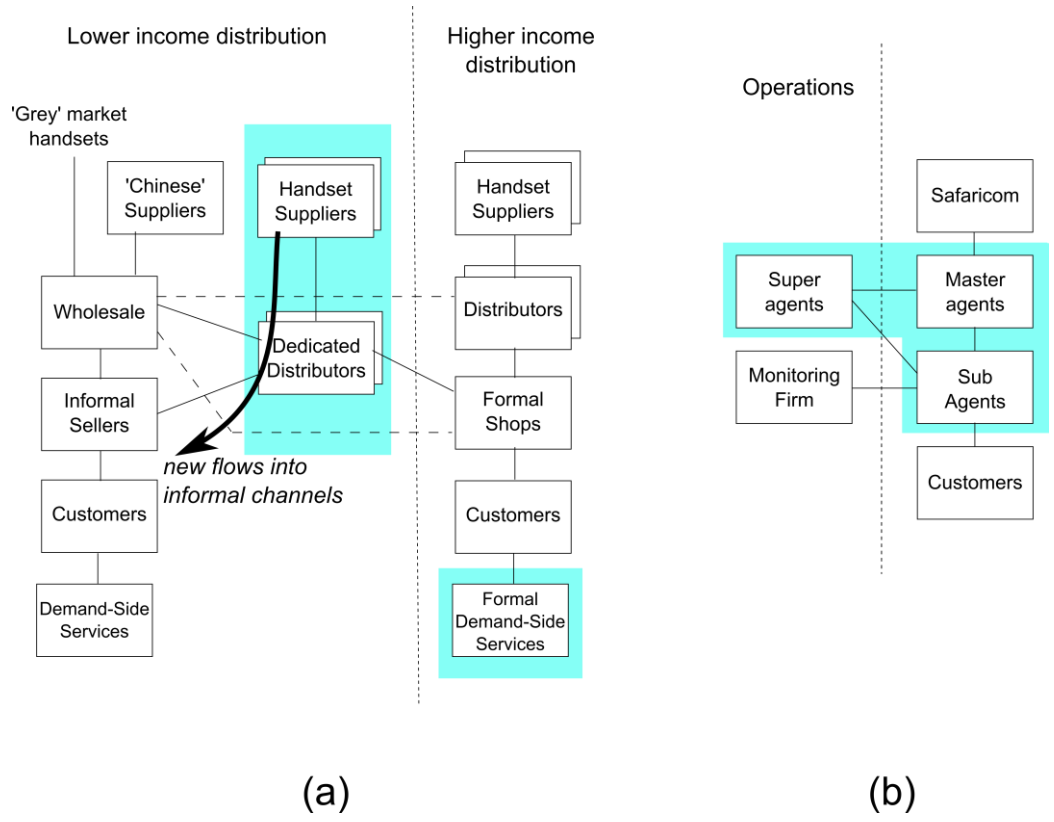

Figure 7.3: Network structures during agressive rollout.
*(a) Mobile handset supply and (b) M-Pesa Blue highlight indicates change from previous stage (in Figure **7.2**).*
Source: Authors fieldwork.

As vividly shown in the World Tel case, aggressive rollout related to ways that handset firms partnered with or mimicked some element of the informal channels. This made it convenient for micro-enterprises to link into branded goods, and additionally have trust and knowledge of quality goods, without them needing to change their local practices. This had a dramatic effect on the sector. The majority of handset micro-enterprises interviewed, began their kiosk and selling activities since 2009 or 2010, and this can be seen to mirror the period where dedicated distribution emerged, making such embedded activity more viable. This was particularly marked in the more remote slum site surveyed where only one mobile seller had been established prior to this time.

In M-Pesa, limitation in service networks reaching low income groups occurred in a slightly different way. In this sub-sector there were no emergent channels, and the designed M-Pesa network had strict standards on agents (from requirements of legislation, and by Safaricom). This initially limited the ability for smaller micro-enterprises to embed in lower income areas *and* meet requirements. Thus, the number of agents effectively lagged behind the customer demand for the service, limited by these strict agent requirements. (Davidson & Leishman 2010, Flaming et al. 2011).

Aggressive growth occurred in emergence of the sub-agent model structure which allowed quicker growth of networks into low income areas for agents. Below is the example of Mary, an agent whose history tracks the emergence of this model.

> ***Mary***
>
> *Mary (interviewed) and her husband were entrepreneurs in a large slum area on the edge of Nairobi. They have run a range of ICT-based business since 1996 - a 'video library', DVD selling, a photocopying and typing service and a small cybercafé. However, whilst some of these forms are still somewhat present, their most successful business has been as M-Pesa agents.*
>
> *In 2008, in the early days of M-Pesa, Mary became an M-Pesa agent in the slum area. As M-Pesa expanded in popularity, Mary was able to add two additional stores branded with the same name in different areas of the slum.*
>
> *However, running multiple M-Pesa stores is a risky business, particularly in the early days, and in such marginal areas managing these three stores was difficult. M-Pesa agents tend to handle significant amounts of money and hence prone to risks. Whilst her stores had not been robbed, one previous manager of one of the stores had over time been able to extract 200,000Ksh ($2300), taking their M-Pesa agencies to the brink of bankruptcy.*
>
> *Beyond these risks, at an operational level, Mary had to deal with the daily struggles of unreliable staff, ensuring good customer relationships, handling the high volumes of activity and troubleshooting particularly as M-Pesa network problems became more frequent.*
>
> *Mary started to grow through following the trend of other dealers and agents in Nairobi of sub-contracting the M-Pesa agent service to other micro-entrepreneurs. For her, this involved partnering with other entrepreneurs mainly in more remote and less affluent locations within the slum*[60]*.*
>
> *Documentation and forms for such sub-agents were signed under her M-Pesa agency name to meet the requirements of Safaricom and she became the master-agent, whilst the store would actually be operated by the partners as sub-agents. For this guarantee Mary took 30% commission on the monthly payments received before passing the rest onto the sub-agent.*
>
> *As she described, this was a win-win situation. She had little difficulty finding suitable sub-agents through her connections in the slum, and for her, this approach also made the growing business more manageable.*

[60] Larger slums in Kenya are inhabited by a large demographic of the population - from lower middle class, to working poor, to poor – often in different parts of the slum.

> *"You effectively sit back and still get the 30% per month without having to get involved in the daily problems".*
>
> *Effectively, the sub-agent model allowed Mary to continue to expand more manageably, expanding in the slum area that she was familiar and at the same time delegating some risks to sub-agents, who made investment and operational decisions. Mary now has 15 sub-agents in her network, using her original location as a 'head office'.*
>
> *Thus, sub-agent approaches allowed her agency (and more generally for the M-Pesa network) to more dynamically grow and allowed her a better way of managing the operational needs and risks of expansion of this innovation.*

As shown with Mary, the emergence of the sub-agent model was not something specifically driven by Safaricom[61]. It emerged from dealers and agents themselves.

> "Safaricom became aware that a growing number of agents were subcontracting with third parties and allowing them to operate under the agent's M-PESA agreement…evolved in large part to accommodate merchants who could not meet Safaricom's agent criteria but who wanted to act as agents" (ibid. p.50).

Thus, as shown in Figure 7.3(b), 'master-agents' like Mary took the role acting as an intermediary to sub-agents. Master agents provided float management, in exchange for taking a cut of the sub-agent commission (usually 20-30%) (Flaming et al. 2011).

In sum, the way the two sub-sectors changed led to similar outcomes, embedded micro-enterprises close to low income users became more integrated into networks, but how this occurred is different related to the network types.

In the handset sub-sector, firms *bridged* between the designed networks of the branded suppliers and the emergent networks that already existed. In the M-Pesa sub-sector, where growth was limited by lead firm control, it was only when agents became intermediaries, and allowed sub-agents to be *decoupled* from lead firm requirements, that more aggressive growth was possible. Thus, aggressive growth can be seen in some senses as principally 'service delivery' and business model innovation that enabled embedded firms.

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[61] It is an open question whether this new emergent structure was officially sanctioned at a regulatory level. As subcontracting arrangements grew in M-Pesa it seemed to be an open secret, but in research we could find no evidence that such hierarchical models were officially approved until they were announced in the later aggregator model stage. The most likely scenario is that the demand for agent growth, in hand with the effects of the political problems in Kenya at the time (the need for M-Pesa to be more locally directed during the crisis), and with state attention focussed on more pressing political issues, that it was in all parties interests' to let this emergent change continue.

Innovation forms

This change in forms of network links to adaptations in innovation. Firstly, innovations needed to be refined to fit better with these new network forms, particularly with reference to low income focussed micro-enterprises. Secondly, as innovations reached lower income users, non-lead firm actors pushed potential new adaptations and practices to be considered by the lead firms.

In terms of the new networks forms effecting innovation, two illustrations of micro-enterprises illustrate how as networks changed in the aggressive growth stage, forms of innovation, aligned to work with previous network forms, began to mismatch.

> ***Naicom (part 2)***
> *As outlined previously, Naicom was a mobile handset wholesaler. Initial growth came from being part of the emergent channels of handset delivery and undercutting the 'designed' retail channels.*
>
> *However, in line with the descriptions of direct rollout and aggressive growth, the store manager described how her store had encountered a number of issues of trust in device quality from informal channels during direct rollout. With the emergence of new 'dedicated distribution' Naicom quickly moved to supplying branded handsets, allowing them to supply more reliable service to their retailers and customers. This was particularly crucial for Naicom whose network of clients was becoming increasingly more complex revolving around transporting boxes of handsets into sellers in rural areas, where faults were very inconvenient to deal with.*
>
> *Thus, using dedicated distribution had much improved running of the store. Nevertheless, in this new form of supply Naicom was still encountering a number of problems. This particularly related to problems that came from its intermediate position as a wholesaler.*
>
> *As outlined by the manager, some relationships with the dedicated distributors were problematic due to the issue of warranties which work in unexpected ways. For example, with one dedicated distributor, selling to Naicom counts as the final sale and so warranties begin when phones are sold to the wholesaler. Handsets with short warranties can thus become invalid, even before the phone has reached the final sale.*
>
> *In another case, due to the rapidly fluctuating costs, refunds for faulty good from dedicated distributors are only paid at the present retail price of the phone. The manager recounted how in one case, where her store had received a batch of malfunctioning phones, she had made quite large losses on returning them.*

A more recent problem that Naicom has encountered was sudden price slashing, where certain mobile devices become undercut by competitors without warning. This was resulted in some stock unexpectedly loosing their value, resulting in large losses[62].

Thus, whilst dedicated distribution has clearly improved reliability of mobiles that Naicom sell making it easier to run the store, the daily headaches of dealing with the dedicated distributors is still problematic.

Michiri

Michiri is an M-Pesa sub-agent located in a kiosk on the edge of a slum area 10km from central Nairobi.

During discussion with Michiri, we noticed that he was turning a large number of customers away during the interview. When asked he outlined that he was waiting for float. (As outlined previously, when an agent has too many customers wanting to convert e-cash to cash, then eventually they hit float problems where the amount of cash float dwindles).

The problem for Michiri was that float balancing was done by his master-agent who insisted on sending a staff member to the sub-agent kiosk to bring cash and physically undertake float balancing. This is a typical way that float balancing was done in early M-Pesa, particularly when there was low trust in a sub-agent. In such scenarios the master-agent takes this approach to minimise the sub-agents handling and transporting of cash.

However, even with calls from Michiri, the master-agent had become very slow to come to do the float balancing. According to Michiri, the Master agent had grown large and had to now manage around 15 sub-agents around Nairobi and its' outskirts, and this made float balancing duties inefficient.

At the time of the interview, Michiri reported he had already waited 1½ hours, turning quite a large number of customers away from the store, and this was a common occurrence that was reducing his volume of customers.

Waiting for float is a common phenomenon to observe, particularly for less advanced agent franchises which have not adopted some of the later M-Pesa adaptations in service.

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[62] In later discussion with a dedicated distributor, this price slashing was revealed to be related to how dedicated distributors and/or very large wholesalers are increasingly rewarded by the branded handset sellers according to achieving a sales goal in a month. For such firms, end of month dumping of mobile devices is often worth the loss in order to achieve the reward from the specified sales goals.

Here are two examples of how elements of innovations customised to previous forms of networks were not well aligned with new structures. In the case of Naicom, warranties and incentives are still structured for the designed channels without consideration to what this means when they are supplied to micro-enterprises and other intermediaries in emergent channels, and this results in detrimental outcomes for service. In the case of Muchiri, the old ways of doing float balancing have become increasingly inefficient in the new sub-agent structures of aggressive growth. This highlights that innovations need to be refined for these new networks forms which reach low income users.

In the handset sub-sector there is little evidence that there has been such lead firm adaptation, and confusions surrounding warranty, repair, prices and legality of certain activities can still be said to be limiting. In the M-Pesa sub-sector, there has been more of a response, with lead firm adapting elements of innovation to new networks through what might be described as 'scaffold'. The float balancing case above is particularly illustrative. As the sub-agent model emerged and old float balancing approaches became problematic, Safaricom adapted service forms to allow float balancing by adding 'super-agents' actors into the network. These were typically banks that allow agents the ability to undertake float management more autonomously without having to always rely on their increasingly busy master-agents[63]. Although such scaffold has sometimes been slow to be adopted by less advanced agents, such as in the case of Michiri above, they can be seen to have generally been successful in supporting the service innovation led by these non-lead firm driven changes in network.

The second innovation form links to aggressive growth and the subsequent push of innovations towards lower income users. In these sub-sectors, this has led to adaptations emerging outside the lead firm that envisage how such innovations might be better adapted by low income users. In both sub-sectors these have been outlined in some detail in the previous chapter. In the handset sub-sectors, this particularly comes from a combination of the novel Chinese phone adaptations for low income users, and adoption of these models in the low income focussed channels that has led to new directions of competition. In the M-Pesa sub-sector, as the service was increasingly used by low income users, a number of 'use changes' were found which related to alternative potential service uses as shown in Table 6.2. As outlined

[63] In the research, this change had significant positive effects on smaller sub-agents located in poorer areas connected to the dramatic expansion of banks focussed on poor communities in Kenya, particularly Equity, Co-operative and Family banks (FSD Kenya 2009b).

previously, Safaricom has done little to refine service limitations or structures of their innovation to enable wider growth of these innovations.

To sum up, the aggressive growth revolves around a focal role for actors other than the lead firm; emergent service innovation or ideas of new directions for low income users are often led by informal actors. Such adaptations if they are supported can become central to service delivery to low income users.

Thus, in this stage, it can be said that some 'reverse' flows exist around innovation. This refers to how elements of non-lead firm innovation are adopted by lead firms. In the M-Pesa sub-sector this relates to the service delivery adaptations around the sub-agent model made by dealers and agents, which become a core part of M-Pesa distribution models. In the mobile handset sub-sector, dedicated distributors increasingly imitated aspects and forms that mirror those of the emergent networks.

Lead firms have dual responsibility here. First, to provide a viable framework for a move of the 'locus of innovation' away from the lead firm towards other network actors without being detrimental to the innovation quality. Secondly, to be ready to both respond where socio-technical mismatches of existing service emerge and to be responsive to reverse flows of innovation – supporting useful flows and adaptations in the system by supporting micro-enterprises and building scaffold when necessary.

7.3.4. Standardisation

Standardisation was found to occur in both sub-sectors, where lead firms attempt to simplify networks. This occured where networks and activities are perceived as becoming uncontrollable by lead firms or policy makers, detrimental to the wider business goals of large firms within the network, or moving towards the borderline of regulations.

Standardisation in these sub-sectors particularly related to those non-lead firm actors who following the aggressive growth stage were more closely integrated into networks. For lead firms, the actions and adaptations of such actors could be seen as dysfunctional or complex to manage requiring some optimisation in the configuration of networks. Thus actors, particularly lead-firms, seeks to reign back certain activity in the innovation system by introducing new requirements which can be seen to make system activity more predictable and consistent (hence this stage is termed standardisation)

However, in the case study, this stage is problematised in term of inclusivity. Whilst the form of innovation objects and services does not dramatically change from the perspective of low income market, innovation processes become narrower where

embedded micro-enterprises face increased risk. In the long term this reduction in inclusivity of process poses risks for continued evolution and relevance of services and innovations for low income users, with lower ability to adapt to changing needs.

Network forms

Whilst the aggressive growth meant that some handset suppliers integrated with the informal channels through dedicated distributors, relations between the more planned and emergent networks remained fragile. Multiple handset suppliers interviewed made remarkably similar sentiments about these channels particularly the informal wholesalers and mobile sellers.

> "*[on wholesalers]*…they are a necessary evil. We would prefer not deal with them…But they are the ones who give credit relations into the wider industry".

> "*[on informal retailers]*….this involves large scale avoidance of turnover tax, income tax, PAYE – the system is very informal and borderline illegal".

> "*[on wholesalers]*…mobile phones are an easy way to launder money. As you know, most distribution is done by Somali's. This is why many of them have become big so quickly" *[here implying some link into Somali piracy]*.

Thus, even after elements of aggressive scaling have led to increased inclusion of informal channels, lead firms often see these channels as unnecessarily complex and problematic, with a goal to optimise them.

In the mobile handset sub-sector, this was justified around the rhetoric of illegality in informal channels, particularly focussing on Chinese imported counterfeit phones. Following the writing into law of the 2009 Anti-Counterfeit Bill in Kenya (GOK 2008), the main outcome of standardisation was high profile anti-counterfeit raids, mainly on micro-enterprise and wholesalers during 2010, and again in late 2011 subsequent to the fieldwork (CIO East Africa 2011). This stage is ongoing, with increased anti-counterfeit advertising, and at the time of writing a draconian counterfeit phone 'switch-off' enforcement, which has reportedly barred over 3 million phones at a network level[64] (generally Chinese and generic phones from informal channels) (wa Chebusiri 2012). These legislative activities have been very much driven by lobbying of the handset suppliers, with firms supporting the financing of training of new anti-

[64] This occurred through blocking phones with incorrect or no IMEI (International Mobile Equipment Identification) codes. This ID is unique to phones and transmitted on connection to mobile cell towers. Some Chinese firms have a tendency to not correctly assign IMEI to their phones due to the additional cost that this process accrues.

counterfeit and custom officers, and involvement of these firms with local police during anti-counterfeit raids.

In one sense the anti-counterfeit legislation and associated activity has been effective, pushing some Chinese firms to become more 'official' as outlined in the case of Cloud Com below.

> ***Cloud Com (part 2) & Swift***
> *As outlined in the previous chapter – Cloud Com is a large Chinese mobile firm selling low cost phones into Kenya.*
>
> *The firm operational manager, Yang was particularly keen to emphasise the legitimate nature of Cloud Com. The interview was undertaken from their new and plush branded offices in Nairobi, and Yang outlined how Cloud Com whilst still supplying to the informal channels had also themselves started to supply phones into more formal retail stores, as well as increasing their advertising spend, particularly on prominent billboards. Thus, whilst informal channels were still the main focus and money making source, more official activity was growing, giving CloudCom an air of respectability.*
>
> *However this has not always been the case, as was revealed when talking to the operation manager of Swift, a firm which can best be described as a Chinese middleman, importing multiple Chinese brands into Kenya and selling them into the market. Swift is an extremely low profile company, mainly because it is one of the firms which deals in counterfeit and Nokia branded 'fake' phones in the market.*
>
> *Ironically in discussion, Swift's operational manager outlined that in previous years his firm had been the official importer for Cloud Com, and this firm had previously been very similar to the other more questionable Chinese brands that his firm supplied.*
>
> *It was only in the previous two years, that they changed their track, becoming closer in form to the branded suppliers, and employing one 'dedicated distributor' as their main point for sales in Kenya.*

Thus, CloudCom can be seen as an example of a previously less legitimate firm who had responded to such standardisation through a focus on reliability of phones and instigated marketing and branding, clear warranties and after-sales service centres[65]. However, this positive outcome represents at most 5 or 6 Chinese firms.

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[65] This is not solely a Kenyan situation, there is evidence of Chinese firms are experiencing parallel standardisation campaigns in other developing countries. For instance, evidence suggests the rise of similar elements occurring in Nigeria (Aginam 2010), and India (Foster 2010). Thus for some firms widespread legitimisation can be seen as a potential global solution to this global problem.

The majority of others (estimated at around 40-45 of varying sizes by one manager) have not simply packed and left, but morphed, still supplying phones into the less affluent channels, but their activities and products becoming more fleeting and invisible. A number of the operational actors in such firms were interviewed, but it was rarely from an office. Such Chinese firms operate from cars, or are located in unmarked offices in anonymous buildings doing business through mobile phones calls. During one attempted interview with a Chinese firm, having painstakingly tracked down the office to an unmarked door in an empty tower block in Nairobi, on request for an interview the firm employee refused, sternly demanding to know how we had been able to locate their office – we left promptly!

One cannot deny that problems exist in this informal network of sellers, but the outcomes of standardisation are open to question. Networks, including crucial network intermediaries have been marginalised, but they have not gone. Rather the networks have become more complex and unmanageable, entirely the opposite to the goal of standardisation, as outlined in Figure 7.4(a).

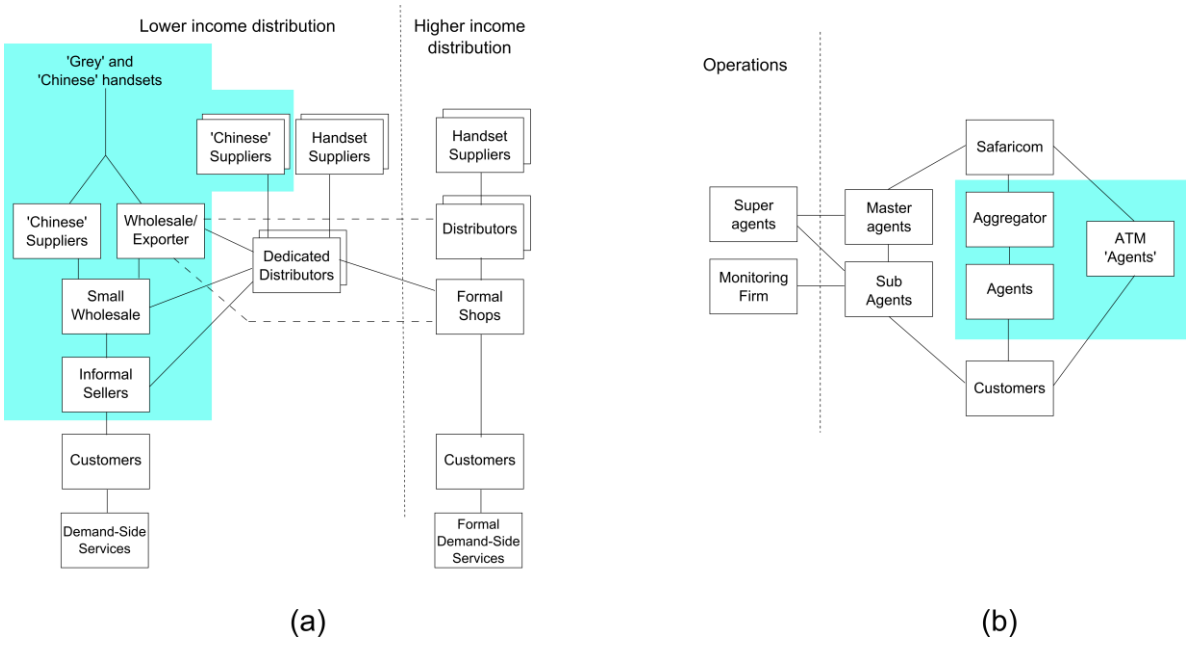

Figure 7.4: Network structures during standardisation.
*(a) Mobile handset supply and (b) M-Pesa. Blue highlight indicates change from previous stage (in Figure **7.3**).*
Source: Authors fieldwork.

In the standardisation stage of M-Pesa, standardisation connected to the feeling that the sub-agent model was becoming problematic in terms of management and control, as described by the M-Pesa manager who recounted a number of issues:

- Some master-agents were seen as increasingly unprofessional in their activity (i.e. moving their agency location without approval).

- Growing complaints about poor quality of sub-agents were seen to stem from poor selection and training by master-agents (i.e. sub-agents struggling to manage float).
- Dissatisfaction of sub-agents with some master-agents, with some sub-agents having been cheated by their master-agents out of commission revenue.

Thus Safaricom instigated a new network structure called the 'aggregator model'. This was an attempt to manage complex agent relationships more professionally. As shown in Figure 7.4(b) the aggregator model follows a broadly similar hierarchical structure to the previous sub-agent model, but there was a reduction at the top-level from hundreds of 'master-agents' previously to just 8-10 'aggregators', who would take increasing professional responsibility for selection, quality monitoring and training of their agents each taking responsibility for 2,000 to 4,000 agents each (Mas & Ng'weno 2010).

However, as shown in the dual forms displayed in Figure 7.4(b), standardisation has not fully succeeded. During research it was unclear how fully the aggregator system had been implemented. According to interviews and firm documentation, the change was supposed to take 6 months to occur, but during fieldwork 18 months later, the process was still ongoing. Whilst some agents interviewed had migrated to a new model, many remained as sub-agents, particularly smaller agents, suggesting that two different network structures were uneasily overlaid at present[66].

This slow change can be connected to the plight of the former master-agents where sub-agent commission in the new model would migrate to the new aggregator agents. Further the presence of reciprocity between master and sub-agents in the sub-agent model, as detailed in the previous chapter, questions whether agents would have the ability to 'go it alone'[67]. In this new model, like the handset sub-sector, there is certainly some veracity of Safaricom's complaints regarding problems with networks during aggressive scaling. However, one can argue the approach that Safaricom has taken in the standardisation stage is misguided, with the new strategy pushing towards more top-down organisational structure and detrimental to agents in that it breaks the crucial (albeit sometimes problematic) relation between the master and

[66] The M-Pesa manager interviewed sidestepped questions about this issue, claiming it was 'not his area of focus'.

[67] The new aggregator system requires sub-agents to provide deposit and float, reported to amount to 200,000Ksh (~$2000), and this would likely be prohibitive to many of these agents particularly as per agent profit is now declining.

Safaricom was aware of this barrier and has attempted to reduce this through a specially designed loan scheme , *M-Pesa Agent mkopo na KCB*, (M-Pesa agent loan with KCB) in partnership with KCB bank, a loan for sub-agents to build float, pay for equipment or upgrade a location to become an aggregator.

sub agent that were key to aggressive growth. Even from the perspective of Safaricom, at the time of research, the restructuring had not been effective with dual networks existing in tandem, making the network and structure even more complex and difficult to manage.

Innovation forms

What these changes meant for innovation is contrasting between the two sub-sectors. In the handset sub-sector, as shown in the network diagram, standardisation has led to increasingly complex and fragmented firms, where actors in informal channel - handset suppliers and wholesale firms have had to become more fleeting to avoid suspicion and/or raids. Often these firms also reduced in size and started competing with smaller firms (one might think of this as downgrading to survive) – Chinese suppliers acting like wholesalers and wholesaler acting like retailers. This has resulted in increasingly swamped and fragmented market and in terms of innovation, this network reconfiguration has been problematic. Micro-enterprise actors are increasingly concerned about ensuring survival, and a preoccupation in risk reduction strategies and retail tactics was prevalent. Similarly, other intermediaries such as wholesalers who are themselves increasingly squeezed are less able to engage in relationship building, which had previously been essential to growth of embedded micro-enterprises.

In terms of M-Pesa standardisation pushes networks towards top-down models of delivery. In terms of agents, the illustration of Sammy highlights some the key problems that emerge with this.

> ***Sammy***
>
> *Sammy is an employee of an M-Pesa agency located in a trading centre 2km away from central Nairobi, inside a corridor/alley of informal businesses. The agent itself has an owner (not interviewed) who is part of an aggregator, with kiosks spread throughout Kenya.*
>
> *The store is relatively new, only one year old with Sammy having been working in the agency for eight months. He is from a small town, 4 hours away towards the coast. He recently finished secondary school, and achieved good grades but does not have the finances to go to university. Thus, he came to Nairobi looking for work that might allow him to save to achieve his goal. He got the job working in M-Pesa through the owner who he knows through his church congregation.*
>
> *There is a high level of risk for the job he is doing; and whilst in the daytime security is fine due to the volume of people and presence of a security guard in the corridor, at the end of the day his store tends to be heavy with cash deposited by local traders, which he sometimes takes to his home for safety, enduring a high risk*

night time journey transporting significant funds. In this area there is also the risk of financial losses through fake money, robbery and scams. In the early days of his job for instance, Sammy was scammed by a fake SMS to handover 5,000Ksh ($60) that was deducted from his pay.

Sammy can be seen as typical of many of the 'new' agencies opened in the post-standardisation period. He is an employee, but he effectively runs this agency completing an average of 100 transactions a day with little input from the absent owner Sammy shoulders the risk and reaps very little reward from the situation. It is fair to say that whilst Sammy has grown to be a well trusted agent, he is not altogether happy both with the job, having one day off a month and needing to work 12 hour days for only moderate pay. However, as the financial barriers to starting his own agency have become steadily more costly in the aggregator model, there is no hope of this for those with such a low income.

Indeed, in a short online discussion post-fieldwork, Sammy recounted that the M-Pesa kiosk eventually closed down - "we ran out of money" - and implied that a saturation of M-Pesa kiosk in the area was the downfall. Sammy himself moved on to work in a less secure job in the tourist industry.

As outlined in this illustration, agents reported an increasing loss of control from the aggregator model, and feeling less empowered in their relationship with Safaricom. Further, with saturation beginning to occur in many locations, there was now little room for agent growth through adaptations and expansion. This can be seen to have a negative effect of innovation, effectively bringing the locus of innovation closer to the lead firm, where innofusion roles became more limited. Aggregator model agencies were left 'ticking over' often by absent owners, employing young unemployed at low wage to run stores who simply followed the now standard rules of engagement. Even if some forms of innofusion are undoubtedly still occurring (such as M-Pesa 'use changes' documented in the previous chapter), reverse flows of innovation are more limited where the lead firm is more disconnected from daily operations.

As innovations move towards less affluent groups, it may be inevitable that elements of innovation and innovation systems need to be standardised to allow sub-sectors to be more efficient or manageable. But, standardisation as shown in these cases is problematic. Firstly, a number of the standardisation approaches have simply led to avoidance strategies by firms within the respective sub-sector, and this has mapped to greater (not less) difficulty in managing and guiding these networks. Secondly, the outcome of standardisation has resulted in increasingly precarious environments for non-lead firm actors, whose position in innovation systems becomes more marginal. These changes led to less of a circulation around innovation (and response by lead

firms), and this is likely to be of detriment to the long term aim of innovation driving towards lower income customers.

Standardisation can be seen to be detrimental to the inclusivity of innovation in these cases, both in terms of both how innovation-as-objects are adapted towards low income groups, and how innovation-as-a-process aids low income actors. Standardisation has weakened relationships which have supported embedded micro-enterprises, and in some cases reduced the viability of micro-enterprise actors

7.3.5. Summary

This work shows the general changes in the nature of innovation as innovations emerge, and how emerging networks of innovation become increasingly more complex as innovations grow.

Taking a comparative perspective on networks which focussed on the role of ICT micro-enterprises and other intermediaries has revealed significant insights, as outlined in Table 7.2. In each stage, it is possible to argue that inclusive elements of innovation tends to be more apparent where there is a balance between appropriate lead firm activity, and non-lead firms activity.

In *scoping*, comparative work highlighted the differences between the two sub-sectors. Inclusion of low income users in the trial and networks, and clear feedback to drive innovation propositions has been a successful approach, whilst other more ad-hoc and in-life attempts to build relations have had more limited success in terms of their focus on low income groups.

In *direct rollout*, good operational relations into networks serve as the 'eyes and ears' that allow firms to modify and problem solve and stabilise innovations as they are rolled out into wider populations, but in the long term may limit the ability to truly push to low income users.

There is evidence in the move from *direct rollout* to more *aggressive growth*, will likely relate to a some reverse flows around innovation where emergent systems activity is more widely adopted, and lead firms support these flows[68]. As can be seen in these sub-sectors, response related to 'scaffold', and contrasting adaptations of network structure and actors which enhanced and legitimised more emergent innovation structures and how ICT micro-enterprise were supported to better undertake embedded innofusion activities, as outlined in the previous chapter. Thus, such

[68] Such changes can also seen to be somewhat driven by outside policy activity, which is dealt with in the next chapter.

adaptive processes allow innovative tactics of micro-enterprises within the network to become a wider part of lead-firm innovation strategy, as knowledge or appropriation tactics are taken up and supported by the lead firms.

Whilst lead firms 'drift' according to innovation in aggressive scaling, *standardisation* is about lead firms taking more control and bringing these networks and actions into more formalised and standardised settings, and removing undesirable elements of emergent networks. However, problems highlighted in both sub-sectors suggest that what lead firms see as 'undesirable' or 'difficult to manage' elements of networks, are often crucial relationships and actors for inclusive innovation. Thus, from this case there is evidence that standardisation links to risks of divisive changes and reductions in inclusive innovation particularly where lead firms have inadequate operational understanding of the networks of innovation in their sub-sector.

In the next section, drawing on the outcomes the systems concept of user-producer interaction is used to more coherently outline an understanding of how network relations can both enable and inhibit innovation amongst low income actors.

Stage	Exploratory Scoping	Direct Rollout	Aggressive Rollout	Standardisation
Corresponding period(s) in M-Pesa	• Pilot (iteration 1) • In rollout (iteration 2)	• Incremental scaling (it.1) • Functional scaling (it.2)	Aggressive scaling	Standardisation
Corresponding period in handset sub-sector	Ongoing user research	Localisation	Regional competition	Standardisation
Network relations	**Exploring Relations** • M-Pesa - inc. relations with network actors • Others - one-off, assess tech needs	**Designed relations** Core relationships to existing actors.	**Emergent system** • Growth of new actors in networks. • Networks have more autonomy	**Lead actors simplify system** • Modify relations • Removing 'inefficient' actors
Nature of innovation	**Co-production processes** Adapting innovation from scoping activities and/or needs found in scoping	**Lead firm led** • Adapting for scale, using network help troubleshoot and solve problems • Use network relations to build awareness and acceptance	**Network driven** • 'Reverse' – network driven service delivery and socio-technical innovation • 'Top-down' – Lead firms support and enhance adaptations	**Maximising innovation** • Absorbing innovations from previous stage more coherently into core systems • Looking for new directions of product innovation
Successful lead firm tactics in cases	**Adaptive trial** • Genuine BoP trial • Modifying innovation in scoping	**Scaling innovation** • Aware of operational issues, adapting innovation • Marketing, acceptance	**Drift** • Allowing independent network and innovation • Spotting adaptations and aiding growth	**Optimising innovation** • Risk of avoidance and complex networks

Table 7.2: Staged summary of ICT innovation.
Source: Authors fieldwork.

7.4. User-producer interactions

The previous sections analysed the growth of networks and the impact on innovation by drawing on the two different sub-sectors in the mobile phone case. This comparative work has provided important insight into aspects of innovation and network relationships: the general nature of emergent networks as innovation grow, the links between network forms and innovation, and some knowledge regarding approaches of lead firms with respect to these processes.

However, as systems models have shown, and supported by this case, networks develop in highly idiosyncratic ways. It would thus be useful to go beyond this empirical driven understanding to build a clearer analytical perspective of the links between networks and innovation. Such work can provide insight into the second research question of this thesis (regarding the links between networks and innovation), and make more explicit how actors, particularly lead firms might proceed in terms of actively managing such networks as part of innovation strategy.

Lundvall's work on relations and particularly his concept of user-producer interactions is used to provide a clearer understanding of the link between network relations and the forms (and limitations) related to innovation. First, innovation direction is examined through reference to the linkages, particularly in understanding how we can define the general nature of relations in such systems where actors are not necessarily directly connected. Secondly, the work looks more closely at specific features that enable interactive learning flows through expanding a discussion of user-producer interactions for these cases.

7.4.1. The nature of relations and innovation risks

As introduced in Chapter 3, the notion of organised markets highlights the importance of relations to innovation (Lundvall 1988). Innovation is inherently an uncertain activity both on the supply-side (in terms of producers understanding user preferences and needs of innovation) and demand-side (in terms of users understanding utility of new innovations). When firms operate in markets, relations are positioned as a solution to these problems enabling knowledge and learning flows between users and producers[69].

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[69] It is useful here to clarify the term 'user' within user-producer relations related to the case.

Lundvall(1985 p.5) uses the term 'professional user' to justify examining a 'non-consumer' user in his work. The two reasons for this is that like consumers, such users still reflect demand, through identifying and having specific goals, needs and activities. However, unlike a consumer, such users are more active players in searching for, articulating, appropriating and using innovation.

(cont)

In these low income markets the importance of user-producer learning through relations remains vital in how innovations and markets mutually adapt, but the way that they are manifested is somewhat different. Conceptualising relationships in low income focussed innovation systems requires different approaches where there are few innovation producers and many small, and often sporadic user-focussed actors linking into low income markets. This section particularly looks at how one can categorise the general nature of these relations given the indirect nature of user-producer links.

Drawing on the case study it is argued that the key to understanding relations is an analysis of elements of managerial and technical control in supply chains, the monitoring, training, malleability of ICTs and disintermediation that assert control in indirect ways in supply chains.

Predominant forms of learning and innovation can be connected to the level to which such elements allow or inhibit adaptation of innovation and interactive learning. In the case study, these elements are linked to innovation through highlighting the way that such elements lead to specific modes of learning and innovation, and also the varying risks in 'unsatisfactory innovations', where "innovative activities and technological trajectories deviate systematically from user needs" (ibid. p.356).

Producer dominance

The M-Pesa sub-sector was characteristic of relations that risked learning verging towards producer dominance. In such a scenario "user-producer relationships are characterised by strong dominance of producers" (ibid.). Relations push away from organised markets towards increasing hierarchical top-down flows.

In more conventional user-producer interaction models, such producer dominant relations are articulated to emerge out of financial and technical knowledge differentials between users and producers within relations. This differs from this case study where producers, being more disconnected from users, asserted dominance through increasing number of elements of managerial and technical control, where the tight rules and threat of being ejected from the network pushes dominance. Thus, relationships of producer dominance were principally manifested through different

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Here, ICT micro-enterprises are argued to closely follow Lundvall's own approach on users, if you like a 'close and active intermediary to users'. Like Lundvall's 'professional user' they still reflect demand of the consumers who they interact, whilst being more active player in innovation compared to consumers.

Thus, in this chapter the notion of user-producer interactions refers more to the micro-enterprise to producer link than necessarily to the end-customer.

aspects of service structure such as training, rules and regulations, activities being constantly monitored etc.

In line with the literature, such dominant relationships lead to learning coming in 'deliberate' knowledge transfer activities through networks, but producer dominance also risks a one-way top-down flow of learning (Pietrobelli & Rabellotti 2011). In the M-Pesa such learning can be seen in agents who tended to focus on new features, rules and edicts related to the supply chain, broadly mirroring the literature. Producer dominance risks were also observable, for example in the small leeway for agents to engage in forms of locally appropriate innovation, encountering standards, norms and rules which guide or limit the potential of any adaptations as has been outlined previously. Even when agents did find gaps to produce adaptations within frameworks set by such relations, the dominant structure precluded and clear flow that interactive learning occurring through supply chains.

The general nature of relations which defined risks of dominance in these elements of managerial and technical control suggest that inclusive approaches to innovation might look to solutions around reducing or dissipating checks and balances on demand-side actors to reduce dominance and allow some freedom for adaptation to occur[70].

Such an approach was supported in the M-Pesa aggressive growth stage where more inclusive innovation emerged when relationships into demand-side actors were loosened through the sub-agent model. This allowed better viability for embedded micro-enterprises and some 'reverse' flows around innovation where dominance was reduced by dissipating some technical control and demands on low income focused agents. This provided some more leeway to act, with less oversight from the lead firm, and thus activity moved away from the previously outlined 'unsatisfactory innovations'.

Pure markets

The handset sub-sector was characteristic of 'relations' that risked being completely disconnected. Lundvall has highlighted that in *pure market* scenarios, relations are based upon prices only. In terms of innovations these social relations move away from organised markets where "producers would have difficulties in observing new user needs, and users would lack qualitative information on the characteristics of the new products" (Lundvall 1992c p.50).

[70] Whilst acknowledging that innovations will inevitable need some checks and balances.

Lundvall's work, offers no examples of such scenarios, seeing pure markets around innovation as an academic construct that would not occur in real life. However, in the informal channels of mobile handsets, where networks from producers to users were found to be quite complex, interchangeable and heavily disintermediated, user-producer interactions as an aggregate can be seen to approximate this scenario.

In such networks, learning has been theorised to come only through spillover effects and imitation, rather than directly through these networks and this links to the findings in the handset sub-sector (Pietrobelli & Rabellotti 2011). There was only sporadic direct learning between the producer and user due to a lack of clear channels for interactive learning. This was illustrated in how lead handset firm learning about micro-enterprise actors and conditions was slow. For users, disconnected user-producer interactions meant that ICT micro-enterprises struggled in identifying the quality of goods connected to relations. Thus, micro-enterprises learning and innovation emerged not from networks, but from other directions, from local market and process adaptations, where slow diffusion of tactics through micro-enterprise imitation and movement of local micro-entrepreneurs were characteristic with less clear reverse innovation flows.

In markets the presence of social relations was theorised to make up for uncertainty in transactions around innovation. However, the handset sub-sector where markets *and* high levels of disintermediation occur organised markets push towards 'unsatisfactory innovation' of pure markets. This suggests that such problems might also be reduced through approaches that support a better build-up of social relations between users and producers.

This is indicative of the processes that occurred during the aggressive scaling stage in the mobile handset sub-sector, where dedicated distribution forms can be seen to have disintermediated relations and improved user-producer interactions providing at least some better knowledge flows between users and producers.

Summary

Here, the general nature of relations has been positioned in terms of the indirect elements that push or dissipate control in supply chains. It is these elements that define the nature of relationships and consequently provide insights on modes of learning and risks to innovation.

One can argue that the contrasting relationships in these sub-sectors links to inherent characteristics of the ICT used, external conditions and actors present[71]. M-Pesa's is a centrally controlled ICT service; the nature of financial transactions and strict regulatory requirements inevitably supports growing elements of technical control in networks. Further, given the important role of agents in hand with the complexity of local service requirements suggests strong oversight as a natural outcome of service conditions. Therefore, more increased monitoring and control are inevitable in some senses from such a combination of factors.

Similarly in the mobile handset sub-sector, mobile phone handsets are seen by lead firms as innovations to simply be retailed downstream, and as technology objects rather than services. Thus, there are fewer needs for checks, balances and regulations than M-Pesa. Further, in Kenya the historical existence of importing specialism in Somali and Indian communities has driven increasingly reconfigurable and intermediated relations in informal channels.

Thus, it is argued that underlying nature of relations and hence the risks for unsatisfactory innovation are likely to be somewhat set in stone. However, as emphasized in both sub-sectors, 'unsatisfactory innovations' are only risks, they are not inevitable. As highlighted in the respective aggressive scaling stages, actions to refine the nature of relations have considerable effect on learning and innovation in the system.

7.4.2. Specific components of relations and innovation

As introduced in Chapter 3, interactive learning perspectives revolve around user-producer interactions that allow commonality of knowledge and learning between user and producers through more dense interactions, and better channels and codes between users and producers (Lundvall 1988).

Work on user-producer interaction has thus also focussed on some more specific aspects of relations that are hypothesised to support interactive learning (Lundvall 1985, Lundvall 1992c):

- *Sophistication of demand* relates to whether users articulate new needs, which when transmitted to producers can drive learning. For producers, appropriate sophistication in articulation is vital to ensure that they gain knowledge of how to adapt innovations for specific users.

[71] One well supported in wider literature examining the underlying nature of innovation networks and in systems of innovation notions of 'path-dependency'.

- *User capability* relates to users being able to equitably link in user-producer interactions. Capabilities has mainly been positioned in terms of alliances of mutual trust between with user groups, who can serve as a focal point of interactions and be a clearer fulcrum of user-producer signals on the demand-side (such as user groups or intermediaries).
- *Distance* in user-producer interactions has been argued to be a critical feature of user-producer interactions in a number of interrelated domains: geographic, cultural, and organisational distance. In terms of geographic distance, closer connection can allow more interactive links. Such issues can relate not only to geographic distance but also cultural distance, where cultural similarities and connection can serve to build clear mutual understanding between users and producers. Finally, organisational distance relates to how producer firms vertically integrate elements of networks which will effect where and how learning occurs between actors.

These directions provide a logical way of examining specific elements of relations (clear user needs, user voice, and user links). Again, it is not doubted that such elements can enable interactive-leaning in low income innovation systems, but given the nature of systems in this case, specific manifestation may diverge. Thus, those elements are linked to findings from the two sub-sectors. Specifically they provide insight in terms of the position and activities of micro-enterprises within networks of innovation.

Sophistication of demand

In low income markets, the notion of 'sophistication of demand' might better be repositioned as 'tracking complex low income demand'. As shown for instance in the M-Pesa trial, receiving the appropriate demand signals from users and the ability to adapt will emerge where low income users and genuinely linked to, and tracked. Both sub-sectors also highlighted that this demand will emerge not only from users themselves, but from presence of intermediary networks whose entrepreneurial activities are crucial to building demand from innovations. It is not only a case of tracking users, but also including micro-enterprises and other intermediary roles in these processes.

Demand is also 'articulated' in different ways in this case. Where innovations have reached low income groups, user-producers networks tend to be delinked by at least one or two intermediaries. Thus, low income demand is generally signalled in the ways that innovations are used and socio-technically adapted within local markets as outlined in the case study.

This implies that an extra element of demand sophistication will relate to how able non-lead firm actors are to adapt innovations to reflect demand. In these sub-sectors, this particularly relates to: the skills of micro-entrepreneurs; the conditions and constrains under which micro-enterprise operate, which limit their adaptations; and the malleability of innovations which can put adaptation beyond the skills of micro-entrepreneurs.

Thus, sophistication of demand implies a set of desired interactions, learning and conditions that can allow micro-enterprises to become more central parts of networks of innovation. These aspects will be closely linked to the general nature of relationships from the previous section (for instance, less beneficial micro-enterprise growth might be linked to more controlled networks will minimise adaptations and use changes). Nevertheless, this aspect highlights further recommendations around nurturing micro-enterprises in order to improve interactive learning.

User capability

Previous arguments about user capability and signals being amplified through demand-side alliances have occurred to a lesser extent in this case where substantive mutual relationships into 'capable' demand-side actors is only sporadically visible.

Intermediaries, particularly those that aggregate a large number of other low income focussed intermediaries or users might become capable or representative users (for example low income focussed master-agents in M-Pesa). However, there is only patchy evidence that these actors have been central to interactive learning.

Even without this, alliances of actors are another set of capable users that might potentially emerge to articulate demand. Some associational activity was found in this case study[72], but respondents who were asked (including respondents who said they were paid-up members) felt that these organisations had had few significant effects.

Thus, this element suggests further recommendations on the demand-side to build more stable and inclusive ICT micro-enterprises. Providing better 'voice', particularly by encouraging associational activity might allow interactive learning flows to be clearer. It may be that in low income innovation systems, there are simply too many disparate actors on the demand-side to be able to have much influence in voicing demands and activities struggle to have much effect, and thus such elements may require further research.

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[72] These included the Safaricom Dealers Association (SDA) and The Association of Mobile Phone Money Transfer Agents of Kenya (AMPHOTRAK).

Distance

In terms of distance, given that the firms examined are in some senses pushing towards low income users for the first time, learning and innovation better emerge from user-producer relations that reduce geographic, cultural and organisational distance.

In terms of geographic distance, direct rollout signals the first stages of growth where firms begin to focus on localising elements of management within Kenya, and as outlined in the case descriptions, in this process producers tend to be more interactive both in their adaptations of innovations for local markets and in their oversight of innovation systems.

The above argument also applies as much to cultural distance as geographic, where closer cultural connection is crucial for producers, in interpreting the often unexpected actions taken by non-lead firm actors. In the standardisation stage whilst geographic distance was reduced, one might attribute some of the decision making in standardisation to a lack of cultural connection between producers and users. Lower cultural distance might help lead firms have better insight about how they could less detrimentally standardise systems when such 'errant' behaviours occurs.

Increased organisational distance in these sub-sectors links to vertical integration and where lead firms have 'sandboxed' low income elements of their businesses or alternatively outsourced elements. These decisions can determine links between user signals and the core innovation decision makers. One example of this can be seen in the outsourcing of monitoring and evaluation firms in M-Pesa. Whilst this reduced the complexity of the lead firm in managing innovation, it also removed a potentially rich flow of user-producer linkage which could be hypothesised to build shared knowledge and interactive learning. This point again relates somewhat to the previous more general discussion regarding the general nature of relationships and innovation, but it makes a more subtle point that producers might closely consider all elements of activity as related to low income users, and what elements are outsourced or integrated.

7.5. Summary

Over time as innovation and innovation systems become more established, innovation may become less susceptible to purposive change (Boudreau & Robey 2005, Hung 2004, Metcalfe 1995). However, in early life there can be more room for activity that can influence the direction of systems (Rip & Schot 2002) as shown in this mobile sector case study.

The five stage understanding underlines a number of crucial activities that occur in innovation systems as they grow - from the initial emergence of interesting innovations, through lead firms driving trial stages and direct rollout, through to the periods where they grow more actively towards lower income users and are later optimised..

In terms of lead firms, it is difficult to be prescriptive for firm activity, but firms can identify the opportunities and potentials for improving relationships for the specificities of networks which can support interactive learning.

Comapartive analysis has built an understanding of how to define the general nature of relations in these systems based around aspects of managerial and technical control in networks, and through this it has been possible to infer some general trends of innovation and risks based upon these elements. More detailed analysis on specific components around relations, based upon user-producer interaction also provided insight on how improvements to relations might link to a more even and clearer two-way interactive learning as systems grow.

Both the underlying nature of relations and specific features, provide insight for actors, but particularly lead firms as to how they might become responsive to lower income markets in terms of innovation. The general features highlight some dangers in misaligned directions of learning as they venture into these low income markets,

In terms of micro-enterprises, this work highlights that non-lead firm activity around innovation is an important factor in inclusive innovation, particularly in how it allow such firms to have room to build locally relevant niches and grow.

The specific features of user-producer instaction provide some more strategic guidance of how to improve user-producer interaction, providing insight into approaches enlightened firms, policy makers or other support organisations might make to support micro-enterprises. Building *sophistication in demand*, can revolve around empowering micro-enterprises which provides a more coherent and stronger set of micro-enterprise firms whilst allowing better signals to be indicted within networks, *associational activity* can contribute to provision of room for such micro-enterprises to survive, and better support wider development of these micro-enterprises.

Evidence from this case suggest that in such local market networks, even some small enhancements of relations can be highly significant in driving growth to such lower income groups. Adaptive relations aid micro-enterprise adaptation, and give firms the ability to capture such adaptations and modify and expand such activity to adapt more

inclusive innovation objects, whilst conceivable providing a better field on which micro-enterprises can survive and grow.

8. Inclusive innovation and institutions

8.1. Introduction

This chapter provides evidence to answer the third research question around policy and ICT micro-enterprises. As first introduced in Chapter 6, it does this by examining inclusive innovation systems from an institutional perspective, institutions here taken to include formal rules and policy as well as more informal institutional norms and cultures.

Such an institutional perspective highlights that policy tends to indirectly link to micro-enterprise. Firstly, policy links to micro-enterprise indirectly by influencing the shape of innovation systems, which in turn have an effect of the role and limitations of micro-enterprises. Secondly, policy is just one element that shapes the institutions of innovation systems, where other institutional elements may support or dissipate policy activities.

In terms policy suggestions, with a few exceptions (Altenburg 2009), there is little analysis in developing countries of policy from the perspective of inclusive innovation, and even less drawing on empirical evidence on the role of policy.

Thus this work builds knowledge in an inductive way, first drawing on Kenyan research to build insights, and seeking to link this into the body of literature on policy for innovation which can ground these insights within more general understanding to provide a clear knowledge of the links of policy into inclusive innovation and micro-enterprises.

The approach in this chapter the approach is to provide some pointers of the general policy instruments that might be prudent to consider related to inclusive innovation systems, whilst highlighting these wider institutional constraints that come from the indirect link of policy.

8.2. Empirical analysis

Initial analysis on the cases from the mobile phone sector in Kenya in previous chapters have already implied that policy has played a role in shaping such systems. Findings that examine the role of policy come from two elements.

Firstly, in the previous chapter, a dynamic 'staged' analysis of the two sub-sectors was produced drawing on research in Kenya, particularly focussing on the growth of emergent innovation systems. In undertaking this inductive work, key 'turning points' were found where new stages emerge, and these could often be linked to policy (or lack of) that have been influential in these turning points. Focus is particularly made on policy elements that have influenced emergence of aggressive growth stages, given that it is at this stage that innovations becomes more inclusive, both as an object and as a process.It is suggested that policy has played a role, both through building underlying regulation in emergent systems, as well as specific policies which support more inclusive innovation and these have thus had an effect on ICT micro-enterprises.

Secondly, as was suggested in Chapter 6, wider institutional analysis in made to examine how policy plays out as innovations reach low income actors. It is important to maintain this wider institutional perspective so as not to underplay other elements of insitutions that can cohere with or contradict such policy related to innovation systems. Thus, beyond policy making, a closer analysis of the effect of policy on innovation intermediaries, particularly ICT micro-entrepreneurs is made. This suggests that there are also policy weaknesses, in this case related to a lack of policy implementation and enforcement that can grow to be problematic, particularly as ICT reach lower income groups. This work links into wider institutional understanding by arguing that where policy is poorly designed, less formal institutions increasingly become important within local contexts and this can have significant effect on the inclusivity of innovation systems.

The terminology of policy in this chapter is positioned as public policy, and viewed as not only laws and legislative rules, but wider courses of action and emphasis including activities of state-sanctioned bodies. This wide net is cast in order to examine the widest range of state influenced actions, in line with the overall objective of building a preliminary understanding of policy for inclusive innovation. General insight is sought, to build approaches that might be useful in shaping inclusive innovation, whether that be through rules, regulations, funding of support organisations or support for global initiatives.

8.2.1. Trajectories and facilitators in innovation for low-income markets

In both sub-sectors, one can see the shadow of the diffusion of innovation models in initial inceptions related to policy. Regulatory interventions, particularly around sectoral regulation and establishing and maintaining competitive markets are the

foundations of the sector: signalling market existence, enabling market entry, and reducing risks.

This enables development of, or access to, innovative technology which is taken up by the 'early adopters' (Rogers 2003): in developing countries generally more affluent users. However, the anticipated S-curve of diffusion does not necessarily materialize because various barriers – including the relatively limited size of the 'middle-of-the-pyramid' in a developing country – mean growth rates remain relatively low.

Beyond regulation, the case looked at three additional directions for policy, and their role in aiding inclusive innovation was examined. These loose areas of policy analyis were drawn from systems perspectives, particularly the specific form of systems introduced in Chapter 6. Given that these low-income innovations systems tend to more readily traverse between innovations and low income demand, both supply-side policy and demand-side policy are of interest. Further, given the crucial role that micro-enterprises have been argued to play inclusive innovation, it is also important to examine policy around micro-enterprises. These four elements are analysed in turn below.

Regulation

As has been introduced in Chapter 5, the underlying sectoral rules and regulations which define the mobile sector have been crucial in allowing a comparatively stable sector to emerge. Establishing mobile market rules and institutions with competing firms underlies the early stage growth of innovation and pushed early adoption. Given the well established discussion in this area (Bowman & Waema 2005, Calandro et al. 2010, Waema et al. 2010, Wanjiku 2009), a detailed examination of best practices in underlying mobile regulation is not a core focus of this work.

However, it should be noted, that findings suggest that regulation is not solely about putting the rules in place and letting thing happen. This is particularly shown in the case of mobile competition which was recounted by one regulator.

> "Our goal is to ensure that competition thrives, but this is very difficult in the current forms of uneven market that exists….For upcoming operators there is the challenge of entering the market in costs...In fact, it is difficult for it not to be an uneven playing field!"

Thus, regulation is not necessarily a one-shot process, it requires continual adjustment, and persistence in such 'uneven markets'. This is particularly illustrated in the mobile money sub-sector, where policy makers have had to actively push

regulation to ensure multiple mobile money firms were able to enter the market to compete with M-Pesa[73] (AFI 2010). This has had some successes. Early competition between M-Pesa and competitor Zain Zap has been seen as one factor that drove the shift of M-Pesa from direct rollout to aggressive growth (Flaming et al. 2011, Mas & Morawczynski 2009). Later, regulators again pushed competition through support for agency banking through new legislation (CBK 2010), allowing banks to compete in this vibrant sub-sector (World Bank 2010). This second wave of competition was a crucial element in shaping the later functional scaling transitions of innovation in M-Pesa around wider mobile banking ideas.

However, it is argued that regulation may not be the sole condition for aggressive growth, as highlighted in the long rollout of mobile handset to low income groups, and in the slow take-up of low income actors to functionally scaled M-Pesa payments. Even where regulatory structures seem to follow good practices, the growth of innovation towards low income users can be slow. This suggests that solid underlying regulation is likely to be a necessary, but not sufficient element for inclusive innovation.

Supply-side policy

In terms of the supply-side, influential policy particularly related to approaches which pushed inclusive innovation-as-object, the mobile handsets and the M-Pesa service forms in these case studies. These innovations have not solely emerged from lead firm's action, but through external support - both financially, technically, managerially and logistically - particularly in helping bring forward innovations in the exploratory scoping stages. These supply-side policies can have both an international element and a national element and mainly related to the role of state-sanctioned bodies in driving inclusive innovation.

The international element was more noticeable in the focus of international bodies in supporting research and development into how mobile phones could be adapted for low income users. For example, one branded handset manager, who had previously worked at an international level, outlined the historical importance of the GSMA's Emerging Market Handset Initiative (EMH) as an example of this, which launched in 2005 in 50 countries. Although this did not include Kenya within its' project, it nevertheless was impactful in Kenya, in certain cheaper and adapted phone models that directly emerged from this initiative, and in how international handset firms began to change their thinking about low income users, increasingly considering lower

[73] During research there were five competing mobile money firms in Kenya.

income users in core processes (such as investing in lower power research and cheaper chip design).

Policies pushing inclusive innovation in Kenya were crucial in the donor supported M-Pesa research. One cannot underplay the importance of the early DFID donor intervention in driving the emergence of M-Pesa. M-Pesa for all the private sector rhetoric that surrounds it, started as donor intervention. One can take insight from the form of this intervention. It looked to initially integrate with capable local partners, private sector firms and NGOs, handing on the innovation to commercial actors as it grew. This research with a specifically pro-poor agenda can be seen as a crucial driver in the emergence of this new service in the market, with an orientation towards inclusiveness from the beginning.

In addition to these approaches, policy makers were asked about the efficacy of supply-side policies that could provide incentives or oblige lead firms to push inclusive innovation themselves. For instance, specific rules within mobile or mobile money licence conditions, or subsidies could drive firms to refine their innovation focus to be more inclusive on such users. However, in this case there was little evidence that such actions have been influential in Kenya. In terms of the licencing rules, a regulator described a lack of such inclusive clauses in current regulation.

> "The old class of *[mobile]* licence used to have roll out targets – but often these targets were very small and were met very quickly by the operators",

Several policy makers also discussed their disappointment at the lack of universal service funds (USF). As a policy expert described,

> "I wrote a proposal in 2004 for the Ministry which outlined an effective universal access fund. But this has had slow progress in launching, it has sat on the shelf! Now they are conducting another survey and forming working groups",

Such funds have struggled to gain any momentum in Kenya, only being substantively instituted into ICT sector rules as part of the 2009 Amendment Act and still only partially implemented at present (Wanjiku 2009). Policy makers have particularly struggled to persuade powerful mobile firms to support such schemes, as reported by one senior civil servant who described how such firms often lobby against such schemes.

> "In the consultative process, groups agree on a common goal but in reality there is often some resistance or one group goes against another",

Demand-side policy

Policy that helps to expand demand, particularly in terms of demand amongst lower income consumers was also found as crucial in growing inclusive innovation. In the case study, the most successful example of this was in policies which indirectly spurred demand through reduced costs of innovation (which particularly affected to low income users). This is most vividly shown in the mobile handset sub-sector, where the removal of the VAT costs in 2009 was a strong driver in mobile handset growth amongst low income users.

For mobile handset firms, the removal of VAT was not directly intended as an innovation policy, it was lobbied for by handset firms as a measure to allow local mobile handsets to compete with grey market imports. However, the indirect effect was a more vibrant local market over time which has driven a reduction of prices in the market, particularly in reliable but low cost branded handsets. As one manager of a dedicated distributor described,

> "VAT has had a huge effect on sales…the day after the new law changed, we sold a whole months worth of devices in one day…since then things have been growing monthly".

This is supported in a GSMA report, which sourced data from Safaricom which showed that "handset purchases have increased by more than 200% since the removal of VAT" (GSMA 2011 p.16)[74].

Whilst it somewhat links back to underlying regulation, in the mobile handset sub-sector demand is closely linked to underlying structures in the mobile market. Here, the active regulator actions on cross-network mobile termination rates[75] have similarly had a demand inducing effect for mobile handsets by making mobile use (and ownership) more affordable. This is something that has particularly preoccupied policy makers.

> "We know from our studies that reducing interconnect rates reduces prices, that is why we don't leave it to the industry….The pure incremental approach *[their current regulation]* has been contentious, and operators

[74] Such VAT reduction, also had an indirect effect on growth through being a driver of the success of dedicated distribution firms, outlined in the previous chapter.

[75] Mobile termination rates set (and gradually reduce) the maximum that can be charged by operators for cross network calls in mobile networks. This approach reduces prices by reducing costs of smaller and emerging mobile operators whose customers tend to be restricted by cross-network prices, and allows them to compete with the large firms. The literature on mobile regulation has generally argued that such termination rates should be based solely on the 'cost', to maximise competition (Calandro et al. 2010). However this has only been implemented in a few developing countries often due to the power of early mobile entrants.

> have threatened court actions. The risk is that this can result in one year delay to get through the courts which is a problem in a changing market".

Thus, termination rate regulation is an ongoing activity and one where policy makers have to struggle hard to get their way. Nevertheless, as the effect on wider mobile tariff levels shows (outlined in Chapter 5), driving increased demand amongst low income user through lower prices has been significant.

In the mobile money sub-sector, similar policies which induce demand through price reduction were not found. However in M-Pesa, a growth in low income demand was partly an outcome of external conditions - the unfortunate adverse conditions in Kenya around the post-election violence. Conditions and examples of use were widely publicised at the time and are generally acknowledged (including in Safaricom presentations) to have pushed increased citizen appreciation of the potential of the service and thus demand, particularly low income groups who were most affected by problems. This is not a specific policy *per se*, but serves to highlight that awareness building approaches to driving demand could also be an effective policy tool.

With this notion of inducing low income demand, policy makers were also asked about other known demand-side policies that might push demand. In particular, in some countries government procurement has been used to support the emergence of early innovation systems. However, in Kenya it was found that such wider demand-side market nurturing approaches had met lower success. One expert in a Kenyan policy institute discussed limitations of government procurement. In general, such procurement has not been successful, as highlighted in an example the respondent referred to in another sector. When the Kenyan government previously looked to outsource vehicle repair and vehicle cleaning to SMEs, almost all SMEs withdrew from the scheme due to the slow bureaucratic nature of payments with SMEs simply unable to afford to wait so long to receive larger payments.

Secondary evidence suggests that similar initiatives around nurturing sectoral systems in ICT have been similarly disappointing with similar problems around bureaucracy.

> "[a]…lack of readily available information on how to compete successfully. Additionally, there is a perception among SMEs that the procurement process unfairly favors foreign firms " (Excelsior Firm 2010 p.14).

> "[with]…onerous application and experience requirements for government vendor selection" (ibid. p.17).

Thus, it is unclear if direct government procurement has the ability to provide demand-side support for emergent ICT sectors and innovators directly due to inefficiencies of such procurement processes.

However, there were some indications that the government had managed to more successfully drive low income demand less directly in similar innovative sectors in Kenya. E-government schemes such as online tax and exam results systems have been increasingly valuable to driving citizens to use informal internet cafes and aided their growth in low-income areas (Limo 2007). More experimental delivery of government supported development projects can also build early demand. For instance, the implementation of large scale social protection projects such as the Hunger Safety Net Program in Northern Kenya, contributed to the growth of branchless banking firms such as Equity Bank in this region (FSD Kenya 2011).

Policy and micro-enterprises

As has been outlined in previous chapters, as innovations increasingly focus towards low income groups, inclusivity links to the ability of ICT micro-enterprises to be part of innovation systems. Thus, from a policy perspective, policy that improves micro-enterprise viability is of interest.

In terms of micro-enterprise viability, much progress has been made in terms of business licencing. During research even the most marginal respondents were found to be aware and displaying their business licences, with many micro-enterprise suggesting that inspectors would regularly check these. This connects with policy reforms towards single business licences, and reducing bureaucracy around small enterprises, and this has benefitted the micro-enterprises researched (FSD Kenya 2009b, Jacobs et al. 2007, Mitullah 2003). The outcome in this case was clarity for micro-enterprises, and a clear rule of law in this respect.

Other crucial small enterprise issues have also supported the growth of micro-enterprises through policy. In interviews with micro-enterprises the majority of respondents, even many of those which were highly informal, had bank accounts. Kenya, has been a leader in the growth and policy around low income banking, and this can be seen to have benefitted such micro-enterprises to whom it is a useful service, particularly for ensuring security of funds and transfers.

In sum, it is now easier and less costly to start, grow and run a micro-business in Kenya, and this can be seen to have aided the growth of inclusive innovation through making it possible for many low income, low skilled actors to more easily embed in low income areas by improving the ability to run an official firm (at least in terms of enterprise regulation).

8.2.2. Policy-related weaknesses and inclusive innovation

Table 8.1 summarises the major problems and concerns that micro-enterprises expressed in interviews. The period during which this research was undertaken is particularly apt, in that problems amongst both sub-sectors were becoming more pressing owing to issues pertaining to the standardisation stage. Previous quick growth of these sectors was now reducing, and innovations were becoming more static.

Given the comparative low number of interviews with micro-enterprises, this list serves as an indicator of key types of problem, and as a starting point to discussions around policy weaknesses related to inclusive innovation.

Problem/Concern	Explanation (in order of frequency)
1) Mobile handset micro-enterprise	
Micro-enterprise saturation	Increasing saturation and strong price competition.
Finding location/Goodwill costs	The need to be located in a high volume location in order to attract customers, in hand with the need to pay 'goodwill' a one-off charge to secure a good location.
Local inspectors and corruption	Related to extracting bribes related to counterfeit phones, unlocking activity and business licences.
Malfunctioning phones	Chinese phones often stop working quickly, creating problems for micro-enterprises.
Cost of moving up/into value chain	High cost to start store, or in buying equipment in order to move to a higher level.
Learning needed	Particularly amongst repairers, the need to keep up to date with the new phones to make a living.
General security risks	Robberies, fake money etc.
Unreliable staff	Related to poor trust between owners and staff, in leaving them running store, or holding significant cash.
Lack of credit relations	Often needed between sellers and suppliers to survive.
2) M-Pesa agents	
Network congestion	Network saturation means that at peak times service is congested, customers have to wait. Research included two days when the M-Pesa network was non-operational.
Scams, Fake money, Store Robbery	Security related directly to weaknesses in the form of agents.
Float problems	Weaknesses in service making some agents regularly need to 'float balance' – costly travel to local banks to get more float.
Saturation	Saturation and local competition in some areas.

Supply chain complaints	Typically related to the relationship of sub-agents with master-agents.
Customers dissatisfaction	At closing time, during network problems, and for various elements of the service. Customers become angry and sometime violent to agent staff.
Security of transportation of money	Relates to risks from movement of cash, particularly float balancing.
Low profits	Related to lower commissions and customer levels.
Errors in customer use of service	Where customers type in phone numbers they often get this wrong - agents have to resolve such problems.

Table 8.1: Common problems of micro-enterprise.
Source: Authors fieldwork.

Lack of competition

A core weaknesses of regulation in the mobile sector, related to the growing dominance of one firm (Safaricom) both as a mobile operator, and in mobile money. Whilst the Kenyan mobile sector is not a monopoly, it does suffer from the uneven competition, with Safaricom having over 75% of mobile subscriptions (of March 2011). In mobile money M-Pesa has such a large majority of mobile money subscribers that competitors are rarely even mentioned in statistics (CCK 2011b).

At the level of micro-enterprise, this has contributed to a number of problems, which have particularly emerged in the standardisation stages. Growing saturation and consequent problems reported by micro-enterprises in both sectors can be linked to a lack of vibrancy in new products and services as innovations become static. In mobile money, lack of competition can also be linked to Safaricom's push to squeeze commission levels at the agent level with little ability for agents to fight back.

Lack of competition is particularly problematic in mobile money, where even with competition pushed by the regulator, M-Pesa is vastly stronger than all other operations[76]. This leaves micro-enterprises with few alternatives when they are unhappy with their position, as highlighted in the quote of a M-Pesa master agent commenting on standardisation.

> "…we don't have much say with them *[Safaricom]*….dealers are feeling demoralised. There is room for someone to come up with an alternative and maybe dealers would take them up".

[76] There are also wider issues in mobile money design, Safaricom's dominance with M-Pesa makes it considerable more difficult for customers with virtual wallets in M-Pesa to quickly switch operators (reducing what telecoms companies call 'churn'), thus there is evidence that it is having a spillover effect and reducing competition in the wider mobile sector (Anderson 2010). Indeed, some academics have argued that prevalent mobile operator exclusive system designs will inevitably lead to monopoly situations (ibid., UNCTAD 2012), and this will be a ongoing challenge in terms of ensuring mobile money and the mobile sector remains competitive.

This statement mirrored comments from a number of actors in the mobile money sub-sector. Intermediaries felt that a lack of competition meant that Safaricom did not have to be responsive in overcoming problems (for example in slowness to resolve growing problems with scams and insecurities outlined in Table 8.1). For agents, a lack of competition also closely linked to the saturation of innovation, and the oft repeated phrase "Nairobi is now closed for M-Pesa" making it difficult for ambitious agents to grow without diversifying into other ICT sub-sectors. Without competition, it is difficult for these actors to leverage improvements.

Whilst the regulator (CCK) has attempted to use the tools it has available to counter this lack of competition, it tends to be in a difficult position when being more muscular in trying to reduce dominance (Waema et al. 2010). There have been attempts within their mandate to change this, but so far have been highly controversial and unsuccessful. For instance, during fieldwork a monopoly telecom rule was proposed which would force monopoly firms in the ICT sector to reduce in size (Nyabiage 2010)[77], but this was angrily condemned and resisted by both politicians and Safaricom.

Quality

In terms of micro-entrepreneurs, another serious concern is the problem of quality of innovations as they reach low income groups. In the table above, micro-enterprise comments around malfunctions, network outages, float problems and security issues are examples of quality problems. Whilst some elements of quality link to individual firm decision making, they can also connect into the wider policy lacks which allow such quality issues to grow when left unchecked.

In terms of handset sellers, this was particularly problematic, and mainly related to the declining quality of Chinese phones being sold. One handset firm outlined the practices in some of these smaller less reliable Chinese producers.

> "Many of these phones are unreliable. They are always cutting corners. They are focussed on selling the items, after that they don't care, it is just the price".

One of the operations mangers in a smaller Chinese supplier went further than this, bragging,

[77] As Safaricom is still owned 35% by the Kenyan government (Safaricom 2012), there might however be a question to the efficacy of any legislative approaches in such cases.

> "Kenyans like counterfeit products, they like their things to look expensive. Kenyans like to get cheated".

When problems emerge with such devices amongst customers, it is inevitably micro-enterprises who find themselves having to deal with, and refund users, as one seller interviewed described.

> "I used to sell China phones but I lost money because people would bring them back malfunctioning, and by the time I could go to the wholesaler in town the warranty was finished".

After hearing the frequent complaints around such quality in mobile handsets amongst micro-entrepreneurs, a policy maker was asked about this in terms of regulation. He highlighted that in fact there were 'type approval' rules in place. These rules, as part of the underlying telecoms policy, were supposed to check quality of handsets, through testing and production of a list of approved devices for Kenya (CCK 2010). However, there was little evidence of significant implementation of these rules. According to CCK information only one model has ever been rejected and this was for a phone released in 2002. Meanwhile, many of the low cost handset brands found during research in the lower income channels, do not appear on the type-approved list of devices, suggesting type-approval is at present ignored.

For M-Pesa, quality relates to the slow degradation of service, with frequent network problems and dropouts, float balancing issues, and slow upgrading of the service as it has grown in popularity. The effects of this on micro-enterprises are illustrated in the case of Muchemi.

> ***Muchemi (part 2)***
> *As outlined in Chapter 6, Muchemi is the chairman of a small local SACCO (Savings and Credit Co-operative) and owner of a single M-Pesa kiosk located in a farmer's goods market, whose customers are mainly made up of traders who buy and sell goods from rural farmers.*
>
> *In terms of his location and the types of interaction he undertakes, which are large transfers to and from rural areas, he consider float issues are a "big flaw in the system".*
>
> *It is not advantageous for him, in terms of business to hold increasingly high levels of float in terms of commission, but this is part of Muchemi's commitment to his SACCO members and it requires considerable extra work. Indeed, even with these high levels of float they are quickly whittled down and typically requires two risky trips a day to a local bank (superagent) to float balance.*

In mornings this comes from the need for extra cash reserves for incoming traders, but later in the day he will run low on e-cash and have excess cash. Float balancing is typically undertaken by his two employees who have to make a 10km round-trip by Mutatu to a nearby superagent (KCB bank) to float balance and these transport costs greatly reduce his profits. In total his agency makes around 35,000KSh per month in commission (~$400) before transportation, staff and running costs.

In addition, at the time of interview he was increasingly concerned about declining commission levels due to the increasing delays and network outages. In the recent month his agency commission had dropped to 30,000Ksh ($350) owing to the M-Pesa networks outages and congestion that had reduced his volume of trading during the month.

According to Muchemi (and supported by a number of other agents), whilst network upgrading had occurred in urban areas, where M-Pesa transfers involved receivers in rural areas, network problems are still significant.

Many agents suggested that, like Muchemi, some elements of M-Pesa had been declining in terms of quality and this was affecting profitability. Indeed, talking to an operational manager in M-Pesa, there is acknowledgement that the service success led to some weaknesses around quality of service – network congestion, service downtime, agent float difficulties. But without regulatory pressure, Safaricom has tended not to place a high priority on quality problems, seen as 'good enough' where piecewise upgrading is still seen as sufficient - extra servers, a service support line for master-agents – particularly when there was little pressing competition. As shown in the case of Muchemi, this declining quality tends to more significantly impact other system actors than lead firms.

In terms of M-Pesa quality, issues of quality have previously been enshrined within regulatory conditions. Mobile phone licencees in Kenya have had to comply with regulatory requirements around quality, based upon eight performance indicators such as completed calls, call block rate and call speech quality and these are annually measured keeping quality of mobile services in check in Kenya (CCK 2011c). However, there is no evidence of similar quality rules being written into regulations as part of mobile money licencing. Firms do need to comply with basic regulations around general banking and money laundering regulations, and M-Pesa underwent an audit in early 2009 (Kinyua 2009), but general legislation for mobile money is far looser with no evidence that quality problems outlined in the table being considered of importance in policy making processes.

In sum, whilst quality is not solely related to policy, growing sub-sectoral wide quality issues that emerge can be attributed to a lack of sectoral regulation and/or enforcement which link to slow and detrimental declines in quality of innovation.

Enterprise issues

As outlined, good enterprise policy has gone some way to aiding the growth of these sectors. However, there is still much to be done here, as the list of problems reported by ICT micro-enterprises indicate.

For instance, for handset sellers who are often more clustered, zoning rules leave only a minimal number of suitable business locations for such enterprises to exist. This is highlighted in complaints around the level of 'goodwill' payments for prime spaces, indicating scarcity of space assigned for such actors.

In discussion with the chairman of one of Nairobi's federations of micro-enterprises, the spatial issue was one of much dissatisfaction and slow policy. Improving such spatial assignment has been under consideration for a number of years, most recently in drafts of the MSE bill (GOK 2010, GOK 2006b), but this bill has been very slow to go through the parliamentary process.

Micro-enterprises also find themselves facing inconsistent implementation of enterprise regulations, even with more consistent laws. For example, one of the few documented activities of the Safaricom Dealers Association was as follows:

> "A meeting with the PS *[government dept permanent secretary]* has been organised to deal with the variance in licenses for operating Safaricom dealership.
>
> ….lobby with the City Council to have a standardised rate applicable for the dealers as opposed to the current scenario where all councils charge unexplainable amounts".

These activities rang true with a number of micro-enterprises interviewed, who even when they are clear about the single business licence regime, in some areas found themselves asked for increasing diverse range of new licences from inspectors – specific local licences, fire safety, signage – which they are not aware or convinced they needed.

Thus, there are still a number of core enterprise issues that micro-enterprises face. With improvement, this tends to relate less to underlying policy than how local council or municipal level actors implement policy.

Summary

In sum, three areas of policy weakness, around competition, quality and micro-enterprise rules have been highlighted as areas as having negative effect on the activities and actors closer to low income markets. The effect of these is that it leads to responsibilities being increasingly delegated to local contexts.

With a lack of competition, particularly in M-Pesa changes, lead firms increasingly squeeze profits from other systems actors, and in hand with saturation this leads to responsibility of finding a viable business models delegating to micro-entrepreneurs. Like the agent Peter, many find they can no longer rely on the M-Pesa service alone and have to improvise through retail diversification tactics. Quality issues not being dealt in wider policy pushes the management and enforcement of quality issues to local enforcers, where micro-entrepreneurs and customers have to deal with these contestations on a daily basis. With unclear rules in some areas on enterprise issues, policy issues are pushed to local and municipal contexts which require micro-entrepreneur fixes, avoidance and negotiations.

Where such delegations occur it means that issues, like those outlined in the table that should be trivial for micro-entrepreneurs (e.g. trust in ICTs, licences, spaces) become a highly active domain of contention amongst micro-entrepreneurs and local actors. Micro-enterprises spend much of their time dealing with those conditions and in tactics of process and organisational activity around embedding. In addition, over time ad-hoc enforcement can result in the need for more disruptive standardisations. This was shown in the case of mobile handset quality, where ad-hoc enforcement on handset quality rules eventually snowballed with increasing visible effect and finally resulted in detrimental moments of standardisation.

Thus, findings suggest that policy gaps indirectly effect micro-entrepreneurs, by pushing risks and problems locally, having a negative effects on the inclusivity of innovation. It reduces trust in innovations. It restrains the ability of micro-enterprise to set up and trade in a consistent manner. It makes embedded micro-enterprise creation a more risky enterprise. One of the most common outcomes of such problems that was observed was that it led micro-entrepreneurs to focus on survival, particularly in activities around adapting innovations to reduce risk and increasing diversity that were outlined in Chapter 6, but this comes at the expense of a focus on the core goods and services.

8.3. Policy and institutional understanding

Drawing on these findings from empirical research, this work is generalised more widely to consider the wider links between policy and inclusive innovation in this case

study. In particular, three elements are expanded on. First, basic economic institutions and the policy rationale for moving beyond this. Second, specific policies beyond basic economic institutions that have shaped trajectories of these sub-sectors towards inclusive innovation. Third, the problems faced by micro-enterprises within the system, which are linked to policy problems, and discussed within wider understandings of institutions in systems of innovation.

8.3.1. Policy rationale

In his guidance on policy for inclusive innovation, Altenberg argues that policies tend to "underestimate the importance of improving basic institutions of the market economy" (Altenburg 2009 p.33). As shown in this case, the benefits that sound underlying policy plays in areas such as mobile market regulation, banking and taxes, are essential components in helping these systems to become more inclusive.

However, in the case of new and emergent innovation such as the mobile case, it is argued that there is a risk of solely focussing on building an 'enabling environment'. This reduces the ability for governments to undertake more ambitious policy led interventions (Calandro et al. 2010). Even in highly efficient regulatory environments, when such emergent innovation is left to the market, there are potential weaknesses and lacks in emergent systems. This is particularly relevant when the high costs of ICT and infrastructure are involved – mobile infrastructure, agent networks, finding markets, building awareness in this case. Thus, a sole focus on basic economic institutions risks lower and slower inclusive innovation, and where markets are seemingly non-viable in more marginal areas, then inclusivity may not occur at all. For example, the long period that mobile handset firms remained in the direct rollout stage might be seen as characteristic of this description. Market regulation and rules supported incremental growth in markets, but with a lack of policy accelerating innovations to low income users, market-led processes of innovation proceeded slowly, and in more deprived groups not at all, as implied in access statistics in Chapter 5, particularly Figure 5.9.

This empirical case for policy that emerges from this research fits with a systems perspective on policy making can also justify more active policy through resolving weaknesses or failures within systems, particularly where system actors encounter obstacles that they themselves are unlikely to solve without external support (Bergek et al. 2008).

As has been outlined previously, developing country systems tend to be emergent, sporadic and often missing crucial elements (Arocena & Sutz 2000, Lundvall, Joseph,

et al. 2009), and this links to an active market 'nurturing' and 'formation' roles in order to drive innovation and establish systems (Bergek et al. 2008).

Further, to move beyond such technocratic notions, policy making for inclusive innovation is also highly relevant in contemporary political decision making. There is a growing agenda for innovation to have wider societal impact, demanded both by citizens and wider donor communities (Altenburg 2009). Thus, sectors of activity where pro-poor use is articulated as particularly beneficial, but not yet impactful are likely to attract policy interest related to political pressure.

Thus, there is a clear policy rationale here that beyond basic economic institutions, there is a clear rationale both empirically and conceptually for active policy directions that can accelerate inclusive innovation.

8.3.2. A toolbox of inclusive approaches

As outlined in analysis, some policies were identified which have been argued to have played a role in accelerating inclusive innovation. However, these components were sporadic, and generally not specifically introduced with the intention to low income use of ICTs. Rather, inclusive effects were an indirect spillover effect of policies.

Thus, in order to build more substantive policy insights on inclusive approaches, these findings around fortunate policies and indirect spillover need to be generalised through reference to the wider policy making literature. The goal here is to abstract from the very specific policies found in this case to an examination of a more general 'toolkit' of approaches, which policy makers might consider could support such transformational drive in innovation systems. This is done below for each of the three elements of policy that relate to inclusive innovation found in the case.

Supporting inclusive innovations on supply-side

The empirical case highlighted successful processes that can be loosely defined around 'research' by which innovations became more inclusive for low income users. Thus, this case illustrates that research is not irrelevant when it comes inclusive innovation. However, the types of supply-side R&D found in this case, in global R&D for low income users and local service research, move away from what might be considered core 'inventive' R&D typically of concern amongst innovation scholars (Nelson & Rosenberg 1993).

Rather this looks towards 'innovative' R&D integrating ICT, human and service perspectives (den Hertog 2010, Miles 2007), and makes a stronger consideration to softer issues such as absorptive capacity and adaptability, to make the best of imported innovation which diffuse into systems (Bell & Pavitt 1993). Such soft/service

R&D activities sits well within a systemic approach to research outside core science and development, which leans more towards technology agenda and connects to building an understanding of technology and innovation over basic scientific work (Chataway et al. 2005).

In poorly defined markets, such research can help promote innovations for developing countries that may sit outside established innovations. For lead firms such R&D can highlight the potential of such innovations, and orientate firms to focus on refining innovations for low income markets, which might not have occurred without external support (Bergek et al. 2008). This is certainly the M-Pesa where focussed service R&D has driven a huge area of global activity which was barely through of as a viable innovation a few years previously. Whilst potentially involving the state, in these cases such initiatives occur through partnerships of private sector bodies, donors, NGOs and international organisations.

In the Kenyan mobile sector, there is little evidence of effectiveness of wider supply-side policy inducing private firms to towards inclusive innovation activities such as through conditions in licencing, subsidies for low income delivery, and universal service funds. Nevertheless, they should not necessarily be neglected as potential supply–side policy levers as they have previously been shown to be effective elsewhere in cases, such as fixed line phone delivery for low income groups such as India (Noll & Wallsten 2005) and in driving the growth of internet services in Brazil (Rauen et al. 2011). Thus, more research is necessary to more clearly understand why such approaches failed in this case and when they can be effective.

Pushing low income demand

Given the empirical evidence of policy around driving demand amongst low income groups, examining a potential 'toolbox' of demand-side policy is of interest.

The literature on demand policy highlights that such a toolbox could include policies which directly grow market intensity such as procurement or price reducing initiatives. Alternatively in early systems, indirect approaches which build and cohere articulations of demand can also make market activities clearer and more viable for firms (Edler 2010, Edler & Georghiou 2007, Edquist & Hommen 1999, OECD 2011).

In the mobile case study, direct support through price and tax reducing incentives, in VAT reduction and network interconnect pricing, contributed to growth in demand amongst low income users. However even with a strong lobby, these proved politically difficult to invoke as illustrated in the case of the VAT on mobile handsets, where even strong lobbying from the mobile sector took a number of years to push this change.

Such approaches, that require very strong and active lead firms, may be less relevant in other cases.

Other approaches to growing systems around procurement might be more amenable and simpler to implement, but as shown in public sector procurement in this case study, at present, such processes seem to have not successfully occurred in Kenya due to the highly bureaucratic government tendering processes suggesting that such policy approaches will need more refinement to be effective.

Whilst there was only sporadic evidence in the empirical case, less well researched indirect inducements of demand involving the state in developing countries; building articulations of demand, and in e-government activity and donor intervention implies potentially fruitful under-researched avenues of policy from findings that might potentially be important part of a policy toolbox which aided demand for innovations amongst low income groups.

Micro-enterprises: small enterprise policy and alignment

Empirical work on policy around micro-enterprise has highlighted that policy which supported and/or stabilised small enterprises presence can also have a positive effect on inclusivity.

The policies found in this case around micro-enterprise link with the previous section on 'basic economic institutions': underlying policy around business start-up and closure, registration and banking. However beyond underlying economic institutions, the literature on supporting small and micro-enterprise policies suggests more active 'toolboxes' of micro-enterprise policy might encourage the growth, and support the survival of such enterprises. For example, micro-enterprise literature has covered assignment of variable spaces to allow firm entrance and growth, provision of better funding and loans for survival, and aid in building organisations to allow informal actors to actively defend their role and position within the wider discussions (Cozzens & Sutz 2012, USAID 2006).

8.3.3. Informal institutional perspectives

A wider micro analysis of the case suggests that where policy is weak it tends to result in a displacement of problems from macro-level decision makers, to become part of the often time consuming contestation and negotiation that are part of the daily lives of micro-enterprises. In the case study this came mainly from difficulties in policy implementation or in inconsistent enforcement of policies.

This can be linked to a wider institutional perspective, and the previous suggestions that inclusive innovation perspectives needs to pay attention to the role of informal

institutions, and their influence on the innovation system as outlined in Chapter 6. So far, examination has been largely around the overarching regulations and specific policy, as part of building the core institutional elements of innovation systems, and correcting for missing elements in inclusive innovation systems (Edquist & Johnson 1995).

However, as innovation reaches less affluent groups, one needs to consider the effect of an increasing schism between the policy design and the actual practices and implementations, particularly revolving around informal norms, and cognitive 'ways of doing things' (Scott 2001). These gaps create a more complex and uneven institutional terrain where various system actors can be seen as active, negotiating, avoiding, contending and use the various institutional elements available to them in active ways (Oliver 1991). For instance in this case underpaid police and inspectors become more active in interpreting rules to extract bribes where policy was less well defined at a local level.

In terms of policy, as innovations reach lower income users, policy and approaches may need to be adapted in order to reduce such uncertainty in specific low income settings. As embedded micro-enterprises become higher risk and more unstable, micro-enterprise activity increasingly focuses on ensuring survival, such as through process adaptations, risk reduction and diversification activities in order to protect themselves in agency rich environments.

This work in line with growing work on policy critiques the simplistic idea of a single and/or monolithic 'policy maker(s)', rather seeing innovation policy as part of policy mixes, in policy alignment, complexity and policy implementation (Flanagan et al. 2011). Beyond examining policy making, it is argued that a focus on aspects of adaptation and implementation of policy is essential in order to fully understand how policy approaches relates to inclusive innovation. Without this, detrimental directions of innovations may emerge, innovative capacities may have to be directed to other activities, and problems may snowball to the extent that eventual policy 'cures' may be as damaging as the 'disease'.

8.4. Summary

Policy making is closely linked to the fortunes of ICT micro-enterprise, but this principally occurs indirectly. In line with innovation systems models, policy whilst not necessarily being focussed on ICT micro-enterprises per se tends to influence micro-enteprise by how it drives (or doesn't drive) inclusive innovation systems. The case of the mobile sector shows that policy has played a role in how innovation is inclusive

and thus has considerable effect on micro-enterprises. Here three important elements of policy considerations are useful starting points for consideration.

Firstly, there is evidence that the efficacy of underlying regulation has contributed to the emergence and direction of innovations pushed them towards a greater focus on low income markets, which has enhanced the roles for micro-enterprises within the innovation system.

Secondly, there is a rationale for more active policy making for inclusive innovation within the ideas of 'systemic weaknesses' or 'market nurturing' for low income groups. Whilst there was absence of specifically mandated 'pro-poor' policies, policies were identified, both sectoral specific and more generic, which had effects on components of inclusive innovation. These generally align with adapted innovation systems models which highlighted that low income systems traverse the demand and supply-side, and that systems increasingly include large numbers of ICT micro-enterprises and other intermediaries. Whilst these findings are drawn from a very narrow base, evidence of effective policies was expanded to suggest specific 'toolboxes' of policy that might be amenable to inclusive innovation - on the supply-side: in softer and service R&D, on the demand-side: in driving demand amongst low income users and in supporting embedded micro-enterprises.

However, given that policy indirectly links to ICT micro-enterprises, institutional perspectives on innovation systems suggest that how such policy coheres with wider insitutitions is another important element in understanding the efficacy of policy. From this perspective, it is suggested that as innovation systems grow more inclusive, new challenges emerge in low income markets, which particularly relate to poorly constructed policy, lack of policy making or poor policy implementation. This leads to a shift of contentious decisions away from policy makers and administrators to micro-enterprise firms and local public servants such as local police and inspectors who have to struggle and contest them in their daily lives (as well as creating extra headaches for lead firms). In the mobile case, poor policy implementation and enforcement around quality issues of ICTs, the difficulty in building competition in the mobile sector, and gaps around enterprise policy resulted in these displacements, and led to this 'new institutional' terrain of process and agency at a micro-level.

Much of the literature, particularly on market led approaches to innovation for low income markets has conspicuously neglected any mention of policy, and indeed there is little evidence that policies in this case have been focussed specifically on innovation, and even less so on inclusive innovation. However, from the findings in this case it is suggested that this perspective is problematic. Policy plays a key role in

contributing to innovation systems which are inclusive, and consequently how they are refined will effect the survival and growth of ICT micro-enterprises.

9. Conclusions

9.1. Introduction

This research started from the position of building understanding of ICT micro-enterprises in developing countries. Such micro-enterprise are important in that they potentially play a key role both as a potential productive driver for low income actors by pushing jobs, skills and knowledge, and as a consumptive driver playing an important role in how ICTs reach low income consumers in developing countries.

The literature review identified a previous focus on outlining the micro-level, highlighting the innovative practices, networks and instabilities of such enterprises. It also highlighted a gap in knowledge, in examining wider factors and relations influential in positioning the actions of such enterprises, and thus the wider productive and consumptive benefits that they might bring. This refined the research topic, as an examination of ICT innovation for low income groups in a more holistic way, particularly through the use of models around inclusive innovation.

In this chapter the key findings around inclusive innovation and micro-enterprises that were outlined in the previous chapters are expanded, drawing on the three detailed research questions introduced previously. The answer to these questions is then linked into the wider literature, policy and academic debates by detailing the knowledge contributions, practical recommendations and further research directions that emerge from this research.

9.2. Summary of findings

Findings are summarised by referring to the research questions which were outlined previously (in addition splitting the first question into its' two constituent parts). Drawing on the previous chapters, some answers and discussion points related to these research questions are considered.

9.2.1. Inclusive innovation

'How do we conceptualise the wider factors which influence ICT micro-enterprises?'

Models of systems of innovation, adapted to consider inclusive innovation provide a conceptualisation in which to position ICT micro-enterprise. Inclusive innovation allows inclusion and analysis of the locally relevant appropriation of ICT micro-enterprises,

positioning them as one part of a wider set of systemic relations and policy around ICT innovation for low income groups.

In this work, activities around ICT micro-enterprise are conceptualised within the concept of innovation, and specifically systems of innovation adapted for inclusive innovation.

Approaches to systems of innovation drawing on 'wider' approaches centre notions of interactive learning which have emphasised innovation within a number of distributed activities and actors (Johnson et al. 2003, Lundvall 1992b). This model provides a good core conceptualisation for this work, outlining an increasingly distributed role of innovation. In the case study, this includes both large ICT suppliers and small ICT micro-enterprises.

However, system of innovation approaches have typically been concerned with examining national (or regional/sectoral) concerns, particularly related to innovation in production and manufacturing sectors which drives wider economic growth. Using such models, ICT micro-enterprise might appear peripheral, even detrimental to the innovation system, with their often-marginal livelihoods and their limited innovations. Thus, models were adapted to move beyond conventional systems of innovation conceptions.

Adapted models

Models have been adapted drawing on the literature of inclusive innovation which has begun to consider the role of innovation in driving wider development, diversity and livelihood as opposed to solely economic growth, and examining innovation in a wider variety of sectors (Berdegué 2005, Cozzens & Sutz 2012, Kraemer-Mbula & Wamae 2010a).

Whilst systems of innovation models provide core understanding – the central focus on innovation, innovation emerging within interactive learning, underlying institutional drivers of systems – inclusive innovation re-orientates the types of innovation, actors, learning and relations. In particular, for innovation in low income ICT markets, sectoral systems of innovation approaches were adapted to include ICT micro-enterprise actors, and as base-of-the-pyramid literature has shown, their innovation plays a crucial role in linking into demand of such markets. Wider considerations in inclusive innovation relate to learning where relationships are more informal and changeable, where some actors are very large, whilst others are small and informal. As value chain literature has shown, examining such relations is as much about consideration of power as it is about interactive learning. These systemic perspectives also traverse boundaries between formal firms and more informal settings and

activities, and a more varied perspective of institutions emerges where both formal and informal institutions may be significant, and where institutional effects of policy may not be universally realised.

Thus, systems of innovation, adapted for innovation provide a more suitable conceptualisation for this work, but its relative unfamiliarity required further adaptation based on empirical data related to the specificities of ICT delivery into low income markets.

9.2.2. Positioning ICT micro-enterprise

'..In such conceptualisations, how do we position ICT micro-enterprises?'

The role of ICT micro-enterprise is as a crucial actor that link innovations into low income markets where innovation processes can be seen within socio-technical perspectives. These activities are guided by wider factors, particularly related to malleability of technology and network guidances.

On the consumptive side, such locally relevant appropriation is part of a larger puzzle related to how ICT innovations reach low income users as consumers. On the productive side, the locally relevant appropriation and adaptation of ICT micro-enterprises is crucial for survival and growth. This linked into how systems of innovation were inclusive in terms of how innovations-as-objects reached low income users, and in terms of the inclusivity of innovation-as-process:

Innovation-as-object

Following on from literature analysis, it was expected that innovation related to ICT micro-enterprises would relate to adaptations of ICT or new processes and practices, which were relevant to local needs as outlined in the literature.

Such explanations fit with results, but in research the types of adaptation found were more subtle than expected, and mainly related to minor adjustments in configuration, in service delivery and in articulating innovations to be acceptable low income groups.

This fits with the "ensemble view" of information systems, which has challenged the more prevalent "tool view" (Orlikowski & Iacono 2001). ICT system should be seen as a socio-technical network of technology, people, processes and organisational arrangements. Thus, innovations that link ICT system to low income groups will not just be technical changes. Instead, they will be socio-technical changes that may link to any one of the ensemble of components that make up the full system (Sahay & Walsham 2006).

The lack of wider technical and large scale adaptation in the case can also be linked to the relational aspects of systems, and the role that large systemic actors of ICT supply

and services play in small firm innovation. In the case study, ICTs were rendered less adaptable through central controlled services, non-malleable ICT objects (or only malleable in certain ways), and networks of ICT which monitor micro-enterprise preventing or allowing certain activities. Thus, wider powers play a role in defining locally relevant innovation.

Socio-technical elements of innovation can be seen as providing more room for innovative activities, as more malleable and more fitting with the skills of micro-entrepreneurs, providing room for adaptation into low income markets; ICT micro-enterprises as innovative intermediaries, adapting innovations for specific markets but within a framework set by wider actors.

Innovation-as-process

An additional finding that was not anticipated in the literature review was the extent of process and organisational tactics present. This related equally both to the way that innovations were adapted in use for specific low income consumers (the consumptive side) and to improving the chances of survivability of the embedded ICT micro-enterprises (the productive side). Indeed, these two elements were found to be closely interlinked, in that improving innovations-as-process and enterprise survival supported ICT diffusion and adoption.

Again, from a systemic perspective this was linked back to wider systems actors, in the forms of ICT products and services, and service rules define certain accepted forms and places of activity. As ICT micro-enterprises 'embed' within poor communities, innovation forms and activity may not fit well institutionally and can introduce risk and instability. Process and organisational adaptations by micro-enterprise are part of this process. It was also found that there was a significant role played by other ICT supply intermediaries, which has not been discussed in the literature, aiding innovation as a process.

From a wider perspective, there is again an interplay here, between ‘agency’ and ‘structure’ – that is forms of organisation and service delivery that come from above which allow and legitimise embedded ICT micro-enterprise, reduce costs of entrance and exit risks; and the need for micro-enterprises to engage in process and organisational innovation to reduce such risks play a key role in processes.

Mismatches

In these elements, there is potential for ‘mismatch’ particularly between lead firm innovation goals revolving around profit-maximisation, and the more sporadic innovation which links to a wider utility-maximisation of innovation intermediaries within low income markets. Thus, research on the links between network relations and

innovation, and between policy and innovation system translates to concerns for large firms and policy makers respectively, to consider how best aligning potentially mismatches in innovations. These relational and institutional elements of research are outlined in the next sections.

9.2.3. Networks and innovation

'How do the network relationships of ICT micro-enterprises link into the forms of innovation that they undertake?'

The form of relations effect flows of knowledge and learning around innovation, and thus plays a role in inclusive innovation. In particular, network relations that support flows of learning from non-lead firm actors play an important role in inclusivity.

Given the disconnected and reconfigurable nature of networks, forms of network relation were defined based upon analysing elements around indirect technical and managerial control in networks, and the level of intermediation.

More 'hierarchical' networks emerge where power and control are prevalent in relations. These risks reducing leeway that micro-enterprise have to innovate. In more marketised networks, some 'local' innovation tends to occur, but there is a risk of disconnection to larger firms and less reverse flows.

User-producer interactions models also highlight some specific components of relations that can play a crucial role in learning and hence supporting inclusive innovations through appropriate demand signals, capability of users and groups on the demand-side, and reducing 'distance' in relations are significant.

This research used notions of user-producer interactions to analyse system relations in low income focussed system which are useful for highlighting appropriate flows of knowledge and learning around innovation. These were adapted to allow analysis of the often informal and changeable relationships between larger ICT suppliers, through intermediaries (including ICT micro-enterprise) into customers.

Given the often disconnected and reconfigurable relationships between producers and those on the demand-side closer to consumers, relationships were defined within a wider set of elements around managerial and technical control in networks, as well the level of intermediation which will determine the efficacy of relations.

More 'hierarchical' networks are characterised by higher volume of elements of managerial and technical control: objects, trainings, rules and guidance from the top down. Micro-enterprises may thus better nurtured and supported, and activity guided with imbalances corrected. However, this can map onto a smaller space for adaptation by micro-enterprises where power elements in relations taken precedence over

interactive learning. Thus, there is a risk that locally appropriate innovation is restricted by the density of this network guidance. More 'marketised' networks are characterised by a far lower volume of these elements and increasingly complex and intermediated relationships. Where lower malleability of technology allows, there may be more room for micro-enterprise 'local' innovation with lower network oversight, but the risk is that such activities only diffuse very locally and risk reducing flows of interactive learning and adaptation.

Findings suggest that this general nature of relations may not be an element that firms have control of. In areas where ICT activity is more complex, where trust is lower, and where regulation is higher, the natural outcome is to verge towards increasing volume of elements of managerial and technical control. Equally, as ICT are simpler, and where there is little regulation, more disconnected market relationships are liable to emerge. This 'natural configuration' of networked firms, which has been documented in wider studies of firm relations (DeBresson & Amesse 1991), suggests that consequent innovation risks are in some senses inherent according to core technologies, regulatory and historical factors in respective sub-sectors.

However, this is not to say that firms in innovation systems can have no intentional effect. Findings were focussed on cases where systems were still developing, and in such dynamic contexts there is evidence that purposive activity can refine the managerial and technical elements that define relationships and this can be beneficial to innovation. In the hierarchical case, buffering ICT micro-enterprise from elements of power and control allowing some more independence to adapt to local conditions and needs was beneficial. In the market case, reducing intermediation between user and producer proved particularly crucial to dynamic growth, this role enhanced by a bridging intermediary actor. Specific features of relations were additionally analysed specifically in terms of user-producer interactions – sophistication of demand, user capability, and 'distance' between linked firms, and what these elements meant for interactive learning in low income markets. Evidence suggested that configurations which provided clear signals and better interactivity between top-down and reverse innovation will tend to support inclusivity.

From a systemic perspective, such 'purposive' activity by lead firms was as much about responding to emergence in systems as it was in designing from scratch. It revolved around lead firms maximising opportunities that emerged in the network structure. Thus, it is difficult to be prescriptive for firm activity. Rather, improving user-producer interactions, enabling more responsivity to the opportunities and potentials of the system, and supporting those beneficial improvements and changes as systems grow provided the most appropriate way forward.

9.2.4. Policy for inclusive innovation

'What role is there for policy in shaping the conditions of ICT micro-enterprise?'

Drawing on inclusive innovation perspectives, policy for ICT micro-enterprises was examined through reference to institutional aspects of innovation systems.

The conditions of ICT micro-enterprise can be shaped both directly and indirectly. Whilst specific focussed micro-enterprise policy had some efficacy, from an inclusive innovation perspective, it was found that there were a number of other policy measures which shaped the conditions of ICT micro-enterprise indirectly through effects on inclusive innovation systems.

Core to micro-enterprises is the presence of basic economic institutions, which in the ICT sector will particularly relate to ICT regulation. Beyond this, specific policy shaped how innovation reached low income groups. Three particular elements were identified – demand-side inducing policies, supply-side soft and service R&D and micro-enterprise policies - which tend to benefit ICT micro-enterprises.

Policy risks were also identified, particularly related to competition, quality of ICT and enterprise regulation. Weak implementation or enforcement can lead to problems around innovation being increasingly negotiated and contested by ICT micro-enterprises, reducing viability.

Institutions and wider policy

Typically systems of innovation are related to wider policy through the notion of institutions. A differentiation has been made in this work between 'underlying institutions' (the less changing institutional environment), 'policy making' (active policy decision making) and 'policy implementation' (how policy works on the ground), where the latter two have been examined more closely related to policy. Linking to the previous research question on how networks in systems change, policy making is argued to be a crucial factor in shaping system emergence.

Policy making

As a first step, the quality of the underlying policy environment as embedded in basic economic institutions was found to be crucial to growing inclusive sectors (Altenburg 2009), and to contribute to reducing the informality of ICT micro-enterprise. In this case study, this particularly related to sound underlying ICT regulation, as well as enterprise rules such as business registration and micro-enterprise regulation in urban areas which define the conditions of ICT micro-enterprise on the ground. Where policy was well clarified and implemented, such as the business environment, clarity aided stability.

However, this work takes a step further, arguing both from a conceptual and empirical view that more active policy is relevant to shape inclusivity of innovations. Three particular directions of policy influenced inclusivity: supply-side soft or service research leading to more inclusive focus of innovation for low income consumers, demand-side policies which stimulate demand for low income users to push growth of innovation, and policies for small enterprise growth which contributed to driving the growth of ICT micro-enterprise. To term it related to the previous research question, these policies might be seen to shape user-producer interactions, and hence push a better link between top-down and bottom-up innovation.

Policy gaps

Analysis of policy effects on ICT micro-enterprise suggest that weaknesses in policy implementation, particularly related to basic economic institutions can lead to problems for micro-enterprises.

Whilst policy is often in existence, a poor construction of policy, poor implementation or enforcement can create problems. This was highlighted in a lack of competition, in lack of enforcement of quality rules in ICTs, and in poor implementations of enterprise regulation in the case study. For ICT micro-enterprise the effects of such policy weaknesses is that activities increasing become delegated and contested at a local level, which increases the complexity of operations for such actors.

Linking back to the institutional framework, one can argue that such examples lead to a move towards more complex sets of formal and informal institutions playing a key role in such settings, where multiple and overlapping rules and decision makers are present and underlying rules and regulations can be unclear.

Thus, in inclusive innovation systems, examining policy implementation on the ground is as important as policy making. This work highlights that it can be useful to extrapolate from ICT micro-enterprise problems back to wider policy lacks to provide insight as to how policy making might be improved. This is particularly important where the distance between policy making actors and those involved in daily practices around inclusive innovation are large.

9.2.5. Linking findings

As analysis has shown, systems of innovation adapted for inclusive innovation provides potential for useful analysis of innovation for low income markets. Inclusion of low income demand focus and innovation intermediaries in system models, increases this focus on different types of activity around innovation, notably the role reverse flows of innovation plays in inclusivity.

As work on user-producer interactions illustrates, how top-down and bottom-up innovation interact is central to understanding how innovation can become inclusive. Notions of user-producer interactions highlight the practical role that larger firms can play in driving emergent systems through enhancing relations which can benefit both firm scaling of ICTs and inclusivity of innovation.

More widely though, such firm decision making is ultimately made within the framework of wider institutional settings. In this work, it has been illustrated that as innovation systems grow, specific policy making can push large firms into making more inclusive decisions, and aid inclusive activities of innofusion amongst ICT micro-enterprises.

Thus, referring back to the potential misalignment of interactive learning in innovation systems, both large firms and policy makers have roles to play in reducing such mismatch and driving forward an inclusive focus.

9.3. Contributions to knowledge

Given the main findings outlined in the section above, this work can be seen to make a number of contributions to knowledge. These are outlined below, again dividing the work using the research questions.

9.3.1. Conceptualisations of innovation

Conceptualisations of inclusive innovation and its link into innovation systems offers useful models which are both well grounded in established innovation systems research, but extends such models for the specific types of low income innovation that were found in the case study. Thus this work contributes to a emerging knowledge around inclusive innovation (Arocena & Sutz 2000, Berdegué 2005, Cozzens & Sutz 2012, Kaplinsky et al. 2009).

The analysis in chapter 6, is to our knowledge one of the first attempts to actually use and critique inclusive innovation and systems models based upon empirical research (with citations above generally relating to less detailed discussions and literature reviews). For instance, the findings around socio-technical innovation, around network intermediaries and around the role of wider institutions in such systems provide knowledge of processes in such systems that have previously not been well considered, and they provide potential new directions in inclusive innovation research.

Findings from the analysis of sectoral innovation systems in the mobile phone sector, where large firm focus is increasingly on low income customers, can be relevant to other sectors where inclusive innovation is of relevance (agriculture, health,

education). Whilst research based on ICT sectors may have some unique features, the presence of multinational firms, the low malleability of innovations and high policy making focus, with further research it is likely possible to expand insights to non-ICT sectors.

9.3.2. Conceptualisations of ICT micro-enterprise

As outlined in the literature review, drawing on work on ICT micro-enterprise, and linking into development and information systems literature, it was argued that there has generally only been a focus on micro-level activity of such enterprises. This highlighted the locally innovative practices and unstable contexts without linking to wider factors connected to these practices and contexts. Thus, this thesis through use of innovation systems models, provided a linked perspective on ICT micro-enterprise that has only been explored sporadically in the past (Cheneau-Loquay 2008, Mujica 2007).

The outcome of taking this perspective is that ICT micro-enterprises and research has been linked into wider considerations in far more detail. Thus, this work questions approaches which solely examine small ICT actors from the narrow perspectives of entrepreneurship (Levy & Banerjee 2008, Rangaswamy & Nair 2012). From a systems of innovation perspective, whilst entrepreneurial innovative activity in the key element of micro-enterprises, such actors who are small and often marginal actors are influenced by wider actors and conditions and thus more holistic models are recommended for future analysis of ICT micro-enterprises, particularly in understanding how ICT reach low income users.

Systems of innovation models provide a more holistic perspective on ICT for low income users. In particular, it identifies the role of network actors in more dynamic scaling processes, links between network relations and evolving innovation as systems emerge, and examine the crucial role of policy within such processes. Whilst this work is by no means the first to see innovation systems as a way forward in consideration of ICT and low income actors (Baskaran & Muchie 2006, Essegbey & Frempong 2011, Joseph 2009, Toivanen et al. 2012), to our knowledge it is the most complete, in adapting models for this sector and exploring the issues in a more complete way.

In sum, beyond micro-enterprise considerations this work has relevance in considering ICT innovation for low income users. Such work also provides knowledge for policy makers and lead firms in understanding the policy and strategy influences upon inclusive innovation.

9.3.3. Understanding the link of innovation into networks

Emphasis on ICT innovation particularly in the base-of-the-pyramid literature has emphasised top-down (strategic-led) innovation and even where micro-enterprise involvement has been articulated as important, their involvement is still largely as subservient to wider firm goals (Anderson & Kupp 2008, Carvalho et al. 2011). In contrast, as outlined in the literature review, ICT micro-enterprise literature offers a bottom-up (adaptive) emphasis on innovation, but with little consideration to wider factors (Chipchase & Tulusan 2006, Lugo & Sampson 2008, Rangaswamy 2009a).

Both types of innovation were found to be present in low income focussed ICT innovations systems, and the use of notion of user-producer interactions built an understanding of the interaction between these two directions of innovation. Whilst use of this concept has been referred to within innovation systems discussions (Arocena & Sutz 2000, Rothwell & Gardiner 1988), it has rarely been used analytically even though Lundvall's notions of user-producer interactions provide a crucial set of criteria to think about interactive learning and innovation.

Contemporary concerns related to inclusive innovation have previously discussed a diverse set of terminologies to describe such innovation processes (user innovation, appropriation, co-production, innofusion). At the same time, work is increasingly acknowledging that top-down low income focussed innovations in the form of base-of-the-pyramid innovations are becoming increasingly prevalent, particularly in emerging economies. Thus, this work offers a contribution by reviving and adapting an older concept that can be used analytically to link together these directions in a useful way, both in ICT and conceivably in other sectors as well.

9.3.4. Understanding the role of policy in driving inclusive innovation

Without systemic perspectives, policy directions on ICTs focussed on low income markets have tended to emerge in an ad-hoc way. Alternatively, in those approaches more influenced by base-of-the-pyramid literature, policy has generally not considered extensively, beyond advocating for sound market mechanisms (Prahalad 2009).

Approaches drawing on systems of innovation offer potential to provide more expansive, and conceptually clear articulations of wider role of policy related to innovation of all actors in the system (market, pro-poor, political) (Smits et al. 2010). Thus, system influenced work, as outlined in Chapter 8, can highlight not only specific policy in terms of driving low income users, but also begin to bring together a range of policies (regulation, demand-side, supply-side, micro-enterprise).

The innovation systems approach adopted positions policy as only one element of institutions which underlie systems and this problematises policy implementation, highlighting new concerns around policy and important wider directions of research in considering inclusive innovation policy.

9.4. Practical recommendations

Drawing on the contribution to knowledge that was specified in the previous sections, it is possible to outline some clear practical recommendations that emerge from this research.

Again these have been divided using the research questions, as it is argued that these questions can represent distinct areas of recommendation for building wider knowledge, in recommendation for micro-enterprises, in lead firm understanding, and in policy making for low income ICT users respectively.

9.4.1. Use of innovation models as a grounding of knowledge

A growing drive and support for developing countries to use systems models to build more complete understanding of innovation, drawing on inclusive innovation frameworks. This is likely to be particularly useful in ICT sectoral approaches.

As was outlined in Chapter 3, whilst innovation systems have gained strong footing in academic understandings of innovation, and used widely for policy perspectives in the developed world, their adoption in the developing world has been sporadic where more traditional understandings of innovation which focus on centralised R&D functions are still prevalent (Chataway et al. 2005, Kaplinsky et al. 2009). Research in Kenya, provides a good example, where innovation policy is still implemented in the Ministry of Higher Education, Science and Technology which shows that such a domain is still seen as a more marginal one.

However, in Kenya there are signs that such thinking is becoming more relevant. The 2008 National Innovation Policy, did draw on systems influences, and thus the remit for policy was wider and integrated, ranging from education, to technology, to governance (MoST 2008) (although it is difficult to see how such a wide ranging policy will be implemented from within such non-core ministries in Kenya). More encouragingly the ICT sector has begun implicitly adopt some of the language of systems as outlined in the current draft ICT Masterplan, which goes under the subtitle 'Inclusion, Innovation, Beyond Broadband' (ICT Board 2012).

Thus, whilst there is still some way to go for innovation systems to become a core concern, a drive to push innovation topics onto agendas is important. Indeed, articulating elements of inclusive innovation is likely to particularly chime with the wider development needs and goals of developing countries and push such acceptance further. As illustrated in the Kenyan case, given the difficulty in implementing truly cross-ministry national policy, inclusive sectoral policy of the type outlined in this research is likely to be more effective, particularly in sectors such as ICT, where the number of actors and interests are becoming increasingly more complex.

9.4.2. More active nurturing of micro-enterprises

Given the central role that ICT micro-enterprises play in how ICT innovations reach low income groups, there is room for considerably more active integration of such actors within systemd, and to nurture such actors.

Both Chapter 6 and Chapter 7 highlighted that there can be dual benefits from more active ICT micro-enterprise presence, both in terms of inclusivity of innovations-as–obejcts and processes of innovation production and diffusion.

For enlightened firms and other actors, building good relations into low income focussed enterprises, can be viable and includes providing structures which allow such enterprises to enter low income markets, embed and grow. Provision of leeway in terms of appropriation can allow wider innovative activity and with appropriate structures allow reverse flows of innovation back up into lead firms. At the same time, this can build valuable skills within micro-enterprises that can serve them as part of longer term processes of technologies, skills and knowledge.

In future, more active nurturing might come from more direct activities to support micro-enterprise, particularly in the ICT sector of focus. Support for associational activity can bring together such actors and allow them to more clearly set the agenda in markets, particularly where such actors tend to be small and less coherent. More direct policy focussed on such enterprises around financial structures and environments, can serve to overcome barriers within innovation systems which limit more significant growth.

9.4.3. Role of lead firms in influencing direction of innovation

Larger and lead firms looking to push innovations towards low income users are likely to grow best when they enable, respond to and amplify innovation that is occurring within the system. This will particularly be enabled through high trust, and clear operational links into micro-enterprise and users.

Chapter 7 has focussed on the interaction between networks and innovation in low income markets. Expanding on the conclusions of that chapter, it is possible to outline some recommendations for larger firms in driving growth to low income consumers potentially providing significant revenue and profit for the lead firm; whilst aiding livelihoods for the thousands of micro-enterprises involved in service delivery.

Principally, innovation has been continuous and widespread. Innofusion, the continued refinement of innovation in diffusion is both integral and essential to ICT diffusion and adoption by low income consumers, and such processes are not solely technical activities. Indeed, the findings in this research is that technical change as innovations reached low income groups were not radical, as much as adapting the structures and processes that are part of the overall ICT 'ensemble'. As systems emerge, there is a growing diversity and complexity of actors and connections, from micro-enterprises and intermediaries who are a source of innovations and adaptations and these increasingly complex systems mean that lead firms actions are liable to have unexpected outcomes. What is striking is how crucial emergent rather than pre-planned innovation has been, not wholly within the control of the lead firm.

The response by lead firms was variable in this research. At times such system activity was ignored and at other times, attempts were made to be removed such activity through standardisation. Such approaches have been problematised in the research, particularly through the systems notions of mismatched directions of learning and innovation limiting inclusivity, both in terms of objects and processes. More successful firm activity and aggressive growth stages occurred where lead firms chose (or were pushed by policy) to respond to such systems innovation through enabling and adapting emergent ICT innovations and amplify this activity.

This leads to a key recommendation for lead firms. In low income delivery relying on innovation intermediaries is crucial, and the knowledge and innovation that emerges from these actors is a crucial resource and insight for reaching low income groups. Insight from the notion of user-producer interactions provides a framework in how firms can best be responsive and more aware to so-called ‘reverse’ flows of innovation. Given the centrality of incremental innovation, likely interactive relationships which best aid these will be operational ones related to ICT supply, where learning and knowledge acquisition comes as much in daily practices as it does through one-off processes of learning.

9.4.4. The role of policy in inclusive innovation

Policy plays a crucial role in driving ICT innovations to low income groups. Thus, there is a wider scope for ICT policy makers both in ensuring underlying policy is sound, and

adopting policy approaches that have positive inclusivity effects on innovation for low income users.

As suggested in Chapter 8, policy making emerged from positive effects and fortunate congruencies of policy. Nevertheless, they fit well into an inclusive innovation perspective in highlighting the role that underlying regulation, policy making and policy implementation have played in inclusive innovation, both through shaping lead firms, enabling innovation intermediaries, and nurturing low income markets for innovations.

From an innovation system perspective, there are a number of directions by which such policy can relate to pro-poor activity, particularly in new areas of policy focus – supply-side service R&D, low income demand and micro-enterprise support which to date have been less analysed in developing countries. At this stage there is still research that can be done to more clearly clarify these more general policy understandings and to build better evidence based on 'toolboxes' of policy approaches, given the paucity of literature. This work provides some suggestions for policy makers in this respect.

Given the minimal rhetoric of policy for inclusive innovation, it is questionable whether policy makers will truly be able to produce joined up combinations of these elements that were outlined, including the complexity of actors, departments and interests involved in the policy making processes (Flanagan et al. 2011). Nevertheless as shown in this research, in the mobile sector piecewise and sporadic policy activity can be somewhat effective, suggesting that ongoing partial sectoral policy implementation could have positive effects.

9.5. Limitations and critical analysis

In this section some limitations of this work is discussed. This is divided into three core areas. First some comments on methodology are made, and some pointers are offered that might have improved clarity of results in this research. Second, reference is made on the generalisability of conclusions given the case studies selected. Third, some further critical comments are made regarding the notions of inclusive innovation, and gaps that work in this area needs to clarify in future.

It is argued that none of these limitations and critiques negates the findings, rather they point towards considerations in future research directions as to how such limitations can be addressed.

9.5.1. Methodology

The methodology undertaken has served to introduce significant new insight into the role and activity of low income innovation systems and through intense research focussing on ICT micro-entrepreneurs has brought new insight on micro-enterprise activities in detail, which has been useful in supporting and refining the theoretical discussions.

However, no field research is perfect, and there a number of ways in which improvements in approach might have elicited further useful data. Some of these improvements could be particularly important in future research as a more complete understanding of ICT sectors focussed on low income user are expanded.

In understanding the roles and links between actors in the mobile case study, in data collections there was a lack of, or low quality quantitative data. For example, there was no clear source of data regarding numbers of ICT micro-entrepreneurs in Kenya, whilst other data related to the types and brands of mobile phones in informal channels, and detailed financial information regarding M-Pesa agents were not provided by respondents due to lack of data, or commercial sensitivity. Given the time and costs, it was not possible to undertake such quantitative surveys or gather such data directly, thus, for quantitative outlines of the mobile sector, only sporadic data related to more general sectoral perspectives was available.

In this research, qualitative data was the core focus, so the lack of such data does not significantly affect any of the conclusions. However, improved quantitative data could still enhance insight. Such data would provide more unambiguous insight on this research and could be particularly important in more active policy promotion, where such data would support convictions made from qualitative research.

9.5.2. Generalisability of work

One of the key concerns that emerge when a specific case study seeks to characterise and understand a more general set of activities is the issue of generalisability. Here generalisability is discussed in terms of both ICT micro-enterprise and wider inclusive innovation work.

Specific aspects of the selected case study are highlighted which mean that it may have some limitations in being generalisable to other areas of ICT. Firstly, the mobile sector is a relatively new ICT sector, with less history of similar operations, less local knowledge and fewer precursor technologies. This will effect both inclusive innovation-as-object, where mobile needs to be first appropriated, explained and domesticated towards such users, and innovation-as-process where knowledge acquisition and

learning will be first needed before appropriation can take place amongst innovation intermediaries. This is in contrast to other low income focussed ICT innovations which have more precursors, with higher acceptance of new innovations, output is likely to be less problematic, and innovations and knowledge may be more appropriately transferred (for instance in digital video which hark back to previous non-digital ICTs).

Secondly, in the mobile sector, ICTs have a particularly low malleability which pushed socio-technical appropriation over technical activity, but this may not be the case in other sub-sectors. For example, in Kenya, PC assemblers operated in similar spaces to the mobile actors interviewed. In informal chats and observation, such actors are involved far more on the technical side of adaptation, in constructing new PC models, in repairing old technology and in software configuration, which suggest that in some sectors where technology is malleable, a more technical perspective on innovation might be appropriate.

Thirdly, the two sub-sectors covered had inclusive innovation systems that emerged around large firms who were part of, or drove ICT supply, albeit each sub-sector with vastly different set of network relationships. Whilst some parallel sub-sectors likely have similar ICT relations and activities to those studied, for example in informal PC assembling (where large PC firms are present) and informal internet supply (where large ISPs are present), in others, this is not necessarily the case. As outlined in the digital video production example in the literature review and potentially others such as other media production and internet based informal innovation, there is less evidence of large or multinational firms as part of these sectoral systems, so emphasis may be different. In particular, reverse flows of innovation may be less influenced by larger firms, and given the links made in their research between large firms and policy making, levels of policy may be lower. In some of these sectors, emphasis on inclusive innovation is also likely to shift towards productive benefits and away from consumptive benefits, for example in digital media production, the link between the innovative objects and development, certainly in a narrow sense, is less clear.

Fourthly, work has explored only one single low income market, in only one developing country. Likely there are differences in outcomes both in lesser developing countries and in more emerging economies. For example, in the Kenyan case there was a sufficient level of good policy, and in capabilities, finance in micro-enterprises, that a volume of embedded firms were able to emerge, be supported and be socio-technically innovative. In less-developed countries without such foundations in place, notions of inclusive innovation may be vastly different. Similarly in more vibrant emerging economies, one might expect that some of the growth barriers found here may be less restraining, and so one might see more dynamic growth.

In PhD research, the limitations of cost and time inevitably define the breadth of sectors that could be explored. The Kenyan mobile sector was specifically selected with these concerns in mind. In exploratory research a particularly relevant and vibrant sector allows evidence to be collected which can provide good explanatory analysis into the research questions posed, but at the same time provide insight on other ICT micro-enterprise subsectors. A city in a lower developing country was selected in supporting work to be firmly grounded in lower income micro-enterprises. In addition, the selection of sub-sectors which include multi-national firms is highly relevant given the growing presence of base-of-the-pyramid and south-south technology transfers in developing countries. Inclusive innovation systems which involve larger firms, like those examined, merit particular study for their potential future importance (Kaplinsky et al. 2009).

Thus, it is contended that the core conclusions; the centralisation of innovation models which include low income demand and innovation intermediaries, the link between quality of user-producer interactions in networks and flows of innovation, and the role of policy in influencing underlining activity; are likely to hold even as wider cases are examined - innovation intermediaries are likely to exist, power relations between larger and more informal firms will still be present, policy will still influence activity. Nevertheless, further research in ICT sectors which vary along the four dimensions outlined above would likely help to enhance generalisability of this work.

9.5.3. Inclusive innovation perspectives

The inclusive innovation literature and approaches, whilst offering compelling new directions to understand the wider link between innovation and development, is still an area of some contention, and these debates can be seen to seep into this research. Perhaps the most significant is the ongoing expansions and contention as to *what innovation actually means?*

Debates (which were covered in the literature review) outlined the move in innovation from radical 'new to the world' innovations driving economies, to those where inclusive innovation relates to incremental, local economic and livelihood improvement and where innovation might be socio-technical, indigenous or organisational.

Whilst the importance of such a shift in perspective for inclusive innovation is not questioned, this ever increasing granularity of innovation does pose fundamental concerns where ideas around innovation might be seen to be increasingly 'watered down' particularly for those adopting 'narrower' and economically focussed models of innovation (Moldaschl 2010).

It is worth noting that this thesis is well aligned with the present inclusive innovation literature, for example the definition of innovation produced in the STEPS centres' 'manifesto' on innovation, sustainability and development closely aligns with this work, looking at both objects of innovation in a wider way, and also the surrounding socio-technical elements:

> "Innovation, we mean new ways of doing things. This includes not only science and technology, but – crucially – the related array of new ideas, institutions, practices, behaviours and social relations that shape scientific and technological patterns, purposes, applications and outcomes" (STEPS Centre 2010 p.1).

In this work, this has meant that it was necessary to cover not only novel approaches (in technology, process, and organisation forms) but also more general tactics (such as diversification, embedding, specific 'business models') which whilst not necessarily novel in themselves play an important role in these wider realms of innovation for development and are hence important to explore.

There likely needs to be further debate here with scholars influenced by more classical perspectives on innovation that may reject new inclusive innovation ideas. For the purpose of this work, it is argued that it is enough to be aware of these points of contention and clearly outline why within inclusive innovation understandings, these processes are worth of analysis (as has been done in Chapter 3 in this thesis). However for wider relevance, inclusive innovation scholars might work to produce more refined frameworks that better link between these different perspectives on innovation. This will be important to allow these innovation studies to remain relevant and coherent.

A second area, where such models still need to be further refined relates to the perspectives on uneven power and relations in low income focussed ICT markets. This subject has been actively tackled in this work, highlighting the delicate nature of relations where very large and very small firms are involved. In Chapter 7, it has been posited that supporting user-producer interactions can be seen as a direction to improve relations with conclusions suggesting lead firm and policy considerations can lead to better innovative learning. However, given these benefits might be short lived, extra steps need to be taken to clearly consider power and control in inclusive innovation.

The debate can be positioned as the difference between a pragmatic perspective based on innovation systems covered in this research, and more critical perspectives of base-of-the-pyramid approaches, particularly drawing on development studies

critiques from the perspective of power and control (that were covered in the literature review (Arora & Romijn 2013, Karnani 2009)). Whilst innovation systems look towards pragmatic prescriptions policy and firm adjustment, taking a power perspective might focus more towards activism, labour power and emancipatory perspectives.

The former pragmatic perspective is again a purposeful choice here, in that this work intended to highlight the agency and potential in micro-enterprise within limits. This is also supported by the thesis conclusions where two sub-sectors studied revolved around significant moments of micro-enterprise influence which had an important and positive effect on inclusive innovation. Nevertheless other cases, particularly where systems are longer established and standardised, power and control perspectives which move away from such pragmatic views may be more useful where inclusivity of innovation is increasingly marginalised.

9.6. Further research directions

As outlined in the contributions to knowledge and limitations, a number of potential research directions emerge from this work, which can expand on some of these topics.

Three ideas are particularly examined. The first connects to the discussion on generalisability of these conclusions, both in the ICT sector, and wider focus of inclusive innovation. Further case studies can expand and support conclusions in these cases and enhance generalisability. Second, this work has highlighted policy making related to ICT to low income markets as an area for expanded research, thus some potential directions of research are suggested. Finally, it is argued that some findings in this study would be better placed into global (rather than national or sectoral) and political economy perspectives, which would reveal more clearly even more wider influences on low income innovation and policy.

9.6.1. Generalising and wider application inclusive innovation models

The model and findings in this work are one case study, in one ICT sector, in one country. As outlined in the previous section, there are important questions regarding how far one can generalise from the findings presented in this research. The detail of that discussion is not reprised here. This supports directions of wider research to enhance insight on inclusive innovation models for the ICT sector, particularly through similar cases in different countries, and through cases in different ICT sectors.

It has also been argued that the findings and conclusions of this work can have relevance outside ICT based innovation, in other sectors. Thus, further work might combine some of the new insights and contribution in this study with research in other sectors. Work in agriculture focussed on low income groups, has already invoked discussions on similar issues whilst not explored at the same theoretical depth, and suggest similar systemic processes and concerns (Clark 2002, Knickel et al. 2009, Spielman 2005, World Bank 2007).

This wider area of inclusive innovation is one that other scholars are actively exploring and this work in ICT can support and extend these discussions. There are likely important difference in such sectors, such as the increased presence of NGOs and intermediary institutions, which are not present in the ICT case. Further, inclusivity is likely to be more intricately linked to development concepts such as the livelihoods model or Sen's capability theory in such work. Research that links these concepts and sectors can improve insight.

9.6.2. Role of policy making in inclusive innovation

A key knowledge advance is that this work has brought out policy elements relevant to ICT delivery for low income markets to the fore, through the use of inclusive innovation models. There is much to research to expand this understanding. This has potential for policy makers and practitioners, and better clarity in directions of policy for inclusion (as opposed to the market policies). Innovation systems literature is well grounded in policy relevant knowledge and can be used to open up this research on policy making, and provide guidance on understanding the role of policy in constituting the institutions which shape systems of innovation.

As highlighted in Chapter 8, whilst some policy have been crucial in inclusive systems, there are other parallel approaches in this mobile case – licence conditions, universal service, direct public procurement – which have had little effect. Thus, the devil is likely to be in the detail here, where research needs to look more closely at the forms, structures, statutes and activities of those policies to understand why some have been important to innovation an others not, in order to begin to build evidence on a 'toolbox' of inclusive policies.

9.6.3. Global and political economy perspectives

This work drawing on innovation models has stuck to analysis from a broadly national and sectoral perspective. Yet, during research, work repeatedly came up against wider global and political aspects that are more difficult to understand in such frameworks. This is particularly pertinent where suppliers, goods, policy and relationships tend to

be global. Thus, an argument can be made that further knowledge can be built of ICT innovation for low income connected into wider global and political issues.

Two examples from the Kenyan case study serve to expand such notions. In terms of M-Pesa, whilst discussion in pilot stages revolved around innovation and enlightened policy in the trial, one might also link such progress into a diamond of socio-political interactions between the British state (in the form of development agency DFID), UK's Vodafone Foundation, Safaricom and the Kenyan state. Whilst this research has not fully dug into these relations there was some evidence in research - the presence of UK government officers in drawing up mobile money rules, cross shareholding between parties, and in the annual 'patent' licence fees still extracted from Safaricom back to the Vodafone, that one might position this ICT innovation within other global political relations.

In a similar way, much of the mobile phone sector revolves around global strategy and political economy. Multinational and Chinese firms decisions to locate in Kenya has been generally positioned from a pure economic perspective here, but again there are suggestions that wider analysis could enhance understanding. In this example, issues such as the political links between China and Africa that legitimise Chinese mobile firms' presence in Kenya and their unconventional strategies; the effect that wider multinational firm strategies have on local decision making, and the national and regional structures and incentives which influence how large firms act, might allow clearer understanding of this sub-sector.

To sum, this work was about getting to the bottom of micro-enterprises and innovation for low income groups by linking to wider relationships and sectoral structures. Global and political economy perspectives would suggest that there is a further step to make, where more fundamental political relations, structures and power shape how innovation for low income users of ICTs is ultimately positioned. This does not negate the value of findings, but rather complicates them. Further research linking such wider economic decisions into wider global and political structures could serve not only to clarify understanding, but conceivably generalise understanding of innovation better, through linking into wider global flows and issues.

9.7. Conclusion

ICT micro-enterprises focussing on low income customers are relatively new phenomena in the developing world, yet their provision of employment and involvement in low income use of ICTs merited more in-depth examination.

Whilst early work has discussed such enterprises through the frame of entrepreneurship, particularly with respect to the active innovation processes that such enterprise undertake, this work has illustrated how this should be combined with a more relational approach. Such an approach links into how such innovative activities fit into processes of ICT innovation for low income groups in developing countries, and this allows understanding of more fundamental influences on such enterprise and conditions.

As the underlying approach for this work, an inclusive innovation perspective has been a useful model, linking actors, relations and policy in a coherent understanding. The adapted models and analysis that stems from this has contributed to academic knowledge, and provides insight for firms and policymakers focussing on such low income users of ICT in developing countries.

To relate back to the original goal of this work, to understand ICT micro-enterprise, this perspective clearly articulated the types of innovation they undertake, whilst effectively linking to a wider sectoral framework, through a systemic articulation of innovation in interactive systems, and in the integrating policy perspectives into this work.

With a growing interest of ICT provision for low income consumers, and the increasing number of actors in such activity, from large to small players, inclusive innovation perspectives are likely to be a element in understanding such activity in future analysis.

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Appendix 1: Summary of pilot research

This appendix provides a brief summary of work from the pilot study:

Interviews were undertaken, focussing on experts who worked in areas related to ICT and micro-enterprise who had an understanding of the sector, as well as interviewing and having informal discussions with a number of ICT micro-entrepreneurs themselves.

Job	Date
ICT Policy maker and consultant	13/10/10
University professor	16/10/10
Manager in NGO with work in informal ICT projects	20/10/10
Private sector ICT sector expert and consultant	26/10/10
Operational manager in ICT focussed government organisation	31/10/10
University professor in ICT and consultant	05/11/10
M-Pesa agent	05/11/10
ICT researcher in Kenya	10/11/10
Researcher in ICT focussed government organisation	12/11/01
Director of informal sector organisation	12/11/10
Country manager of mobile handset firm	13/11/10
Expert with knowledge of mobile trading clusters	16/11/10
ICT Policy maker and consultant	17/11/10
Owner of PC assembling firm (formerly SME)	30/11/10
Policy maker in ICT ministry	30/11/10

A **number of presentations** of ICT-based projects and research in Nairobi were also attended interacting with delegates to increase my understanding of the underlying aspects of ICT as well as speaking to a number of high level policy makers.

Event	**Date**
Research workshop on urban ICTs in African cities	15/10/10
Research launch on SMEs in ICT sector	9/11/10
Local launch and discussion of international report on ICT and private sector development	19/11/10
Research presentations on public ICT access in Kenya	26/10/10

Appendix 2: Information sheets

Overleaf the information sheets and approval forms are presented for reference. Footnotes indicate that this core form was adjusted slightly dependent on interview type.

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Understanding ICT Micro-enteprises in Developing Countries - Participant Information Sheet

You are being invited to take part in a research study as part of my PhD research looking at micro-enterprises in developing countries that use information & communication technologies (ICT).

Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

Who will conduct the research?

Christopher Foster, PhD Researcher (Main researcher)

Prof. Richard Heeks, Professor of Development Informatics

What is the aim of the research?

This work is part of my research looking at micro-enterprises in developing countries that use information & communication technologies (ICT). The goal is to produce research which looks to improve the conditions of such enterprises.

As part of this work I am undertaking studies of ICT micro-enterprises in Nairobi.

Why have I been chosen?

You have been chosen because you work in an ICT micro-enterprise and I am interested in understanding more about your work within this sector[78].

What would I be asked to do if I took part?

I will undertake interviews, covering ICT micro-enterprises in which you are involved:

- The interview is expected to last approximately 1 hour.

[78] Changed slightly for different organisations.

- The interview will be undertaken in confidence, and your identity and any information shared during the interview will be kept private

- You will be asked to sign a confidentiality form (overleaf) before the interview, which outlines how the information will be used and kept private

- A recording will be made of this interview which will later be transcribed[79]

What happens if I do not want to take part or if I change my mind?

You are not obliged to take part in this work.

If you wish to withdraw from this research then you are able to do so at any time and without giving reason. At this stage, all your records will be destroyed.

Will I be paid for participating in the research?

The research is conducted by a research student, and in line with ethical policies, you will not be compensated for taking part in these interviews.

Will the outcomes of the research be published?

Outcomes of research will likely be published in future in international journals and university reports.

Contact for further information

Mobile: +44(0) 7751 537350 (uk)[80]

Email: christopher.foster@postgrad.manchester.ac.uk

What if something goes wrong?

If you require further information, or do not understand one of the points above, then please contact me using the details supplied

The researcher, and university takes seriously any problems that emerge due to undertaking this research, and arrangements exist to help support participants who feel that the research has affected them negatively. In the first case, you should contact the researcher using the information supplied

If you wish to make a formal complaint about the conduct of the research you should contact the Head of the Research Office, Christie Building, University of Manchester, Oxford Road, Manchester, M13 9PL.

[79] This was only be included in appropriate interviews.

[80] Local mobile number included here.

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Understanding ICT Micro-enterprises in Developing Countries - CONSENT FORM

If you are happy to participate please complete and sign the consent form below

	Please Initial Box
1. I confirm that I have read the attached information sheet on the above project and have had the opportunity to consider the information and ask questions and had these answered satisfactorily.	
2. I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving a reason and without detriment to any treatment/service	
3. I understand that the interviews will be audio-recorded	
4. I agree to the use of anonymous quotes	

I agree to take part in the above project

Name of participant	Date	Signature
Name of person taking consent	Date	Signature

Appendix 3: Sample interview script

Below is an example of a transcribed interview script for reference. As outlined in the main text, interviews were recorded with a pen and paper and later written up.

As you will see, this means that interviews are written in third person, which follow the gist of his explanations rather than the actual words, except where specific quotes are noted in inverted commas.

The interview below took place with an M-Pesa agent, whom we will call Samuel, who works in a kiosk 15 minutes away from Nairobi centre. Samuel is a fairly typical agent, he is quite fluent in English (the interview takes place solely in English) and has completed secondary school, but with no jobs available now works in an M-Pesa agency.

As can be seen, generally the interview attempts to follow the semi-structured themes as shown in Appendix 4. Occasionally this goes off track when discussion is expanded by Samuel, or when certain subjects are revisited.

This specific interview was in the middle of the interview set for the M-Pesa case study, so some questions relate to specificities of service and jargon which have already been discussed from other interviews, hence they are not expanded. Nevertheless, the interview starts with a set of simple questions about the service to help build rapport with the interviewee and to get them talking.

At the end of the interview, the script includes observational comments of events and interactions that occurred during the interview which also provide very useful data in the research.

Much of the discussion is fairly mundane, but in line with other interviews some reading of certain points can reveal important issues: certain strategies of local innovation – in this case related to ensuring security and in customer interactions – and reveal aspects of the uneasy relationships of agencies both into the Safaricom network and into the dealer.

Some information has been removed from the script to preserve anonymity.

What is your job as an agent?

M-Pesa dealer undertakes money transactions

- M-Pesa sent on the SMS network
- Takes a sliding scale of commission dependent on the value of transaction
- Registrations are also done here
- No commissions taken are taken by the agent. These come back through Safaricom later

How do customers make M-Pesa transactions?

M-Pesa is a transaction done on the phone

- Three types of transaction – Register, Give cash, Take deposit
- He makes a transfer between two phones he has in his kiosk to demonstrate how it is done
- To deposit you send the virtual money to the agent number shown behind him on the wall who will then return the cash
- Agent has phone with special sim to administer the transactions – Safaricom/M-Pesa menu
- Both then receive a text message and then the money transaction takes place
- It is made secure for the agent and transactor of M-Pesa transfers – required you to enter your M-Pesa ID and PIN, so that if someone uses your phone, your money in the M-Pesa account is still protected.
- He shows us how it is possible to change pin number through the menu system

What do you do when someone wants to register with M-Pesa?

- Requires a different form – He shows us a similar book, but with a slightly different colour forms - enter the details of your name, ID card number, job, location etc
- To have m-Pesa you need a Safaricom simcard, a mobile and a valid national ID or passport otherwise you cannot be registered.

What if you lose your ID?

- You need to have an ID. If you don't you cannot register and you cannot deposit or withdraw from the agent. It is against the rules

What if you have too much money or M-Pesa?

- If there is not enough float/Pesa then you tell them to come back later

- In terms of Pesa – When it gets too high then it can take it to certain banks to deposit it for cash. There is an <*X*> bank just across the road
- ''If you have 100K Ksh as float then you never have any problems with running out''

We've hear that sometime people send transactions to wrong people?

- With transactions you can connect to call support – customer care provision

Ask about log books which he has opened in the kiosk?

- Recording of transactions
- This is a logbook of all money withdrawal and deposit transactions
- He shows us how the book makes a duplicate of this for each transaction – eventually one ends with vendor, the other with Safaricom
- Also recording is part of M-Pesa ID requirements – ID is put on each transactions in the logbook
- He shows us the transactions in the logbook in more detail talking about each one. Details of transactions recorded are: Deposit value, ID of confirmation which comes when the M-Pesa transaction is confirmed by text, name of transaction, Mobile number and signature of transactor

Who are you main customers? What type of transactions do they make?

- Balance of withdraws and deposits in this agency – in this area local traders use M-Pesa like a secure bank - They put money in at night they then take it out the next day
- Like a bank but for these traders the M-Pesa agent is often just around the corner and they do not have to have an 'account'
- '''We are more popular than the bank because M-Pesa runs more hours than the bank'''
- His M-Pesa kiosk stays open until 8p.m.
- Officially it is supposed to be 5pm (as supported by the opening hours signage). This difference is because all of the traders in the local area tend to close after 6 then they need time to count their money and stock before they come to the agent. At this time the banks are closed

Are commissions expensive for these traders?

- Traders are often happy to pay the commissions on this, as this is much better than loosing all of your money

Do you work all these hours?

- They open 8am to 8pm – Generally Samuel works those hours. But there is also one other guy who can help in the kiosk if it is needed

You are busy today. Is this normal amount of customers?

- Typically transactions are around 100 per day
- Very few registrations now most Safaricom owners have an account already
- Much more busy at the end of the month when people are paid for their jobs
- Samuel talks about being tired with his work - working 30 days out of 31 days every month so virtually 7 days every week. This is why it is hard for him to keep going. Why he wants to go back to school

Does Safaricom come and check the agency?

- TDR visits once a week to check standards in the booth
- He shows us a separate summary sheet that records the a number of key statistics - float/amount of deposits/amount of withdrawals/number of registrations per week that he shows the TDR
- This is read and then signed by the supervisor

You handle a lot of cash. Is it secure?

- It is okay in the daytime [I see a guard passing by during the time I am there].
- '''It is safe because there are lots of people around'''
- At night the float is taken away – either to the home of Samuel or put in a unspecified safe *[not sure if he means a safe here, or that he hides it somewhere in the Kiosk. He would not expand on this any more]*

We have heard about the increasing number of agents. Have they affected your business recently?

At present it does not seem to be making a difference.

- There are 5 other M-Pesa stores in the local area
- S talks about the importance of trust and building this with customers through good service – '''some customers will come a long way to use the booth that they know'''

What about the new M-Pesa ATM's?

- Withdrawal is more complicated at an ATM, and ATMs tend to only be in certain places in town

- Poorer people generally prefer to use the agent rather than the ATM.

How did you become an agent?

- After finishing secondary school, he was unemployed and could not afford to go to university – so was looking for work
- Started the job at this store due to a personal connection with the owner, who had his trust
- Enjoys working in money, because of this the store owner prefers to employ someone that they can trust. Previously they had some problems with employees stealing from the agency
- Store owner had the money to be able to open M-Pesa
- Future – Sees M-Pesa store as a stepping stone to something else. He wants to save up and go back to school once he has saved some money, run own business rather than working for someone else

How long has the agency been here?

- Store is relatively new – Just over one year old. S started working there when it had been going for around four months
- Part of larger dealer of phones – called <*X*> – The <*X*> network has <*X*> agents

Can an M-Pesa shop sell anything else? (having observed some DVD and an old computer in the store)

- An M-Pesa store can sell anything they wish, often for example airtime and phones – but they cannot sell Zap or other competitors goods
- This one sells M-Pesa only. It used to also be a video library but we could not handle running both due to the number of transactions we were getting for M-Pesa. So now they have moved just to M-Pesa

How about technical problems with M-Pesa

- Often the network works less well after strong rains
- Also if someone in sending money to a rural area then it can have many more delays
- Safaricom has around 75-80% of all network at the moment – quickly surpassed Telekom, and no reason to see that the M-Pesa booth might start to reduce

Do you interact with other M-Pesa agents nearby?

- No real connection between the M-Pesa agents – Samuel knows some well enough to say hello, but not much more

How about the other traders in the corridor?

- Use to have neighbour who sold phones but business was moved to the centre and replaced with another clothes shop
- Knows the other traders – Introduced to several during the course of the interview
- Not a member of any association

We were reading about the new M-Kesho service. Are you an agent?

M Kesho is a partnership with Equity. You have an equity bank account and you use M-Pesa

- If you don't have an equity account but use M-Pesa then you can open an equity account. Used for safety of money as well as allowing people to improve the saving of their money
- It is being used a bit by some of the businesses that come to his agency, particularly small scale businesses
- Compared to a few years ago, increasingly such businesses have bank accounts with banks like equity as compared to a few years ago

What does the agent do?

- Transactions and commissions are the same as M-Pesa but M-Kesho add some extra work where agent needs to explain the service to new customers
- Well publicises in newspapers and in terms of flyers,
- Samuel has had some training about it – and some early confusion where Samuel has to explain to customers – but they quickly understand
- His customers are small businesses, individuals – mainly around the idea of safely storing money

Do you see customers moving to competitor services?

- Samuel talks about orange new service – Limit per transaction is high – 100K Ksh per transaction compared to Safaricom which is 35K Ksh
- But still a lot more agents in terms safaricom – though other services particularly Zap are growing

- For Zap the comission is lower – as compared to M-Pesa and in hand with lower volumes suggest that you would need me than Zap in order to run a businesses

Are there risks in running the business?

Network has been getting worse over time and this probably has connection to the upgrade of M-Pesa which happened the previous weekend

- Upgrade seems to have increase the bandwidth – system works better afterwards ''although not in some areas'' – [Seem to be the suggestion that sending SMS in certain areas where there has not been a full upgrade can still be problematic]
- Delay of upgrade due to cuts in fibre – Samuel speculates of sabotage

How about security risks? We heard about some scams, how do you avoid these?

Fake M-Pesa SMS – Generally happens to new staff and in fact scammers look for new staff to take advantage of

- Importance of training to recognise the signs of fake message – He shows us an SMS and outlines the unique and correct 'message centre number', 'letterhead' on the SMS coming from M-Pesa which will not occur with a fake message
- Scammers go looking for new and experienced agents to try this scam
- When Samuel started he lost some money due to such a transaction – he received a fake SMS and gave money but it didn't turn up in account
- Loss goes to an agent not to M-Pesa when one of these scams occurs

Logbook and privacy issues

- Stories of people loosing money due to scammers looking at the logbook and seeing the float level
- Samuel uses a ruler on the logbook to hide this information from customers when they are signing the logbook
- Logbook used to be risky, but has now been changed (new set of logbooks which Samuel exchanges around 2 weeks ago). You no longer write the telephone numbers or float in the book with this improved design

Security and Robbery

- In insecure areas where one might get robbed, one can apply for an 'M-pesa management sim card' which allows you to transfer M-Pesa at the end of the day elsewhere so that are at no risk in terms of transferring M-Pesa by robbers
- But if you have excess case S doesn't seem to think there is much being done. You buy a safety box, go accompanied

- Anecdote by S about how on the weekend of the M-Pesa upgrade he did not have time off. He still had to hang around the <*X*> area ''to keep an eye on the money" which is kept in the booth to avoid any risk of losses

Fake agents

- He has heard of stories but this is less of an issue – should be fairly easy to spot – Agents have official signage and official numbers as well as ID
- If something seems risky you can call a certain number

Fake currency

- Training to spot fake currency done by M-Pesa
- Special bulbs to see watermarks
- Business will again take any losses due to fake currency – ''M-Pesa has trained us to spot fake notes, so it is out responsibility''

Do agents get trained?

- Training to the M-Pesa agent – Taught step by step by the safaricom person
- Meeting and feedback occur regularly with agents – S comments on going to a meeting about a month ago. Able to ask questions about the service and to give any feedback
- Also last week S received an SMS based survey from Safaricom about network and issues

Observation during interview

Transactions of customers

- Generally transactions are for a few hundred to a few thousand – Withdrawal slightly more whilst I was there
- Someone asks for an amount (presumably withdrawal) under the minimum amount and it is rejected
- Someone also came and asked for a big withdrawal ~120K which was too large to handle for the agent
- Several people pass by and request airtime, which the agent does not sell

Network issues

- One transaction occurs, where both parties have to wait for a minute or so

- Girl having a problems with M-Pesa network. Told to come back in a few minutes – disappears then returns but it is still not happening. They try to call the support number but they are busy as well

Booth style outlet for main trading and a door for the agent to enter – both of which ca be locked. Kiosk is electrified but has two power cuts during the time.

- Equipment present - Old logbooks from previous transactions, Part Refurbished PC on the floor, Old monitor attached to the wall and some other remnants of the former video library store
- Walls - Covered in M-Pesa/Safaricom ads, facebook on SC/Bamba credit/SMS game/ UK M-Pesa, Bible verse on walls, Small sticker which has been annotated with a load of mobile numbers
- Float – in a TV tuner box – would say it has roughly 30-60K Ksh in it

Local interactions

- Samuel is regularly greeted by many traders inside the small bizar as they pass
- Samuel has a hanger with a load of keys which a number of people come and take and then return. Although we do not ask about this in the interviews
- Some customers pass who are obviously regulars who are greeted in a more expanded way

All discussion with customers is done in Sheng

- Figures and numbers, simple statements are given in English with more complex explanations done generally in Swahilli

Appendix 4: Interview structure

Themes and typical interview questions are outlined for the mobile handset sub-sector interviews. Mobile money questions followed the same themes but actual interview questions were slightly different dependent on the specifics of the sub-sector.

What they do? How they do it?

- What are the main business functions?
- Discussion of technologies based on observation.
  (e.g. New or second hand? Best selling products? How many phones do you sell a day? Pick out some phones and ask about features, brands etc? Discussion of anything surprising that is observed)
- Discussion of other items based on observation.
  (e.g. signage, licences, logbooks or record keeping)
- In the case of the above points, if there is anything of low familiarity then they are asked to expand.
- Any particular practices which are unfamiliar they are asked to demonstrate.

Business History

- Are you the owner or employee?
- How long has the business been running?
- Has it always been located here? Was it easy to get this kiosk?
- Has it changed products over time? Biggest changes in enterprise?
- Do you/the owner have other kiosks?
- Biggest problems in business at present?

Individual History

- (if an employee) How long have you worked here? Where did you work before?
- Education level? Did you have any training/education in enterprise and technology before you worked?
- How many days do you work per week? Hours? How much do you get paid?
- How many employees work here?
- Your future plans?

- If you wanted to become an owner of such a business, would it be possible? How much money would you need?

Local Business Issues

- Who are their customers: Typical income of customers? Age? Business or personal use?
- How do you decide prices, Do you have a specific profit margin? Do you compare prices with local competition?
- Do you know other nearby kiosks owners?
- Are you in any associations, or groups in the area?
- How do you deal with the increasing numbers of sellers in competition with you? Do you see customers going down? How do keep being profitable?

Relational Issues

- Who supplies your goods? One supplier or multiple? Are they imported?
- Are goods on sale and return, or do you buy at wholesale?
- How do you decide what devices to stock? Do you rely on the suppliers' knowledge or based on your customer demand?
- How often do you restock?
- How else do interact with supplier? (e.g. do they give credit, do they refund for malfunctioning phones)
- What do think of the suppliers?

Institutional Issues

- Are there any rules and regulations that affect the business?
- What licences do you have to operate?
- Do you get problems from local police or enforcement?
- Are there problems with security here? How do you avoid theft of goods and money?

Seeking Further Connections

- Could you introduce us to some of your neighbouring enterprises?
- Could you connect us to the store owner?
- Could you connect us to the technology suppliers?

Appendix 5: Key processes of M-Pesa

Below the key elements of M-Pesa are presented in more detail:

Registration

To use the service, the sender will need to register to have an M-Pesa account with an agent, presenting identification and filling in some personal details. A sender will need to be connected to the Safaricom mobile network, via an appropriate mobile sim card. The phone number of this sim card is used as the identifier of the M-Pesa account. In addition to a sim card, a user will also need a mobile phone when they are making transfers. It should be noted that owning a mobile phone is not necessary as an M-Pesa account links not to a specific mobile phone but rather to the sim card. Indeed, in less affluent areas in Kenya, agents tend to have a spare phone which they lend to users without phones to plug in their sim card and use the service.

Cash deposit

A registered sender will hand cash to the agent, verifying their identity, and giving their mobile number to the agent (which identifies their M-Pesa account). The agent once satisfied with identification will use their mobile to send a mobile message, which transfers e-cash from the M-Pesa account of the agent to the M-Pesa account of the sender.

Person-to-person (P2P) transfers

P2P transfers take place directly. To make the P2P transfer, the sender will enter the receiver's mobile number (M-Pesa account) and amount for transfer into their mobile, and send a mobile message to make the transfer. Once the transfer has been verified by the system, this will result in a transfer of e-cash away from the senders' to the receivers' account. M-Pesa provides some level of interoperability for unregistered and off-network receivers, who upon a P2P transfer will be informed by SMS that they have received an M-Pesa transfer and to redeem this, they need to go to an agent.

Cash withdrawal

Users are not obliged withdraw immediately on receipt of transfers, rather M-Pesa account acts somewhat similar to a 'lite' bank account. Cash withdrawal will occur when a user goes to a cash agent where they will send a message from their mobile phone entering the amount of cash they wish to withdraw and the identifier of the agent they are interacting with (which is displayed at all agent stores). Provided the user has sufficient funds the agent will receive an approval SMS from the system, and they can provide the cash to the user.

Organisational transfers

With organisations, there are two potential flows of transfers, as shown in Figure 5.6(c). Individuals might transfer virtual cash from their own accounts to one of an organisation to pay for goods or service. In the other direction, organisations can also bulk send payments from to a user provide that they have their mobile phone details. For this to occur, an organisation needs to become a corporate user, and is then assigned a specific identifier for their virtual account.

It should be noted, that for smaller organisations, M-Pesa use tends to be more ad-hoc where an individual in the organisation might use their own personal account to receive or transfer P2P payments to and from individuals.

Appendix 6: M-Pesa commission and tariff list

Taken from Safaricom's 2007 tariff list and Mas & Ng'weno's presentation of commissions (Mas & Ng'weno 2010 p.19, Safaricom 2007).

Type	Minimium (Ksh)	Maximum (Ksh)	Customer Tariff (Ksh)	Agent Comission[81] (Ksh)
Deposit (cash to e-cash)	100	2500	0	10
	2501	5000	0	10
	5001	10000	0	15
	10001	20000	0	20
	20001	35000	0	40
Send Money to Registered User	100	35000	30	-
Send Money to Non Registered User	100	2500	75	-
	2501	5000	100	-
	5001	10000	175	-
	10001	20000	350	-
	20001	35000	400	-
Withdraw (e-cash to cash)	100	2500	25	15
	2501	5000	45	25
	5001	10000	75	35
	10001	20000	145	60
	20001	35000	170	70
Withdraw by Non Registered User	100	35000	0	(as above)
Registration			0	80
Balance Check			1	0
Change PIN Code			1	0

[81] Note that commission levels indicate total commission for agent and Master-agent prior to tax.

For guidance, exchange rates (1st March 2007): $1 = 69Ksh; £1 = 136Ksh.