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Nurturing user-producer interaction: Innovation flows in a low income mobile phone market.

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Abstract

Understandings of innovation in developing countries, low income markets have considered two perspectives. The role of top-down, more strategic innovation from larger firm actors, and more diverse, socially relevant perspectives that highlight the role that localised practices plays in making innovation applicable to local needs. However, to date there has been little analysis of the link between these two perspectives.

In this context, the goal of this paper is to explore the interaction between top-down and localised elements of innovation, and to provide an understanding of the conditions by which these two perspectives might be complimentary. Drawing on the case of mobile phone sector in Kenya, and adapting Lundvall's concept of user-producer interaction, a conceptual model to understand such innovation flows is outlined which highlights the centrality of operational links between producers and users which serve as a medium for interactive learning.

1. Introduction

There is a growth of interest in the idea of inclusive innovation - that is a focus on conceptualising innovation which provides benefits for low income groups in developing countries (Altenburg 2009, Cozzens & Kaplinsky 2009, Foster & Heeks 2013a).

Two essential directions can be discerned from literature where such inclusivity has been discussed. The management literature, particularly revolving around 'base-of-the-pyramid' markets (Hart & London 2005, Prahalad 2009), has positioned innovation for low income communities as predominantly a top-down, strategic and firm-led exercise in management of innovation, where innovations are refined to have efficacy in these markets. In contrast, a second direction has also emerged where understandings of innovations and low income actors look to integrate more diverse, inclusive and socially relevant perspectives on

innovation. Such work can be said to examine more micro-level and emergent innovation activities (Cozzens & Sutz 2012, Singh & Gubta 2011, Utz & Dahlman 2007). Thus, this work has begun to highlight the important role in developing countries for innovation that emerges from more localised contexts.

However, to date in the literature there has been a division between these two approaches to innovation in low income markets, one coming within business discourse of management of innovation in developing markets, the other more influenced by development studies and approaches to supporting livelihoods. Here we argue that better link between these two directions is important in more clearly understanding how innovation can be more inclusive:

For firms innovating for low income groups: More complete perspectives on localised innovation processes provide insight for how larger firms can adopt and scale appropriate innovations, promoting both relevance and inclusivity. How such firms go about understanding and linking to these rich localised processes should be a subject of core interest for success in such markets.

For actors working with localised innovation processes: The existence of local or grassroots innovation is typically isolated from wider flows of innovation, and thus localised innovation (or lack) is often seen as something linked to local variables (e.g. resources, capacity). This work argues for a more relational approach for understanding localised innovation, where external pressures and knowledge flows are crucial in defining the extent and limitations on local innovators.

The paper is presented as follows. Firstly these two directions of innovation are explored more thoroughly, and some suggestions from literature are discussed which might best link these processes. It is argued that interactive learning models of systems of innovation provide a potential direction for analysis, and we revive Lundvall's concept of user-producer interaction as a useful way to link between these innovation directions (Lundvall 1992a, Lundvall 1988). User-producer interaction highlights the centrality of relations between innovation producers and users which serve as a medium of interactive learning. However, given the specificities of the actors and divergent processes of innovation in low income markets, these models need to be revisited in light of empirical work to best understand how to refine this conceptualisation for the specificities of these low income users of innovation.

Secondly, analysis of the utility of such an approach is undertaken, drawing on the case of mobile phone sector in Kenya which provides a perspective on the intersection between these

two types of innovation. In this case, user-producer interactions are best understood by examining the indirect elements of managerial and technical control between user and producers, and in the configuration of user-producer relations. This provides insight into the general nature of interactions and thus orientates how top-down and localised processes of innovation mutually interact.

In sum, this work hence extends current literature in two clear ways. Firstly, by reviving and extending the notion of user-producer interactions as playing a key role in understanding inclusivity, it highlights and adapts a conceptual approach that can provide better clarity of the links between top-down innovations and localised possesses. Secondly, this conceptual approach is used also highlight specific considerations which can aid actors involved in such innovation that can bring benefits, both for large firms and those interested in localised inclusive innovation processes

2. Innovation and inclusivity: two directions

2.1. Base-of-the-pyramid and innovation

Work around base-of-the-pyramid (BoP) markets predominantly looks at successful (and arguably) inclusive strategies led by large firms who see low income groups as untapped markets (Hart & London 2005, Prahalad 2009). In such work, provision of relevant products to low income groups is articulated to centre around adaptations or new innovations which fit within the unique cultural, financial and social needs of low income groups (Prahalad 2006).

Successful BoP ventures have typically adopted contextual, social-embedded approaches to achieve success, by offering uniquely tailored products to markets, and working with local consumers and entrepreneurs in BoP delivery (Hart & Christensen 2002, London & Hart 2004). Thus, BoP work has somewhat acknowledged and examined local processes that capture the innovative capabilities of these low income groups, particularly in joint 'co-creation' activities in early stages (London et al. 2010, Simanis & Hart 2009).

Yet, there are still significant gaps in base-of-the-pyramid conceptions of local innovators. Notably, the BoP literature has been critiqued in it tends to consider localised innovation and community inputs in a rather functional and coherent way linked to the ultimate goal of furthering business success (Arora & Romijn 2013). Further, the background of this literature from within management literature leads to a strong focus on single firms and their

strategies. Together these positions means that frameworks and approaches tends to underplay and reduce the richness of activities occurring in such settings.

These conceptual weaknesses link to a lack of practical relevance. Guidance does not provide clear understanding as to how firms integrate localised innovation at scale. Here conceptual weaknesses are exacerbated where there is no clear guidance in how to deal with increasing number and diversity actors who are involved in using and adapting innovations (Anderson & Kupp 2008, Foster & Heeks 2013b). In such complex scenarios, how firms best nurture and respond to localised innovation has been underplayed.

In essence, it can be argued that base-of-the-pyramid activity, particularly as innovations begin to scale, for all the early 'co-production' rhetoric, innovation is still dealt with as a top-down strategic and firm-led management of innovation by these large firms once early stages have been completed.

2.2. Localised flows of innovation

New understandings of localised innovation in developing countries, look to encapsulate more diverse, inclusive and socially relevant perspectives on innovation and have made a focus on innovative localised processes of adaptations (Cozzens & Sutz 2012, Singh & Gubta 2011, Utz & Dahlman 2007).

Such work has been termed under a bewildering set of labels - frugal, indigenous, pro-poor, inclusive, local, grassroots and informal innovation – outlining a range of local practices and adaptations around innovations, in communities, in SMEs, amongst activists, that have hitherto been underplayed in innovation studies (Lorentzen & Mohamed 2009). In these contexts, innovation is articulated as emerging in the unique conditions, practices and constraints of low income settings where low income communities use their knowledge to solve problems, and share solutions relevant to their local needs and settings. Thus, in terms of inclusivity, this work has begun to highlight the important role for innovation that emerges from more localised contexts plays in developing countries.

Whilst these may not necessarily directly link into wider economic growth, such activity can be essential at a micro-level by allowing citizens to build jobs, resilience and position in society and vital to ensuring livelihoods at a micro-level (Arocena & Sutz 2000, Cozzens & Kaplinsky 2009, Lundvall 2011). Thus within a wider inclusive innovation framework localised

processes of innovation have value in being a key component when one considers innovation as not solely a driver of economic growth.

Such work has focussed mainly on the activities of localised innovation and practices. Whilst there has been some link between such localised activity and wider innovation drivers: institutional support for local emergence of innovations (Berdegué 2005, Utz & Dahlman 2007); and in acknowledging that localised innovators may be linked into value chains (Kaplinsky et al. 2009, Kraemer-Mbula & Wamae 2010a); such work is still sporadic and requires more focus, particularly in provision of more empirical analysis.

This lack is surprising given the continued growth of firm-led BoP innovations in low income communities in developing countries. Rather than local or grassroots innovation being an isolated phenomena, it is likely to be influenced and linked to the innovations that are diffused into local contexts – such as agricultural tools, mobile phones, informal manufacturing processes etc. Thus, in a similar way to base-of-the-pyramid literature there is a disconnect. In localised settings, the wider influences around diffusion of innovations require further research in order to more clearly understand the top-down links to localised innovation.

2.3. Weaknesses

One can see this disconnect between approaches as more than a cross-disciplinary detachment, it can be seen as a weakness in the literature which reduces practical guidance for those concerned with both top-down and bottom-up processes.

For firms looking to focus on low income markets, clearer understanding of how to capture, nurture and understand localised processes around innovations is a crucial requirement of such firms, in provision of appropriate products to such low income consumers and consequently business success. Indeed, in terms of inclusivity such firms might also more rapidly amplify relevant localised innovations and adaptations, which can drive inclusivity of innovations at scale.

For localised innovation, a lack of relational analysis leads to a danger of missing the 'bigger picture' where variation in local innovation is linked to local variables, such as lack of resources or the need for local capacity building, ignoring external pressures. Whilst taking a strong locally-contextualised view has undoubted valuable, one can legitimately argue that without relational analysis, actors and policy makers concerned with promoting these new

types of innovation will be limited in understanding.

In this context, the goal of this paper is to answer the following question,

> *How do we conceptually link between these two perspectives on low income developing countries innovation?*

By answering this question, work seeks to reduce the knowledge gap that has been observed around innovation for low income groups in developing countries, particularly with a goal to understand how top-down, bottom-up complementarities can drive inclusivity of innovations.

2.4. Systems Approaches

In this paper, it is suggested that approaches based upon adapted systems of innovation models, and more specifically the use of Lundvall's concept of user-producer interaction (Lundvall 1992a, Lundvall 1988) can build an understanding of such innovation flows.

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 1997, Freeman 1995, Lundvall 1992b). They centralise 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). In developing country settings, 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 have potential, and models that examine the ways of doing, using and interacting (DUI) related to innovation can be used (Lundvall, Vang, et al. 2009). Such perspectives look towards definitions of innovation emerging in the 'wider' everyday processes of interactive learning by multiple system actors compared to 'narrower' definitions which have typically analysed formal institutions and organisations (ibid.).

Given a DUI perspective on innovation, there is particular interest in the key varieties of interactions between actors in innovation systems, as this will determine how actors 'do, use and interact' and ultimately the directions around innovation. Lundvall's work on user-

producer interactions provides a means to examine the link between interactions in systems (Lundvall 1988). Innovation is inherently an uncertain activity both on the supply-side and demand side. On the supply-side, producers need to build understanding user preferences and innovation needs of users. On the demand-side, users need to build understand the utility of new innovations in order to make adoption decisions. User-producer interaction thus denotes an examination of those key relationships between producers and users which link to how learning and knowledge flow between producers and users as shown in Figure 1 (ibid.).

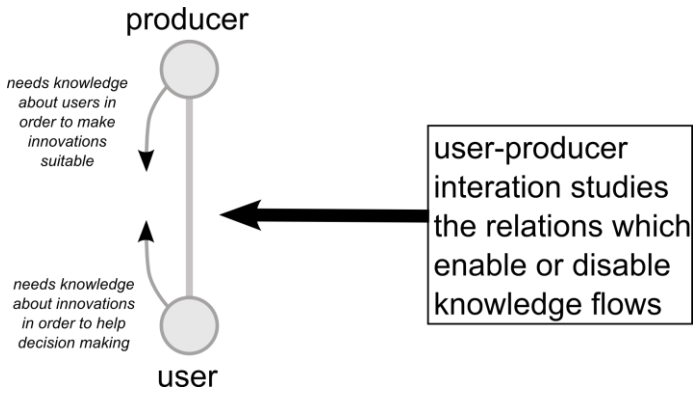

Figure 1: User-producer interactions in innovation systems

Work on inclusive innovation is complementary extends DUI systems perspectives through consideration of a wider range of interacting innovating actors (such as informal sector innovators), and by better conceptualising innovation that emerges in a range of systemic activity including those focussed on improving livelihoods (Berdegué 2005, Kraemer-Mbula & Wamae 2010b). This is highlighted in recent papers using innovation systems in sectoral examination of inclusive innovation in developing countries, such as in work on agricultural innovation systems (Clark 2002, Spielman et al. 2009, Sumberg 2005) and health innovation systems (Mugabe 2005, Mugwagwa et al. 2010). In these contexts, systems models need to be more focussed on the micro-level, particularly the importance of 'demand' in low income markets, and integrate the increasing decentralised and fragmented actors present in these sectors (Foster & Heeks 2013a).

It is argued that user-producer interaction concepts are vital to understanding the DUI processes around inclusive innovation, by analysing networks and relationship of systemic actors, and how this links up with the flows of interactive learning (Nahuis et al. 2009). Indeed, building such relations is likely to be even more important for low income actors, due to the lower level of mutual knowledge between producers and users. Given that low income

markets are liable to still be in flux, producer knowledge about unfamiliar markets is liable to incomplete. In parallel, users of innovations (or potential users) especially need to build knowledge and learning of innovations to inform first adoption decisions and how to use and adapt these new innovations. Thus, by thinking about how linkages enable or restrain knowledge and learning flows within the DUI system, the conceptualisations of user-producer interaction can be seen as a way to link between the top-down and bottom-up processes around innovation.

However, as shown in Figure 2, given the vastly different set of considerations in inclusive innovation systems, how to qualify the concept of user-producer interaction is not as obvious as when it was first introduced in Figure 1. Users tend to be highly informal or disconnected, and there may be a few powerful innovation producers linked to many low income users. Thus, to be an effective conceptual tool, empirical work needs to be used to provide insight, first to clarifying how to analyse the concept of user-producer interactions itself and second, to use this concept to integrate between top-down processes of innovation and localised activity.

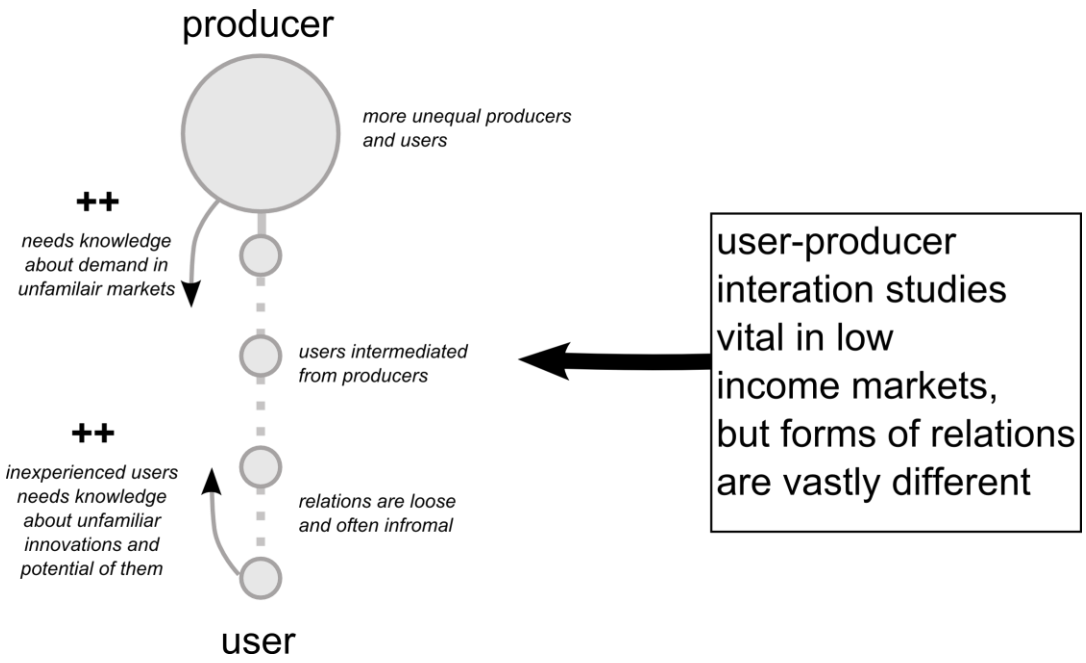

Figure 2: User-producer interactions and considerations in low income markets

3. Methodology

To analyse the concepts of user-producer innovation, empirical analysis is made in the mobile phone sector, drawing on research focussing on low income market delivery of mobile technologies and services in Kenya. In this sector there are an increasing number of innovative technologies and services focussed on low income users. This sector was particularly chosen because it included a number of innovations that were introduced by large firms, but as they reach low income users; they increasingly became further adapted resulting in unexpected uses and new behaviours in local contexts. Here we particularly focus on two areas, mobile phone handset supply and mobile money services (cash transfers through mobile phone messaging), two cases which were purposively selected as having contrasting types of user-producer interaction (see next section).

Work draws on semi-structured interviews undertaken as part of research in the sectoral mobile innovation system in 2010 and 2011 including policy makers involving in total 109 semi-structured interviews with innovation system actors; handset producers, distributors and wholesalers; mobile money operators and agents; informal sellers and street hawkers; and support organisations, in order to understand the innovation system. Data gathering also included extensive document analysis, particularly relating to lead firms strategies of relevance to the two sub-sectors. Analysis of the networks of these two cases is used to examine user-producer interactions and this is linked to the key genres of innovation occurring.

4. User-producer interactions

Our research finds that in these cases, at some stages, processes of top-down and localised innovation cohere well, and this leads to more inclusive innovation. At other times localised innovation is ignored, suppressed or strongly guided and this can lead to mismatch between the innovation desires of local actors and wider firm strategy. Here, empirical relations and outcomes are analysed.

4.1. Guided interactions: Mobile money

Work particularly focuses on the vastly dominant mobile money firm in Kenya called M-Pesa. The networks of interactions of M-Pesa are shown in Figure 3. M-Pesa closely revolves around

the lead firm, mobile telecom operator Safaricom, who oversees all activities. Here we focus on person-to-person mobile transfer elements of this service which are the vast majority of low income customers transactions in M-Pesa (Jack & Suri 2010, Stuart & Cohen 2011, World Bank 2011).

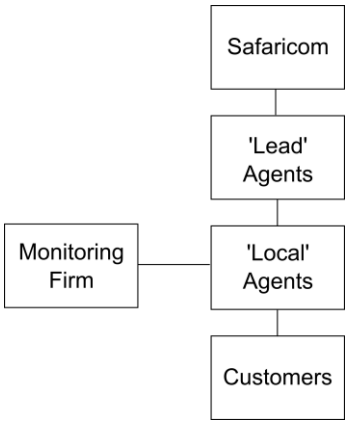

Figure 3: Network of M-Pesa. ***Source: Authors fieldwork***

In this transfer network, operational responsibility is given to a number of actors who are independent of the lead firm, in particular there are a number of firms called 'agents' who run the core customers facing element of mobile money services, engaging in cash deposit and withdrawal services for service users[1]. This occurs through a hierarchical arrangement where larger 'lead' agents sub-contracted to smaller 'local' agents. It is the 'local' agents, small micro-enterprise, who provide the M-Pesa service to low income customers. In addition, quality monitoring is strongly present in the M-Pesa service, this is undertaken by several outsourced firms whose role is to visit agents to ensure that they are complying with rules and regulations as specified by the lead firm.

The M-Pesa service was found to be characteristic of 'guided' user-producer interactions where often "user-producer relationships are characterised by strong dominance of producers" (Lundvall 1988 p.356). In typical systems models, such guided relations have been previously articulated to emerge out of financial and technical knowledge differentials between users and producers within relations (Lundvall 1992a), but this is not the key method of control here. As shown in Figure 3, the innovation 'producer', Safaricom tends to be disconnected from low income users through a number of intermediaries. Thus, guidance is

[1] Agents in M-Pesa are actors allow customers to convert between virtual e-cash of the mobile transfer service and real money. In M-Pesa, there was 27,988 agents in the country as of April 2011 (Safaricom 2011)

asserted through exerting number of elements of managerial and technical control, where the rules, objects and threat of intermediaries being ejected from the network link to top-down guidance.

Where such guidance is heavily exerted, this leads to limitations in the extent to which consumers and particularly intermediaries can locally adapt services according to local needs. This is illustrated by the case of Beatrice below:

> *Beatrice is an agent located in a small M-Pesa kiosk the heart of a slum area 5km from central Nairobi. One of the biggest problems that Beatrice faces in her agency related to the identification requirements in all M-Pesa deposits and withdrawals[2]. The problem is that many customers in this highly insecure area do not carry their ID card for fear of losing them. Other even more marginal actors do not have, or cannot obtain an ID[3].*
>
> *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 shown in this example in a guided networks, 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 service to make it more relevant

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

[3] 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.

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 are more subtle, but equally influential. One key limitation found was how embedded service structures limit localised adaptations. This is highlighted in the example of 'use change' adaptations. In interviews, certain localised 'use changes' service adaptations were found that depart from how the service is predominantly positioned and marketed to users by Safaricom. Examples of such localised adaptations include:

- Storing money as e-cash for very short periods as a safety measure in insecure areas, useful for micro-enterprises who 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.
- Using M-Pesa as a way to build very small levels of savings, particularly amongst slum dwellers.

Such adaptations were found locally, but they were not widespread, due to them hitting barriers around high commission costs (certain transactions in the M-Pesa service are charged a sliding scale of commission). For instance, one agent involved in micro-finance, suggested that use of M-Pesa to support micro-finance savings had so far been very disappointing, and this linked to high commission costs. This is supported by other research in Kenya which has made a more in-depth calculation of these 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, there are a variety of ways that localised innovations are constrained or guided by top-down flows. As shown in these examples, sometimes this comes through more obvious activities such as top-down rule setting and policing which more explicitly restrains behaviours. However, more 'tacit' top-down elements such as service barriers also play a key role with a range of different aspects such as training, rules and regulations, objects which were found to shape how localised innovation are undertaken in this service.

In this guided network, learning on the demand-side often links to how actors try to integrate and understand the features, rules and edicts that come from the producer. However there is a risk that control elements limit the potential of local adaptations. There is a risk of crowding out localised innovation and this is problematic in that often these local adaptations and domestications are crucial in the service being relevant to users, and make it more inclusive. Taking the two examples outlined above, limitations to adaptation around ID rules and 'use changes' reduce the potential for the M-Pesa service to be useful in certain localities and so top-down actions have reduced use and consequently inclusivity.

Of course, in such a service involving finance, it is inevitable that a plethora of top-down influences will emerge to enforce and guide appropriate behaviour, and these might lead to some limitation in how a service is adapted and used. From a user-producer position, if producers are appropriately connected to users they may be able to identify such adaptations and needs and to modify services to fit better with these local activities. Evidence of this responsive adaptation by producers during the time of study were lacking and there is little evidence of lead firm adaptation to localised processes as exemplified in the two examples shown above. This may relate to the disconnected linkages from user to producer, and the uneven size of these actors which precludes a clear flow of interactive learning back to producers.

4.2. Markets interactions: Mobile handsets

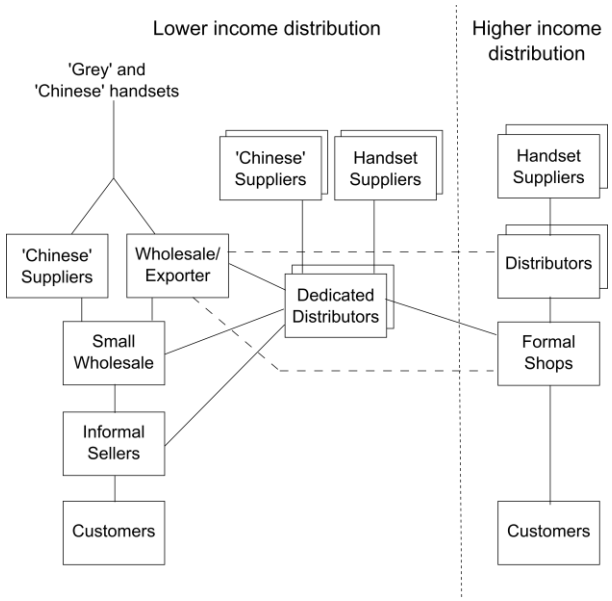

Figure 4: Networks in mobile handset case. ***Source: Authors fieldwork***

Whilst mobile handsets are sold through networks linked to formally designated shops in large towns generally focussed towards more affluent users (right in Figure 4), lower income users tend to purchase phones through comlex alternative channels (left in Figure 4).

Here focus is on these growing 'informal' channels that link to sellers in trading areas, markets and kiosks. In Kenya, such sellers are independent micro-enterprises, who link to mobile handset suppliers and operators, through intermediaries such as phone wholesalers and distributors. This channel also involves a diverse set of handsets including both 'branded phones' (multinational handset brands), 'grey market' (imported branded phones), second hand phones, and so-called 'China phones' (emergent Chinese based firms producing low cost phones).

Originally, these informal channels were exclusively used to sell grey market and second hand phones, as a way to provide cheaper goods for lower income users. But, more recently internationally firms, increasingly aware of the need to focus on lower income groups have themselves linked into these channels thorough new 'dedicated distributors', providing better quality goods into these channels.

Like the M-Pesa case, the handset sub-sector is characteristic of user-producer interactions that are disconnected through a number of intermediaries. Indeed, in this case this disconnection is more marked as shown in Figure 4. Notably, producers of handsets are primarily located outside the Kenyan context.

This fits closely with user-producer interactions in markets as outlined by Lundvall when social relation become more minimal and where producers can "have difficulties in observing new user needs, and users would lack qualitative information on the characteristics of the new products" (Lundvall 1992a p.50). In the informal channels of mobile handsets this was found to occur because networks from producers to users were not only marketised but also quite complex, interchangeable and heavily intermediated.

As highlighted by the theoretical perspectives on user-producer interaction, this has a detrimental effect both on how users are able to understand and appropriate select technologies, and how producers adapt to users.

For users, disconnected user-producer interactions meant that local demand-side actors as the key active player struggled in identifying appropriate goods for users due to poor relations. This ishighlighted in the case of Evans below.

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' (informal SME) 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 build knowledge of trustworthy supplies of handsets. This poor link also had a secondary effect in that it reduced his ability to get wholesaler credit that could aid growth.

"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, a lack of relations to producers was to the detriment of understanding of the quality of goods. With a lack of clear links, learning and innovation in handsets emerges mainly in how intermediaries adapted and survive into local markets, diversified stocks and tactic taken to ensuring viability of businesses, as opposed to specific adaptations of the technology itself by users. From the producer side, with a lack of close connection there was little amplification of specific local adaptations by handset producers, where diffusion around local activity mainly came through imitation and movement of local micro-entrepreneurs with less clear learning back to lead firms.

Thus, in general in the handset sub-sector marketised relationships *and* high levels of intermediation have led to a lack of relations between users and producers, and this has been detrimental. However, there is some evidence that some recent changes might help improve user-producer relations. Some large handset firms through dedicated distribution have linked closer to less formal channels and lower income users. Accounts from such firms indicate that there is an increasing flow of marketing and data between users and these larger firms. These

better knowledge flows between low income users and producers have also resulted in some more adapted devices recently being introduced for the needs of low income users.

5. Discussion

For low income innovation systems, given a DUI approach, the general nature of user-producer interactions has been examined in terms of the operational networks around these innovations. These elements define the nature of user-producer relationships and consequently provide insights on modes of learning and risks. These are outlined in more detail below.

5.1. Characterising user-producer interaction

In the Kenyan mobile sector, in line with the literature review, user-producer relationships are characterised as being rather different to conventional systems. In both cases, this started at a few large producers associated with an innovation, moved down through a set of large intermediaries, to local intermediaries, to users. Also in line with the literature study, evidence suggests that user-producer interactions seems to be vital in these cases, where clear knowledge flows and ability to appropriate innovation is important in these markets where low income users often have unique demands. Here we examine how to best define and examine user-producer interactions in these low income DUI systems.

First, on the demand-side, as examples have shown in addition to users, local intermediaries will be a key locally actor related to the 'user' side of innovation, whose linkages and learning are crucial. There is no doubt that many of the locally innovative activities and adaptations found in this case originally emerge from users themselves, but demand-side intermediaries are often the ones who will more actively disseminates such approaches. This is line with work on intermediaries which is increasingly articulating their central role in refining and domesticating innovation or one hand and brokering between users and producers on the other (Howells 2006, Stewart & Hyysalo 2008). Thus, it might be more appropriate to analyse user-producer interactions through understanding the skills and activities of locally embedded intermediaries on the demand side. This discussion links closely Lundvalls discussions around *capability on the demand side* in user-producer interactions and the ability for users or other demand side actors to actively voice and shape the agendas of producers (Lundvall 1992a).

Second, in terms of the two specific cases, one can see contrasting characteristics that define user-producer interactions. In market interactions, highly intermediated networks serve as a diffusion channel for lead firms, often with producers making little consideration to how such networks adapt and how such activity might harm or enhance the in low income markets. In contrast, guided interactions can be characterised by the elements of technical and managerial control which tend to allow large firms to have some semblance of control on how technologies or services are actually diffused through such sporadic networks. Thus, this links into two other concepts that Lundvall(1992b) has discussed. *Power* balances and control are crucial and are transmitted in a range of more direct and indirect activities, norms, objects etc which shape users interaction. *Distance* outlines how closely linked users and producers whether that be geographically, culturally or organisationally (i.e. what elements of delivery are insourced or outsourced). This allows some more granular understanding of the connection between users and producers, particularly with relation to how local adaptations become absorbed by producers, both embodied (i.e. technological adaptations) or disembodied (i.e. best practices and configurations) (Rosenberg 1982).

5.2. User-producer interaction and outcomes

Given this outline which helps to categorise and understand the nature of user producer interactions, it is possible to discern different learning outcomes from these two types of user-producer interaction. When networks are defined as more market led, learning amongst demand-side innovation intermediaries tends to focussed on adaption to fit in with local markets. Being indirectly connected to producers, the inherent inequality between intermediaries and lead firms, means that local adaptations are limited in their flows back to distant larger firms. Thus, as outlined in the handset case, local adaptations tend to spread through idiosyncratic adaptation, spillover effects and imitation, rather than directly through these networks and this links to the findings in the handset sub-sector (Pietrobelli & Rabellotti 2011).

In contrast, where user-producer interactions are more guided, learning comes in 'deliberate' knowledge transfer activities through networks. However, given the importance of demand-based learning and localised innovation in such unique (and often lesser known) low income markets, there is a risk of top-down control and producer dominance restricts learning to a one-way top-down flow, and reduces the ability for local actors to be able to themselves learn locally and innovation due to the limitations that are placed upon them.

Thus, each direction has its own respective risks in terms of innovation. A marketised approach risks unchecked localised innovation on the demand side, which does not flow back to producers. With a lack of oversight, this might lead to inconsistent quality and sometimes undesirable forms of innovation locally, which producers have less power to stop. For producers, insufficient user-producer interactions risk reducing understanding of low income markets. For guided interactions, an excess of guidance leads to a risk of mismatch between localised needs of innovation and top-down forms, where demand-side interactions are limited in the range of localised innovation available, and hence there is lower scope for local actors to be able to adapt appropriately for their local markets.

5.3. Suggested approaches

One can argue that the contrasting genres of interaction in these cases links to inherent characteristics of the ICT used, external conditions and actors present[4]. 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, the important role of agents in hand with the complexity of agent requirements implies strong oversight as a natural outcome of service conditions. Therefore, 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 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.

It is argued that underlying nature of relations and hence the interaction risks are likely to be somewhat set in stone. However, as emphasized in both cases, these are only risks, they are not inevitable. Actions both bottom-up and top-down to refine the nature of relations have had considerable effect on learning and innovation in the system. The key three tenets introduced previously, *capabilities on the demand side*, *power* and *distance* can again provide insight here.

[4] One well supported in wider literature examining the underlying nature of innovation networks and in systems of innovation notions of 'path-dependency'.

Building *capabilities on the demand side* is likely to revolve around the presence and position of local intermediaries, and the knowledge that emerges from these actors which can be crucial resource and provides insight for inclusive innovation. Thus, nurturing these actors can amplify voice and localised adaptations of their users.

Guided interactions with an excess of top-down *power* may benefit from purposive activity which reduces the volume of indirect elements of managerial and technical control and provide more leeway for localised innovation to occur, providing more room for local independence and learning.

In less coherent market networks, approaches to disintermediating can allow producers to move closer towards users and improve circular flows of knowledge and learning. Stronger relations are likely to be enhanced where *distance* between producersand low income markets is smaller. 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.

6. Conclusion

Emphasis on ICT innovation particularly in the base-of-the-pyramid literature has emphasised top-down (strategic-led) innovation. Even where micro-enterprise involvement has been articulated as important, their involvement is still largely as subservient to wider firm goals. In contrast, as outlined in the literature review, emerging literature offers a bottom-up (adaptive) emphasis on innovation, but with little consideration to wider factors.

Both types of innovation were found to be present in the case researched, and the use of notion of user-producer interactions built an understanding of the interaction between these two directions of innovation as outlined in Figure 5.

As shown in the top row, given the uniqueness the markets of focus, it is first appropriate to clarify how user-producer interaction is defined. In this work it was found that three elements – capability on the demand side, distance between users and producers and power elements – serve to define typical interactions between users and producer; from those more guided, to

those more marketised. These forms outline learning and ultimately directions of innovation that occur (as shown in the middle row in Figure 5).

<table>
<tr><td rowspan="2">Defining user producer interaction</td><td colspan="2">Capability on the demand side
Ability of intermediaries and users to be able to express preferences in localised innovation
Distance
Geographic, cultural, organisational elements that disconnect producer from users
Power elements
Top-down devices, both explicit and tacit which guide and limit localised innovation</td></tr>
<tr><td>Guided interactions
To overcome indirect linkages, guidance occurs through elements of managerial and technical control</td><td>Market interactions
Tend to more highly intermediated, and with a lack of control elements</td></tr>
<tr><td>Localised innovation and learning</td><td>Learning often relates to indirect control and network-based learning to comply with producers
More consistent innovation but reduced range of localised innovation that can be undertaken
Risk of mismatch between localised needs and top-down innovation</td><td>Some room for local adaption. Diffusion by imitation and localised movement of actors
Risk of ‘disconnect’ from lack of producer learning
Lack of oversight leads to inconsistent quality and sometime undesirable innovation</td></tr>
<tr><td>Refining user-producer innovation</td><td colspan="2">Enhance capability on the demand side
Particularly nurturing of intermediaries to allow localised innovation to better voiced
Reducing distance
To allow firms to be more responsive firms to localised innovation and to guide and amplify useful innovations
Power trade-offs
Balancing the elements of relations that control and allowing local innovation</td></tr>
</table>

Figure 5: Summary of findings on user producer interaction in the two cases

This analysis also point to advice in improving user-producer interactions, particularly related to the inherent risks that come from more guided and marketised interactions (as shown in the bottom row in Figure 5).

For large firms interested in low income markets, intentionally nurturing user-producer interactions within supply networks, by supporting and operationally connecting to demand-side intermediaries, and by balancing elements of power in relations can be beneficial. Reducing distance can enhance knowledge that firms will gain about the often lesser needs of low income users whilst ensuring.

For those interested in the value of locally innovative activities within communities, it has been highlighted that the nature of interactions around diffused innovations often determines how such innovation are able (or not) to be adapted. Interventions that enhance the voice of low income innovators, and those which dissipate top-down control might be used as ways of enhancing the range of localised innovation, with respect to the long term inclusivity of the innovations.

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