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Does quality matter for innovations in low income markets? The case of the Kenyan mobile phone sector.

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Abstract

Growing interest in lower income groups as consumers in emerging and developing markets has led to discussion on the issue of product quality, but so far work has generally focussed on simple goods rather than technology and innovations. However with innovations, one would expect that product quality would be more crucial in order to push trust of complex products amongst inexperienced users. Thus, this paper seeks to build understanding around issues around quality of innovations; focussing on what quality declines mean for vulnerable low income groups, and the types of policy approach that can be undertaken to improve quality.

Research was undertaken in the mobile phone sector in Kenya where firms have increasingly focussed on diffusion amongst low income consumers. Here it was found that quality has become an increasing contested and problematic terrain. In the short term, decline in quality is often acceptable for inexperienced low income users, but in the longer term this becomes detrimental to innovations both in terms of trust and expense amongst consumers, as well as effecting the livelihoods of informal entrepreneurs who are often part of delivery of innovations to low income groups.

Policy around quality was found to be present, but was limited by two key tenets. First, where implementation actors were unclear, public standards on quality tended to collapse into private standards followed only by diligent firms. Second, standards were often applied at a firm level which missed out on issues emerging amongst downstream diffusion actors often involved in adaptations which linked to quality variability.

Undertaken and focussed correctly, policy on product quality drives diffusion of innovation and supports a level playing field, which in the long term supports more inclusive innovations. A lack of focussed policy can lead to the risk of rejection of innovation and 'big bang' policy interventions that are detrimental to the trust in innovations amongst low income groups.

Keywords

Inclusive innovation; developing countries; quality; ICTs; base-of-the-pyramid; policy

1. Introduction

There is an awareness of the growing role that emerging and developing countries are playing as final markets for products and services [1,2]. Further, given income distributions in such countries, low income groups often become a central focus as firms look to scale [3,4]. With limited disposable income and potential vulnerability of these groups, one key concern has been to examine the quality of products which are focussed towards these new markets, analysing how quality varies with a cursory examination of policy and standards [2,5-8].

However, such work has mainly explored this question peripherally as part of wider discussions of changing markets. In addition work has typically focussed on simpler goods - basic products, staple foods and commodities - where quality and the impact of quality variability are clearer. For instance, poor seed quality lead to yield decline, raw material failure have a knock on effect on downchain businesses.

What of the growth of innovations focussed on low income groups, such as those that revolve around ICTs, which have been argued to be a key foundation to growth of dynamism, and interest in these groups as viable markets [3,9]? With innovation, less is known about how product quality varies or the effects that quality variation has in such markets. Yet intuitively one might imagine that quality be a more crucial element to the efficacy of innovations in such markets. As Lundvall's [10] work suggests, quality declines in complex innovations may be more difficult to discern amongst consumers. The negative impact is also likely to be exacerbated amongst vulnerable users who are encountering these innovation for the first time and with lower resources to rectify problems.

Thus, this paper seeks to look more closely at these issues around low income final markets in developing countries, and innovation quality. It looks to provide knowledge around how quality of innovations vary when they are focussed on low income final markets. Moreover, this work seeks to make an expanded analysis of the potential effects that quality variability might have amongst these markets. Drawing on this analysis, policy implications that these issues bring forth are outlined, covering existing and potential future policy structures that link into these quality concerns.

Beyond contributing to this growing debate around quality in these final markets, this research seeks to link innovation quality into debates around 'bottom-of-the-pyramid innovation' and 'inclusive innovation'. Firms and policy makers have articulated that such innovations need to not only drive firm profit but have positive social impact upon the groups of focus [2]. Such literature has focussed on impact stemming from the 'first steps' of user *acceptance*, as innovations are diffused to low income users and scaled by firms in markets [4,11]. Yet, with the growing number of scaled innovations focussing on such groups, research on quality can enhance these analyses to bring greater understanding around longer term impacts of these innovations.

The paper is structured as follows. In section two, the literature around quality is examined in three key directions. The literature on innovation in low income markets provides insight into innovation processes; the emerging literature on quality and developing country markets highlights some of the diverging positions on quality; finally work on policy and standards provides a perspective to analyse relevant policy implications. Thus, these three core pillars provide a clear pathway to conceptualise innovation, processes around quality, and policy making found in this case.

The research issues are explored drawing on qualitative research undertaken within the mobile phone sector in Kenya, outlined in section three. This sector provides a suitable setting to analyse these issues, where innovations can be seen to have scaled and grown in acceptance amongst low income groups. In particular, three specific case studies are compared and contrasted: mobile phone handset supply, mobile communication services, and emerging mobile money services, with empirical results around quality in these cases outlined in section four.

In section five, the implications of these findings are discussed. In all the examples, it was found, perhaps surprisingly, that issues around innovation quality have become a key issue as they scale to low income users. In line with other quality literature, quality variability can be linked to the increased price sensitivity of low income users, where firms seek to minimise costs and compromise on quality. To users unclear about the expected utility of new innovations, these quality differentials seem like small annoyances during early adoption of innovations, but in the medium term these often become detrimental - in terms of ongoing costs and trust - with some users even later rejecting innovation that they have already adopted. Standards linked to product quality were found to present in these examples, but there is a tendency for them to be poorly focussed or implemented, leading to slow decline in the quality of innovations which affects users. In one case, quality decline eventually led to more radical 'big bang' policy change that have been strongly detrimental to the impact of innovations.

In summary, in section six, it is argued that maintaining quality is a core element in how low income market innovations are 'inclusive'. It is argued that there is a rationale for policy to support improved quality, but as highlighted in the analysis, such policy will need to be appropriately implemented and include consideration of the shape of low income innovation systems if they are to be fully effective.

2. Innovations and quality

2.1. Low income markets and innovation

Recent years have seen growing discussion that examine developing and emerging countries, and specifically low income citizens within these countries as the final markets for goods and innovations.

Where such trends have been identified, a number of underlying drivers have been identified, the saturation and sluggish growth of developed markets for multinationals [12]; growing demand in emerging and developing countries [7]; the reducing cost of sophisticated technologies [2]; and the growth of emerging market producers of innovation (e.g. China and India), who often focus on developing county markets as a core strategy [13]. Whatever the foundation it is likely that in current conditions, such markets will accelerate as the focus of firms seeking new markets and profits.

In this context, the notion of 'innovation' is used to denote the novel goods and services that reach such markets, and conceivably enable progress amongst such groups. These innovations may not necessarily be new to the world, those new to the nation or even the community can have as much of an effect [1]. Further, goods pushed in such markets often tend to encompass a whole slew of technical adaptations, socio-technical processes and business model changes that one needs to consider these new flows as somewhat novel in comparison to their 'top-of-the-pyramid' predecessors [20, 22].

As this work seeks to provide a more substantive understanding of quality in such markets, it is prudent to examine structures in these markets, which diverge somewhat from conventional structures. Innovation for such low income markets is often complex and fragile, where user needs are less clear and users are more vulnerable. Given this status, innovations that focus on these groups have articulated the importance not only of firm profit, but also positive impacts upon the conditions of low income groups, in order for them to fully scale and to be accepted. Thus work on 'base-of-the-pyramid innovation' has talked of the 'double bottom line' of impact of innovations. However, there have been a number of critiques of such innovations as often inappropriate, pushing unnecessary consumer spending, ongoing costs and a lack of impact [14-16],

Recently, perspectives have also emerged within the notions of 'inclusive innovation' have made a more systemic analysis of what it means for such innovations to be impactful. These draw on innovation theory to analyse activities, with the goal to them leading to sustainable growth [17-19]. Attempts to more succinctly define inclusive innovation have looked to multi-scalar frameworks, revolving around not only the relevance of innovation, but how innovations have a lasting impact on users, and how innovation processes enable ownership [20,21]. Quality concerns around innovation can be thought of as one element within these more refined taxonomies of inclusive innovation and whilst we can say that quality is likely to intricately linked into how innovation achieve impact, it is not entirely clear as to how these links occur, and thus need to be examined empirically.

As part of examining low income final markets, it is also important to draw on literature which has examined 'innovation systems' in such markets in order to understand the actors and processes which connect to quality. Previous work has posited that these markets have more divergent actors and processes, and these depart somewhat to typical models of innovation. In particular three key elements have been observed [Drawing in these sections on 20]:

New production actors

New actors linked to these new final markets particularly relate to two components. Firstly, innovation producers tend to somewhat depart from typical global multi-nationals where these markets often see an influx of emerging market producers, particularly Chinese and Indian firms [1]. Secondly, innovations may revolve around new producers who specifically focus on such markets such as local subsidiaries of multi-nationals, and new partnerships of actors focussed on these markets [22].

New demand-side actors

New actors also exist closer to the demand side of innovation, particularly in the form of innovation intermediaries [23]. These actors are typically operationally involved in distribution of innovations into low income groups. These 'demand-side' actors can be considered an important part in innovation, in the way they adapt, appropriate and domesticate innovations to the specific needs of low income users. This activity is crucial in ensuring that innovations are adapted appropriately to markets [9].

Reconfigurable relations

The networks linked to these new final markets have the tendency to be more fluid and reconfigurable than previous innovation models have recognised. This particularly links the role played by the demand-side innovation intermediaries outlined above, who can

be more marginal actors, often part of informal and potentially reconfigurable relationships with larger firms [24].

Thus, this section argues two key points. Firstly, examining quality of innovations is likely to be a crucial element in whether innovations that reach low income groups are 'inclusive'. Secondly, such an examination will require awareness of the forms of innovation systems in these markets, which are likely to influence both quality and the forms of policy that may emerge.

2.2. Understanding quality in low income markets

There is a limited literature that has discussed issues around quality in such low income final markets, but it is useful to examine this work in order to bring key issues to light. In particular, one can detect two different perspectives on quality.

Management perspectives discussing low income final markets within 'bottom-of-the-pyramid' strategies have taken the most optimistic approach around quality. In such perspectives, it is argued that firms will only succeed in low income markets through rebuilding innovations from the ground up. This is necessary to integrate cost savings that fit in with the price needs of low income groups, and this process will not lead quality declines. As Prahalad puts it, quality retention leads to disruption in low cost innovations, "keeping world-class quality as a nonnegotiable standard allows us to challenge many assumptions regarding cost, quality and delivery" [25].

However, other work suggests that such ideals may not be well founded, at least for certain goods. More generally, theoretical work on quality has argues that quality links into customer attributes and their perceptions, and thus in low income markets it may be that these quality requirements are less stringent [26,27]. This is supported empirically in research on final markets in developing countries, that has emphasised the trade-off made between quality and price as goods diffuse into more price sensitive middle- and low- income markets [6]. Typically in such scenarios, low quality goods may take preference in terms of these markets, where compromises on quality control or reliability are a viable sacrifice [7,8]. At the same time, this does not necessarily mean that quality of goods is totally neglected. Even where compromises are made, firms are likely to follow standards and engage in some quality control to maintain some level of trust in goods, within this wider margin of quality acceptability [5].

This empirical work is limited in that generally it does not focus on innovations *per se*, with a focus on more basic goods with very limited evidence on quality and innovations. Where it exists, evidence seems to concur with the trade-off thesis, as a five country research on ICT consumer rights suggests [28]. Further evidence is needed, whilst the story of trade-off in quality may be a core trend, the bottom-of-pyramid examples suggest a decline in quality is not necessarily a given as innovation reach low income actors. Complex innovations can be adaptable and might be reconfigured and adapted, particularly under the watchful eye of policy makers, without this leading to wholesale policy declines.

2.3. Policy and quality

Work has previously suggested that policy related to quality can be justified from bounded rationality perspectives. This suggests that when users of goods have incomplete information (or time) and are unable to accurately select innovations, then their decision making might be 'non-optimal' [29]. Thus, policy provides a way of

overcoming this gap in knowledge, whether that be in underlying regulations, standards, monitoring, or building trust.

Literature on innovation suggests that these bounded rationality concerns are likely to be more marked when it comes to innovations [30]. First, modern innovations with their tendency to be complex, may limit the ability for customers to recognise high or low quality. Second, given that innovations are likely to be novel to users, there may be little knowledge from which customers can draw on to identify high or low quality. To illustrate these points, think of a low income consumer purchasing certain simple goods. With experience, they may well begin to identify quality - such as by sight, smell, consistency in a fruit or vegetable - but, it is a more difficult task when it comes to the pros and cons of a complex innovation. Thus, an argument can be made for policy around quality from bounded rationality perspectives. A more empirically grounded analysis is needed to highlight the types of policy approaches that can help overcome these limitations, and whether policy is viable to implement practically.

To ensure a clear understanding of existence (or not) policy, multi-faceted and process perspectives on policy are necessary [31]. Work tries to take more granular perspectives on how policy around quality is implemented, with an interest in what is deemed to be part of public policy and what is left to private firms [32]. Policy should also be seen within a life-cycle, which includes benchmarking, policy making, assessment, enforcement and punishment for non-compliance [32,33].

3. Case study approach

This work is explored drawing on research undertaken in the mobile phone sector in Kenya. In particular, three specific cases of quality are explored within this sector: mobile phone handset supply, mobile operator service and emerging mobile money services (cash transfers services through mobile phone messaging). For low income markets, all three are treated as innovations, as complex technical services and technologies substantially new to these markets, and often encompassing a range of wider adaptations in order to fit into these markets

Whilst none of these can be described as completely ubiquitous innovations in Kenya, all three cases increasingly reach low-income groups. Mobile handsets and operator service availability have grown in tandem. A recent government survey shows that, in 2012, more than 70% of the total population had access to a mobile [34], with an increasingly competitive market of operators attracting less-affluent users. In terms of mobile money, there were roughly 19 million registered subscribers in 2012 (83% of the adult population), transferring around US\$650 million per month, the great majority of whom (c.90%) were registered with one specific service called M-Pesa [35,36]. Again, research has shown growing adoption and use amongst less-affluent groups [37] groups in Kenya. These three cases are used to provide insight. They are all scaled innovations with a growing focus on low income groups and which could be inclusive given the appropriate conditions. The cases also fit within the previous discussion around quality, in that without extensive empirical work outcomes of quality declines are unclear.

The detail of these three case studies draws upon fieldwork in Kenya during 2010 & 2011 involving 109 semi-structured interviews in the mobile sector, drawing on ideas of actors in adapted systems of innovation for low income markets, as outlined previously. This included policy-makers (14 interviews); handset producers and operators (7); handset distributors and wholesalers (20); informal handset sellers (27); mobile money operators and dealers (8); mobile money agents (32); and other demand-side micro-enterprises

(15). Interviews with policy and large firms were selectively sampled in order to build clear insight. For intermediary actors, selection was based on locational sampling to ensure a spread of different types and socio-economic focus within the sample. This work was supported and triangulated by secondary data, particular using secondary data from firm sources and sectoral reports to build a clearer picture of these issues.

The original goal of this work was to build a clear understanding of actors and processes within the low income innovation system. Interest around quality emerged inductively from the interview process and later analysis of scripts. It can be seen as a key issue that emerged in these discussions, spoken about by respondents in a variety of ways. Thus, it was subsequently explored in more detail based upon this discovery.

Empirical work is presented in three case narratives in the paper. These cases are presented descriptively in the next section, drawing on this evidence in order to more clearly understand these issues around quality.

4. Findings

It was found that in all of these cases, quality has become an increasing contested terrain particularly as innovations reach low income users. Discussion regarding three key elements are presented: quality variability found, sources of these quality issues, and policy. This work forms the basis for more cross-cutting discussion in the next section

4.1. Quality of mobile handsets

Quality issues

With mobile handsets, quality issues revolved around reliability as they reach low income groups. Most insight in this area, came from a set of interviews with mobile phone repairers who have direct experience in the declines that surface in mobile phone models.

In the early days of handset selling, repairs suggested that issues around quality were more catastrophic, where imported phone models would often be non-functional on purchase. In these cases, user might be able to gain refunds on faulty models. More recently, new trends have occurred where phones are simply unreliable and tend to decline with use, requiring repair or replacement parts. Phone parts, particularly phone batteries tend to decline in a short time on a number of models. Other common faults related to components that only work partially (such as microphones, speakers and mouthpieces), and poor quality of component construction (such as poor circuit board soldering). According to repairers, such issues are particularly found in Chinese sourced generic phones that can be highly unreliable.

Quality and actors

The source of quality issues can be seen to link to three actors: new supply-side actors, intermediaries and new types of low income demand:

New supply-side actors: The principal cause of frustration for customers has particularly come from so called 'China phones'. Such phones represent a growing trend of new mobile firms based in the far-East, particularly China, who focus on low income markets in locations like Kenya. Although not their exclusive strategy, the core focus of

such firms is around competitive pricing in order to reach lower income customers and increase sales.

Whilst firms have gone about such strategies in logical ways - simplifying devices, and in replicating generic components - short cuts that affect quality can further reduce prices. As reported by repairers, a number of firms tend to use lower quality components where decline in devices can be very quick. In fact, several repairers reported that when repairing phones, it was entirely possible that two phones of the same model identical on the outside, would have entirely different components and construction inside, becoming highly confusing to such repairers.

These activities were also highlighted in interviews with one firm owner and several Kenyan managers of such Chinese firms. Several discussed the complexities of production back in China. As one handset manager outlined when discussing 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 operations manager in a smaller Chinese supplier went further than this, he was able to take advantage of customers who lack of understanding of phone models, bragging,

“Kenyans like counterfeit products, they like their things to look expensive. Kenyans like to get cheated”.

Thus, quality decline can specifically be linked the practices of these new actors on the supply-side in the mobile sector which can involve short-cuts, even wilful exploitation in taking advantage of customers' inexperience.

Activities of intermediaries: Mobile phones handsets that reach low income groups tend to be retailed through a supply chain of wholesalers and informal sellers located in markets and slums close to the locations of low income users.

Such actors and the way that their businesses run are contributors to how quality affects consumers. For instance, one interview was undertaken in Nairobi with a wholesaler of mobile phones from Tanzania. Prices are cheaper in Nairobi and hence exporting devices allows him to reduce prices for his low income customers. To avoid tax and state bureaucracy, phones are smuggled across the border. To do this, his mobile will be stripped of boxes, instructions and warranty cards, which according to him “don't have much use...”. As can be imagined, for end customer of such devices, this lack of a complete package can affect their understanding and perception of the quality of these goods. Further intermediary tactics, some legitimate such as street vending and wholesale stocking tactics, other less so such as supplying counterfeit and questionable refurbished phones to customers, all lead to challenges for customers. Quality of goods may be reduced by the time they reach the customer.

One can also argue that intermediaries are themselves sometimes a victim of quality issues, where up-chain issues affect their businesses. As outlined in earlier sections, it is difficult to directly ascertain quality of Chinese phones and hence intermediaries can be financially hit when they source malfunctioning and faulty goods. Typically, when selling to their low income customers, intermediaries feel the effects when they have to refund goods, or pay for them to be repaired informally, in order to maintain their reputations

within local settings. In more marginal areas, particularly those distanced from the key suppliers, such issues can limit intermediary growth. When problems emerge with devices amongst customers, it is inevitably intermediaries who find themselves having to deal with, and refund users. For example, in one slum area on the edge of Nairobi, mobile phones suppliers are somewhat limited by the low income focussed intermediaries. As one seller 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”.

New forces of demand: Weaknesses in phones might be manageable with careful use, but the quality declines tend to be exacerbated by rigours of the lives of low income users where phones are more prone to heat, dust and bumps. Within research, examples of such rigours observed included phones sitting on the dashboard of a shared taxi driver all day bumping around, a shared handset in a vegetable seller hanging from the top of a kiosk with a string, and a phone sitting in the dusty confines of an informal workshop of a woodworker. During several interviews with repairers we also observed informal workers bring in their mobile for repair. The first process undertaken tended to involve cleaning the phone for gathered dust with a toothbrush that had typically encased the innards of the phone. Other repairers talked about common repairs that highlighted use, for instance resoldering poorly installed mouth and ear pieces that become detached when phones are dropped by users.

Beyond, this type of more strenuous use, other strains relate to approaches to using mobile phones that exist amongst lower income groups. For example, low income users regularly switch sim cards as a tactic to get the lowest price, but this leads to extra strain on cases, and sim card components. The inconsistent availability of electricity leads to tactics to gain quick recharges, but can lead to reduced life of phone batteries.

There is some evidence that some of the simpler branded mobile phone handsets have been made to be sturdier for some of this strenuous use, but this is only in a small minority of handsets. Thus, the use profile represent another facet that links to quality.

Standards

After hearing the frequent complaints around quality in mobile handsets, a senior policy maker was asked about regulation. He highlighted that ‘type approval’ standards were in place.

These rules, 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 [38]. However, implementation of these rules is rather haphazard. Examining the list of handset models approved by Kenyan regulators suggested that this standard around quality was effectively voluntary, where only larger producers tended to follow them whilst smaller ones did not. According to the list of approved models, only one mobile phone 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 markets, did not appear on the type-approved list of devices, suggesting type-approval is at present ignored.

The policy respondent above suggested that the reasons that this rule had not been fully implemented related to a lack of clarification in the rules. A perusal of these laws

clearly highlights the regulator (CCK) as the arbiter of type approval evaluations [38], but it was unclear as to how or who will ensure that these rules are maintained in the market (e.g. should it occur at time of import, self-policed by private firms or through retailer inspections?)

The evident failure of type approval to police quality in handsets in these markets, and declining quality eventually led to a more radical action by the state. This occurred after research in a draconian network level phone ‘switch-off’ enforcement¹, which according to the regulator barred over 3 million ‘counterfeit’ phones from being able to access the mobile phone network (generally Chinese and generic phones) [39]. This ‘switch-off’ was undertaken linked to a rhetoric around criminality - the inability for many generic phones to be tracked at a network level by the state, counterfeiting and criminality. However, the effect has been more all-encompassing with reportedly dramatic effects on users [40]. In particular, it was often inexperienced users who had bought such ‘counterfeit’ phones assuming them to be genuine, only to suddenly find their investment deemed unusable.

Thus, in this case the lack of implementation of standards eventually led to a rather dramatic ‘big bang’ moment in an attempt to fix problems. For some, this solution has been more problematic than the original quality issues.

4.2. Quality of mobile network

Quality issues

Quality issues in mobile operator service tends to revolve around the reliability of mobile network as it scales. This was particularly marked with growing demands for mobile network coverage in lower income and more remote areas. In such areas, where running mobile masts viably is more demanding, without careful planning there can be quality compromises, particularly where mobile operators are underfunded.

Quality issues in the mobile network mainly manifest themselves on the customer side, in the ability of the mobile users to get coverage of network on their mobile phones, and for mobile networks to be able to handle sufficient calls and SMS. In more remote areas, customer often report higher levels of network cut-outs and on one network it was reported that voice services regularly decline to the level where voice service becomes very difficult to use.

Quality and actors

Again, the three actors outlined in the previous example, all play roles related to quality in mobile networks:

Supply-side actors: The cause of quality declines in mobile network can be argued to come from two directions. One links back to underlying regulation in mobile networks and the argument that regulators have not pushed mobile firms to expand their coverage sufficiently into low income areas. For instance, as one policy maker outlined,

“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”

1 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 and network equipment can detect this and block these devices.

Several policy makers also discussed their disappointment at the lack of universal service funds (USF) that would push network investment in more demanding rural areas. 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”

Thus, with little requirement or motivation for mobile operators to invest in low income areas that may not appear profitable, firms can under-invest, leading to a lack of capacity and quality problems at the 'edge' of the network.

Beyond this regulatory justification, additional quality concerns on the supply side can be linked to mobile operator investment. Even in central areas, mobile operators can underplay infrastructure as mobile networks become increasingly popular. In Kenya, both regulators and ICT experts suggested that this was particularly prevalent amongst the smaller operators, who can be under capitalised in terms of structure. In competitive markets where call costs are a crucial selling point, firms may under invest in infrastructure in order to maintain prices/profits. Indeed, some of the mobile operators have gone as far as using the threat of underinvestment to lobby the regulator to reduce levels of price competition in the market (so far unsuccessfully).

Intermediaries: In this case, intermediaries' involvement in this service links to some issues around quality. For instance, informal distribution of mobile airtime and sim cards can affect user perception of quality, particularly tactics around retailing, including selling nearly expired top-up or sim cards, and splitting down value call-time through use of over-the-air call time distribution (called *sambaza*). Such appropriations whilst important to survival of entrepreneurs, can be confusing for the customer and potentially lead to quality problems.

Demand-side actors: Beyond the more obvious demand considerations that push expansion of mobile coverage - more rural users interested in using mobiles service in increasingly remote areas - user innovations amongst low income groups can also be seen to contribute to quality declines. A number of tactics that have been used, particularly by low income groups in mobile networks, such as beeping (missed calls when low on credit) and household airtime sharing, led to unexpected use of mobile features that can cause problems for operators. For instance, beeping is known to be inefficient by blocking scarce phone connections which increases the risk of busy networks. The use of beeping has got to the level that the lead operator Safaricom in Kenya introduced and marketed a free text based alternative 'Call me' service linked to these problems, in an attempt to reduce this inefficient 'beeping' use in the network.

Standards

Like type approval rules, potential for the regulator to police mobile quality has been present within the original telecoms act

“the Commission [CCK] shall....protect the interests of all users of telecommunication services in Kenya with respect to the prices charged for and the *quality* and variety of such services” [41] (emphasis added)

However, whilst a number of reports have outlined the declining quality of such services [42,43], for a long period no standards were implemented to check quality. More recently however rules have begun to be implemented. Following consultation in 2010, the CCK released its' first QoS (quality of service) report for mobile services, evaluating quality in areas such as 'call drop rate', 'completed calls' and 'speech quality'. Operators performing below standards were deemed to be non-compliant and in need of remedial action [44].

This first report was highly controversial, particularly as two large firms Safaricom and Telkom Kenya were found to be complying on only three out of the seven measures [45]. This report was highly publicised in the press with Safaricom going as far as to question the commissions' methodologies in order to dispel embarrassing publicity [46]. Such reports can be seen to have pushed some general improvement in call quality in the network over recent times. Thus, whilst there still remains problems around rural call quality right up to the present [28], in discussions with users and policy makers, public embarrassment from these widely disseminated reports have spurred improvement by operators, as evidenced in the upwards trend in the QoS measures in the 2011 and 2012 reports [47,48].

4.3. Quality of mobile money services

Quality issues

Quality issues in mobile money somewhat link to those outlined in the previous sections, due to the fact that the mechanisms of mobile messaging operate through messaging over the mobile network. However, there are extra issues specifically linked to mobile money, and these have significantly increased in recent years as such services have grown.

Examples of quality declines particularly revolve around downtime and growing delays in network transfers in mobile money networks. For example, mobile money transactions are not officially valid until a 'confirmation' message is sent to the customer. When delays in this message occurs, this is highly inconvenient to customers who often are confused about whether to repeat their transaction or simply wait for the confirmation.

Quality issues have also arisen around users making mistakes when using the service. Service users need to enter phone numbers in order to transfer money in the service and when incorrectly typed, this results in a money transfer to the wrong user, and a complex process in order to claw back money occurs (assuming the user even notices the mistake). In addition, mobile money scams are increasingly prevalent where less skilled users can get conned into transferring their mobile money to unscrupulous operators. In fact, during interviews in Kenya, virtually all users had at some time experienced a mobile money scam in some shape or form, with a number losing money.

Quality and actors

Supply side actors: Examining the technology of mobile money, one might suggest that some elements of quality emerge from poor design of this innovation. Two examples of this relate to the form of mobile phone software and the SMS form used. In terms of the mobile phone software, most of the mobile money service run using a simple menu system software call 'SIM toolkit'. Whilst this software has many advantages, such as being compatible across virtually all phones, it is also problematic in its limited functionality and difficulty in updating. An illustration of the link to quality relates to

users needing to enter phone numbers to make mobile money transfer as outlined above. When this problem surfaced as a serious one, a clear solution was found by the lead firm². However, this solution required users to copy and replace their existing sim cards due to the nature of the 'SIM toolkit' software, one that required some cost on the side of the customer. Thus, the stubborn continuation of quality issues around wrong mobile numbers links to the software used. Similarly, a number of the scams that were reported to occur, link into how SMS messages are used in mobile money. This provides scope for 'fake SMS' which purport to be mobile money system messages, tricking users into making money transfers. A lack of detection around these fake SMS leave the users highly vulnerable.

Intermediaries: As compared to the previous two cases, intermediaries in mobile money are more intricately involved in the operations of the service as cash-in and cash-out agents (as opposed to the more peripheral involvement of intermediaries in the previous examples where they tend only to act during retailing and ongoing advice and repair). Thus, the role of these intermediaries has quite a significant effect on quality perceptions in this innovation.

As outlined in discussions with a mobile money manager, intermediaries and quality of service issues were significance during the time of research. Declines in quality related to wider issues - latency in messaging and growing numbers of customers using agents. However, many agents exacerbated these problems, struggling under weight of customers and complaints at these busy and problematic times. According to the management this linked to poor training of these actors that led intermediaries to be unprepared to deal with increasing problems in an efficient manner. Thus, quality of service (speed and reliability of service, ability to troubleshoot) closely related to the skills and training of agent intermediaries.

In turn, the more generic quality issues - latency, downtime, scams etc. - that are out of the direct control of intermediaries, are crucial in determining the ability for agent intermediaries to run viably. In one example, an agent interviewed was increasingly concerned about declining profit levels due to the increasing delays and network outages which reduced customer volume. In the recent month his agency commission had dropped from 35,000Ksh (\$400) before transportation, staff and running costs to 30,000Ksh (\$350) owing to networks outages and congestion that had reduced his volume of trading during the month. Other agents complained that they has been on the receiving end of violent behaviours or threats from customers who accused them of 'cheating' them when network problems slowed down transactions, creating new risks for these intermediaries.

Demand-side actors: Some of the issues around quality can be linked to the growth of less technically-savvy users of the service, and low income groups. For instance, errors in entering mobile numbers and susceptibility to scams was reported by agents to be more common in more marginal areas, where users can be seen as more vulnerable to quality declines.

² This related to linking the software with the mobile phone 'address book' (i.e. users would select a contact and the software would automatically look up the phone number without the user having to type it in)

Standards

Approval for mobile money services comes from the Central Bank of Kenya in partnership with the regulator, and revolves around firms proving that their service is stable, it complies with appropriate banking legislations, and follows anti-money laundering rules [49]. However, mobile money has grown in an adaptive way and as yet there is no specific clear regulation which defines any wider rules around mobile money. In particular, as opposed to the emergence of the mobile 'quality of service' reports and regulations, in mobile money there is little mention of examining quality of service issues - downtime, latency of messages or number of misplaced transactions - which might push improvements in quality.

One area that does benefit mobile money is that in such financial services, being seen as reliable and trustworthy is integral to the service being viable, and hence private enforcement of standards is more effective. Firms are far more active in self-regulating quality. In particular, all firms employ monitoring and evaluation of their intermediaries in an attempt to maintain quality at an operational level, and to reduce poor or unethical practice. Such self-regulation has been quite successful in maintaining quality and consistency in some key facets of service. However, this only works to a certain extent, and firms are liable to underplay other elements of quality, when they are not under pressure by policy or state oversight.

5. Discussion

Table 1 below summarises the main narratives around these three cases in terms of the main quality issues, the presence of rules that enforce quality and the resulting way that such rules have been implemented. What is perhaps most illuminating, is that in these markets quality is not a peripheral issue. It has become an issue which is increasingly problematic when left unchecked, and one where active policy and the implementation of policy seems to be integral to whether quality is detrimental to innovations or not.

Case	Quality issues	Quality Rules	Implementation
Mobile phone handset	Unreliable handset quality, short life of phones	Type Approval Rules - Present in telco regulation	Low but leads to 'big bang' of mass handset switch-off
Mobile phone operator	Coverage in some areas, quality of voice and dropped calls	Quality of service requirements - Presence in telco regulation	Initially low, but later more focussed QoS inspection has had positive effect
Mobile money providers	Latency in networks, downtime, risk of scams	Basic licensing conditions - Not present in regulation	Private standards work to some extent, but growing problems

Table 1: Summary of quality issues in the three cases

Findings are particularly discussed in this section in terms of the three questions first outlined: First, examining the main trends around quality decline; second, to link quality into innovation for low income markets; third, to examine the differing approaches to policy around quality.

5.1. Quality

Evidence from the mobile sector suggests that as firms look toward low income users as final markets for innovation, this does lead to them compromising their service in some

ways (whether intentional or not) in order to maintain relevance amongst low income groups. In these cases, this occurs in different ways, but ultimately the underlying drivers relates to the pressure of price sensitivity of low income groups. This does not mean that firms totally abandon quality concerns though, but rather they might be reduced with a focus only on specific key threats to their businesses.

Thus, the thesis advocated by Prahalad[2] that 'world class' quality remains central in these markets, where firms will reconfigure low cost innovations from scratch, does not ring true in these scaled cases. Even where there have been more radical innovation in structures and technologies as in the case of mobile money, quality issues still resurfaced. Thus, it is suggested that in terms of innovations, at least in this specific sector, quality-price trade-offs are likely to be a key concern.

Given this situation, where quality is variable, the second question to pose is what this means for inclusivity of innovation? In terms of the innovations themselves and their utility, quality declines can be quite subtle - shorter lives of handsets, need for repair, lower coverage, slowdowns in receiving payments. Initially, for users who have just adopted such innovations, quality issues can be seen as a mere annoyance which does not outweigh the positive aspects of the new innovation. However, as shown here quality lacks are draining on the resources of low income users in the longer term, particularly in terms of adding extra or ongoing costs on users. They limit some adoption of technologies, where quality declines can be detrimental to the trust in innovations, making them more risky particularly amongst those most constrained in terms of resources.

Slow quality declines in innovations can also hit a point where their negative effect becomes more widely noted. At such points, where more forceful 'big bang' legislation emerges to enforce quality, the effects can be detrimental in that sudden shocks have significant effects on the viability of innovations. As suggested in the mobile handset case it is often lower income users who feel the greatest effect of such a shock. When innovations are new and complex, it is very difficult for users to be able to clearly judge quality and when faced with a choice it can be extremely difficult for users for users to evaluate based upon quality, but they will feel the effects of later 'big bang' actions.

Low income groups as final markets also integrate a range of intermediaries who are an essential component of reaching low income groups (see next section). In terms of the impact of quality declines, it also tends to have an impact on these intermediaries (a significant number who themselves are from low income groups). When users encounter problems around quality of innovation, it is these intermediaries who have to deal with their problems resulting in time or costs dealing with customers where reputations can be effected by quality of these services. Thus, as well as quality effecting inclusive innovation-as-output it also impacts on inclusive innovation-as-processes, by making low income intermediaries livelihoods less viable.

5.2. Innovation system actors

Three actors in innovation systems for low income groups have particularly been identified as significant in terms of quality:

On the *supply-side*, low income markets are highly challenging and it may be that new actors or new combinations of actors are the driving forces. In the cases presented, such new actors might look for quick gains over long term establishment (as in the case of

some Chinese firms and smaller mobile operators), or alternatively may not have the experience in how to build in quality considerations into their innovations. This leads to conditions where trading off quality is inevitable, where quality issues emerge³.

In terms of *innovation intermediaries*, the active processes of adaptation that intermediaries undertake can also drive some of the quality concerns related to innovations. This related to both errant behaviour, short-cuts and cost reduction and activities that make innovations more viable for low income groups, but which may in turn have an effect of quality. Perhaps the crucial element related to intermediaries is that they typically tend to be considered outside the purview of policy making on quality (as outlined in the next section on policy)

On the *demand-side*, the condition of actors and the way that innovations are used often included more strenuous uses and in new activities unexpected by innovation producers. Where new activities emerge in ways that were not intended by innovation producers, they can expose areas of complex innovation that have not been fully tested or magnify certain quality issues.

5.3. Policy

Controlling and monitoring quality is mainly undertaken through internal standards policed by private firms. Firms were all found to have standards and police them to some extent, to ensuring that innovations continued to be seen as viable to consumers. However, whilst more overt elements might have some quality control, firms often neglected less visible elements of innovations (e.g. mobile phone reliability, latency in mobile money). Thus, there is a rationale for policy which moves beyond solely private standards. Such policy can link to ideas of nurturing new markets for innovations by providing clear and implemented standards, and a 'level playing field' under which firms play [51]. A lack of clear policy or implementation risks highly disruptive 'big bangs' when long lasting quality declines lead to market failure scenarios which require remedial policies to prevent wider spillover of problems [52].

In the examples presented in this paper, whilst these were cases of a lack of policy around quality, quality issues can be linked to cases where statutes existed, but remained not implemented, or where implementation was unclear. Where rules are not implemented, monitored and without clear punishment, such rules can be seen to lack teeth, and effectively collapse back into private rules where only certain firms will abide by such standards.

Another problem found in policy implementation related to the presence of extended networks of actors, particularly around intermediaries. These actors complicate policy as they muddy the waters as to where quality policy should be monitored and enforced. Whilst quality control at a manufacturer level in a case like mobile handsets is useful, this may miss out on adaptations and tactics occurring at an intermediary level which will also have effect on quality. Thus an incorrect scope of policy can also be detrimental. In terms of this idea of scope, intermediary level quality monitoring seem to be particularly appropriate. In some elements of the mobile money case, quality controls at an intermediary scope have been effective in ensuring that services remain

3 In competitive markets, this can create friction between so-called 'high road' and 'low road' innovators, 'high road' innovators will be more quality driven but may have lower tendency to innovate, whilst 'low road' innovators more likely push new innovations but tend to underplay quality concerns.

consistent. However this is likely to be a more costly option in terms the volume and regularity of implementation.

6. Conclusion

To answer the question in the title of this paper, based upon this limited set of cases, quality is a crucial factor in the growth of innovations focussed on low income groups, and it affects how inclusive such innovations are.

First, it is found that, at least in the mobile sector, there is a tendency for firms to underplay quality concerns when they are looking to reach price sensitive low income customers. Such quality issues can be quite subtle and are often missed by consumers within their purchasing decisions. In the medium term they have the tendency to reduce efficacy of innovations, and have significant increase on ongoing running and maintenance costs. Given that in low income markets, the 'face' of such innovations tends to be 'intermediaries', low income entrepreneurs also feel the effect of quality issues, through reduced business, delays, customer returns and other problems. In marginal cases, quality can thus be said to also have a considerable effect on inclusivity in terms of innovation processes by limiting the ability for low income users to be part of innovation systems.

Second, the sources of quality decline provides knowledge for firms and policy makers involved in such markets as to potential ways of reducing such quality concerns. In particular three key sources were highlighted and for each of these sources there are further questions regarding quality control. For *new innovation producers* who employ different processes and/or have novel financing there is onus on regulators and standards bodies to ensure that firms in the market are appropriate and can meet their promises around quality. It may be as in the case of the mobile handset, that a totally open market without standards is inappropriate and detrimental to growth in the longer term. *Intermediaries* and their tendency towards active appropriation poses questions, to both firms and policy makers, as to how processes of quality management are policed, right down the supply chain. For *new innovation users*, who have different demands of innovations than might typically be outlined, there is a particular onus on firms to build more appropriate monitoring systems in order to identify and then to adapt innovations to be more sturdy to new activities around such innovations.

Third, there are policy rationales both from a theoretical side (in terms of bounded rationality of consumers) and on the empirical side (in terms of the quality declines outlined) that suggest policy for quality in these markets should be taken seriously, as it has been in these cases. As outlined, it may be that policy needs to be adapted to fit in with these new markets, particularly in terms of ensuring appropriate implementation and oversight of the potentially larger number of actors in the innovation system.

In sum, at present whilst issues around *acceptance* and *scale* of innovations tend to be at the forefront of considerations in low income market innovation, an underplaying of *quality* will be one that can quickly limit low income markets. It is only through clear policy making and implementation that such quality issues will be handled as such markets grow.

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