



Towards a more equal world: the mobile internet revolution

Vodafone Group Plc

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Welcome

from Vittorio Colao,
Chief Executive, Vodafone Group Plc

Welcome to the latest publication in Vodafone's Policy Paper Series. Our aim is to give leading independent experts a platform to express their views on issues that are also important to us. One such issue is rising inequality around the world and the unequal distribution of income and socioeconomic opportunities that result from it. This Report looks at how the shift to smartphones and data services in emerging markets is a turning point. The authors examine the opportunities that access to mobile internet can present for disadvantaged groups and the steps governments can take to maximise the potential of smartphones to address inequalities. The opinions expressed in this Report are not ours, but those of independent experts whose views we respect even if we do not always agree with them. These studies will be of interest to anyone concerned with the development of good public policy on this important topic. I hope you enjoy reading them.



Vittorio Colao
Chief Executive, Vodafone Group Plc

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Contributors' biographies



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With thanks to Alexia Migliaressis-Phocas, Vodafone Group

Overview

Inequality of income and wealth has increased around the world since the 1980s, driven by the forces of globalisation and structural economic change



Access to mobile broadband can address inequalities...

-  Mobile networks have become the key communications infrastructure in many countries
-  Supporting marginalised and disadvantaged groups more than others
-  3 billion smartphones forecast in 2020
-  Enabling individuals and businesses to tap into new opportunities

Policies and partnerships can maximise the potential of mobile broadband...

-  Increasing investment to provide reliable and high quality broadband networks
-  Ensuring operators have access to sufficient spectrum to offer high quality services
-  Encouraging collaboration between different players in the communications value chain
-  Increasing education, particularly digital literacy
-  Developing locally produced, relevant information and apps
-  Promoting consumer trust and making government online services mobile friendly

Towards a more equal world

Diane Coyle & Howard Williams

In the years since the start of the global financial crisis, a consensus has arisen that has placed inequality at the forefront of the policy agenda. For emerging market economies, growth and poverty reduction are still vital challenges, but there is also a need to ensure the benefits of growth are shared widely.

Access to communications services and networks plays a vital role in enabling individuals and businesses to tap into new opportunities. Mobile has been particularly important in creating opportunities for people in marginal groups with low incomes or status, especially in emerging markets. In many countries mobile networks have become the key national communications infrastructure, offering many millions of people access to basic communications and other services that were, until recently, confined to elites.



The UN's Sustainable Development Goals enshrine the global agreement around addressing inequality. The goals highlight the importance of empowering and promoting the social, economic and political inclusion of all people, irrespective of status, and of ensuring equal opportunity and reduced inequalities of outcome. This Report begins the process of assessing and understanding the place of mobile internet access in achieving those ambitions. We argue that investments in mobile broadband networks and the rapid spread of smartphones in developing economies could potentially decrease inequalities by offering widespread access to online services. New opportunities could be provided in many areas of life, such as business and education, as well as social life. This will not happen without actions by governments and regulators, and by private sector investors. The research reported here points to two central messages:

- Access to high quality and secure mobile broadband networks is more important to marginalised or disadvantaged groups than to others. This vital 'public infrastructure' requires investment in reliable, high quality networks and affordable services; a second-class service or a failure to enable the investment could embed or deepen existing inequalities.

Unlocking the full potential of mobile broadband to address inequalities requires a partnership between:

- communications regulators who will shape the enabling environment for network investment;
- other arms of government delivering complementary investments including m-government services, education provision and information partnerships;
- mobile operators building out broadband networks of successive technology generations; and
- other private sector and non-governmental actors delivering mobile broadband services of value to disadvantaged groups in society.

Without these elements in place, there is a risk that technology will deepen existing inequalities.

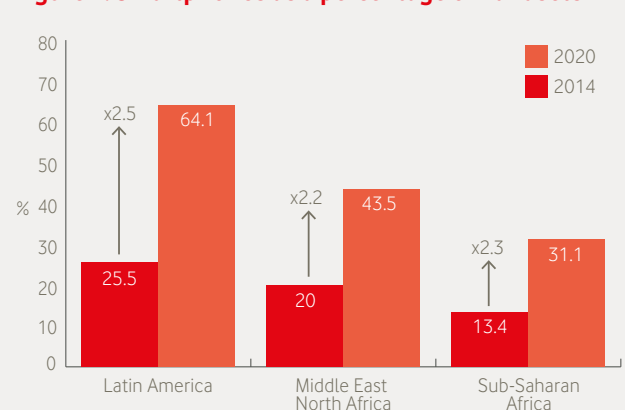
- The services and information available via mobile broadband need to be relevant to users. Affordable access to the network by itself is not enough; the value equation requires local information and services, and, crucially, an adequate level of education and digital literacy among users.

THE RAPID SPREAD OF SMARTPHONES

Smartphone ownership is growing around the world. By 2016 there were 3.7 billion unique mobile users globally and smartphone sales had reached 1.2 billion¹. The number of mobile internet subscriptions has been growing globally by around 20% year-on-year²; McKinsey has predicted that between 2015 and 2018, an additional 500 million to 900 million people will go online, the vast majority in emerging markets via mobile broadband³. Ericsson forecasts that driven by smartphone use, global mobile data traffic will rise eightfold between 2015 and the end of 2020.

The rise in take-up of smartphones and mobile broadband is happening rapidly in many emerging markets. Thanks to the introduction of some low cost (although often low quality) models, smartphone shipments to Latin America, Africa and the Middle East are set to result in a significant increase in smartphones as a percentage of handsets by 2020.

Figure 1: Smartphones as a percentage of handsets



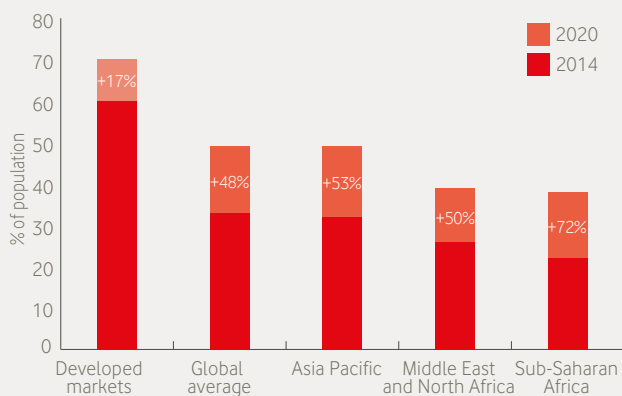
Source: Analysys Mason, 2015

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The use of mobile broadband in emerging markets is also growing apace. Cisco forecasts India's consumer mobile traffic will grow at a compound annual growth rate of 67% between 2015 and 2019⁴. Similar growth rates are forecast for South Africa and China, and even faster growth in the rest of Africa and the Middle East region⁵.

Figure 2: Mobile internet subscribers – forecast growth



Source: GSMA Intelligence, 2015

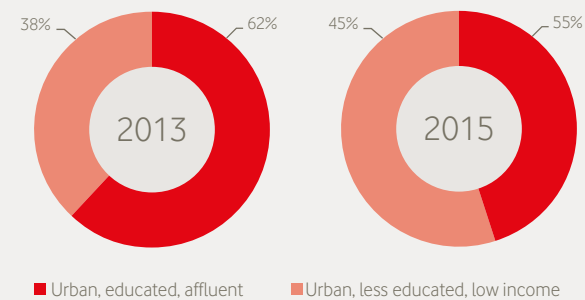
The aggregate picture created by these statistics is impressive but it is necessary to understand the trends in more detail to assess the impact on inequalities. For that reason, it is also relevant to understand what the impact of smartphones and mobile broadband access will be, how much data those subscribers consume, how many of the total are individual or

multiple subscriptions, who does not have access, and what proves to be the quality and relevance of the services available.

There is already some evidence that smartphones and mobile broadband subscriptions are beginning to reach more widely among lower income groups and women. In India, for example, one survey shows the proportion of mobile data users from lower income groups and older age groups has increased, while 34% of urban women in 2014 were accessing mobile internet, up from 20% in 2013⁶.

In Nigeria, the uptake of mobile phones increased rapidly to 142 million active connections as at February 2015 from 90 million in 2011⁷. A survey in Lagos, Aba and Abuja of over 6,000 blue collar workers such as drivers, beauticians and traders found that while feature phones dominate for reasons of affordability, half are now using mobile internet with a monthly data spend of NGN1,000–2,000 (approximately US\$5–10)⁸.

Figure 3: Changing characteristics of mobile internet and smartphone users in urban India

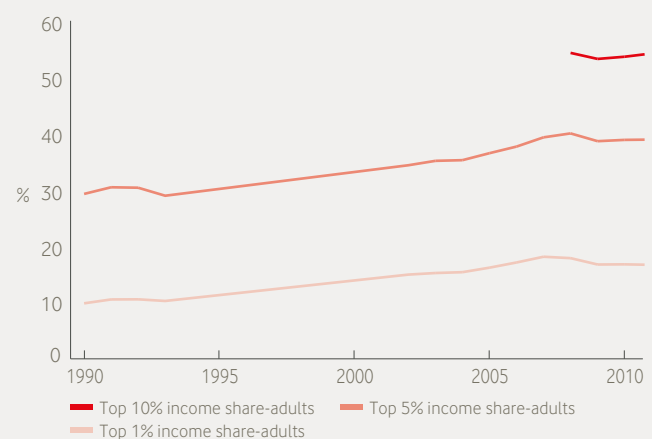


Source: Ericsson ConsumerLab, The changing mobile broadband landscape, India 2015

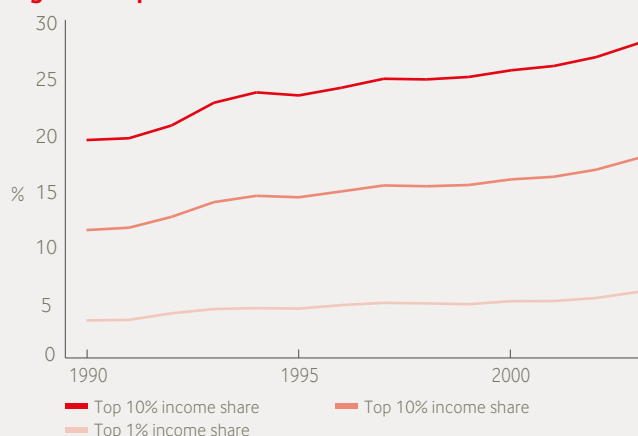
The extent of inequality in emerging markets

Why is inequality a concern now? There is a growing body of evidence to suggest that inequality of income and wealth has increased around the world since the 1980s, driven by the forces of globalisation and structural economic change⁹. However, the impact of the financial crisis highlighted firstly the sharing of the pain of recession and slower subsequent growth, and secondly the uneven distribution of earlier growth. While there is no evidence that a moderate degree of inequality limits economic growth, a high degree of inequality does do so, possibly operating through the distortion of the political and regulatory framework as economic power is turned into political influence¹⁰. While political influence operates everywhere, its effect in many emerging markets is particularly damaging because of the relative weakness of state institutions¹¹. As the charts below show, in a number of key emerging market economies, recent years have seen a higher share of total incomes going to the highest-income groups.

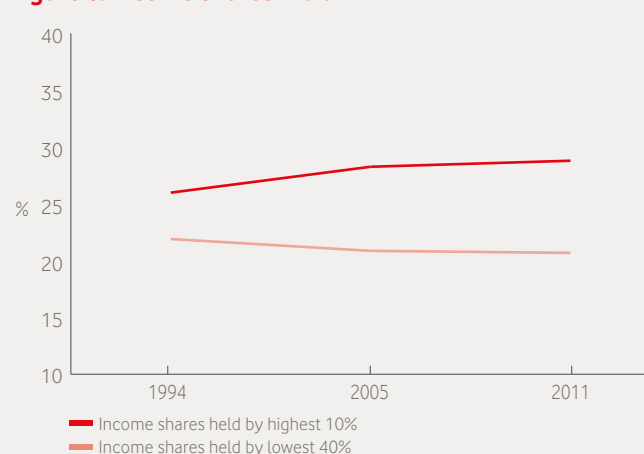
Figure 4: Top income shares South Africa



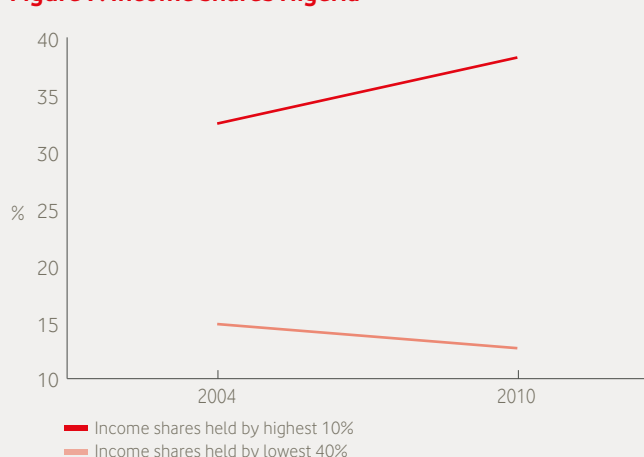
Source: Alvaredo, Atkinson, Piketty, Saez & Zucman. The World Wealth and Income Database, 2016

Figure 5: Top income shares China

Source: Alvaredo, Atkinson, Piketty, Saez & Zucman.
The World Wealth and Income Database, 2016

Figure 6: Income shares India

Source: Oxfam (World Bank data), 2014¹²

Figure 7: Income shares Nigeria

Source: Oxfam (World Bank data), 2014

Defining inequality

Poverty or marginalisation makes it hard for people to overcome the high fixed costs of accessing networks – transport, utilities, communications and social – that would link them to economic and social opportunities¹³. The public infrastructure in developing countries is inadequate; for instance, more households in developing countries own a mobile phone than have access to electricity or indoor sanitation¹⁴. Paying for access to high quality private infrastructure is expensive, albeit far less so in the case of mobile than fibre communications networks. Part of the challenge of development is reaching the tipping point whereby many people have affordable access to sufficiently high quality networks. The quality threshold, and its interaction with private investment incentives, is important; investors need to be willing to invest in sufficiently high quality networks or there is a risk that with broad but second-class connectivity, inequalities are reinforced rather than reduced. We return to this in the policy section below.

In this Report we refer to the concept of development as the enhancement of the capabilities needed to lead a meaningful life¹⁵. Accordingly, we examine the concept of inequality in terms of systematic differences in the capabilities of people with certain socio-demographic or other characteristics (incomes/class/caste, gender, age, location, health/ability, ethnicity). We look at the following hypotheses:

- **Access and usage:** Access to and use of mobile voice and data services is a prerequisite to its usefulness as a tool to address inequality in capabilities. Hence tracking the uptake, use and cost of mobile across different communities (geographic and social) is essential.
- **Accessing growth and income:** Mobile allows individuals and organisations greater opportunity to participate in economic growth, income generation and social development.
- **Extending and deepening social networks:** The use of mobile to reshape, deepen and extend social networks allows people to change their patterns of access to knowledge and hence challenge existing social norms and allow innovations within a community. Such changes help to mould the processes defining the social context of people's daily lives.
- **Accessing information:** Direct access to information addresses knowledge inequalities. The hypothesis is that the more open and diverse the access to information resources, the greater the opportunity for flexible economic and social innovation.
- **Accessing resources:** Access to new types of service such as cloud-based services significantly changes the cost profile of organisations and alters the nature of geographic markets. Moreover, cloud-based services can greatly reduce transaction costs and create new opportunities for economic development.

The issues of enhanced growth and reduced inequality are of vital importance as governments implement their responses to the Sustainable Development Goals. To begin to assess the potential of information technologies in this process, we need to define what inequalities we refer to in this Report.

In this Report we look specifically at the following groups in terms of their access to opportunities and resources, and the impact that mobile broadband access could have on their lives:

- Women and girls, based on a survey of smartphone owners in Kenya;
- Micro-entrepreneurs, based on a survey of small businesses using smartphones in Ghana; and
- Small farmers in India and elsewhere.

How could mobile broadband access address inequalities?

Drivers of demand

Access to smartphones and mobile broadband in itself would do nothing to redress these inequalities. The outcomes will depend on the scope of investment in the networks, the provision of relevant services, and the uptake and use of services by disadvantaged socio-demographic groups. There are three drivers of demand: affordability, accessibility and relevance.



Sales of smartphones are rising by 30% a year in emerging markets

Affordability

The cost of smartphones sold in developing markets has fallen rapidly. In late 2013, the cost of a basic smartphone was about US\$100; by late 2014, smartphones costing US\$30 were available in India and Africa made by Chinese manufacturers. These phones typically have Facebook, Google and WhatsApp services pre-installed. Very cheap handsets need WiFi for internet access, while smartphones able to access 3G and 4G (LTE) networks cost more¹⁶.

Analysts believe that when the price for a 3G-enabled smartphone falls to US\$30, which is a similar price to a high-end feature phone, mobile internet access will accelerate¹⁷. Already sales of smartphones have overtaken sales of feature phones, and are rising by 30% a year in emerging markets¹⁸. There are likely to be non-linearities in the effects – in other words, a tipping point – just as with the spread of broadband compared to dial-up internet in the developed world. Small changes in frictions in accessing information can cause much bigger changes in behaviour.

Along with the cost of the handset, the cost of data packages affects mobile broadband take-up. Operators are offering micro-data packages such as the data 'snacks' offered by Vodacom in South Africa¹⁹. MTN similarly offers a R29/month Facebook and Mxit package, with access limited to those social networking sites.

Accessibility

Accessibility refers to people's capacity to use new technologies. Research suggests seven out of 10 people who do not currently use the internet do not know how to use it. Indeed, almost four out of 10 say they do not know what the internet is²⁰. Speed of learning also differs. People accustomed only to the keypad of a feature phone have to learn how the gestures work, whereas those with experience of a computer keyboard find it much easier.

"Switching from the feature phone's keypad to the on-screen keyboard of a smartphone usually proves quite challenging for almost all of the unconnected/newly connected, making them reluctant to switch ... On the other hand, whenever the connected move to smartphones, their mental model of QWERTY keyboards helps them to cope, resulting in a minimal learning curve²¹."

Our findings highlight the vital importance of education in driving smartphone use. Those with a higher level of education are not only more digitally literate, they are likely to more easily recognise the value of access to new sources of information and be better equipped to take advantage of it. The results from the survey of women and men using smartphones in Kenya show education to be the real driver of mobile broadband take-up and depth of use. The women who have smartphones value them highly because they have experienced the benefits of greater access to information and social networks that, for them, differentiate smartphones from previous mobiles. The results from Kenya serve to emphasise the role of education policy in making progress on gender inequality.



Social context makes a big difference to people's willingness and ability to adopt and use new technologies."

People need confidence that something new can help them, and close social ties with trusted individuals who can explain the benefits and how to use the technology can facilitate that confidence. Social inequalities are clearly relevant to the likelihood of an individual having such connections²². Social ties also affect the incentives to spend scarce money on mobile airtime and data, changing the cost-benefit assessment²³.

Relevance

A further important dimension of accessibility is the relevance of the content available to users. However, it is unclear how much of the content being accessed is locally provided rather than international content. A survey by the Pew Research Center showed much greater smartphone use among English-speaking people in African countries, and while correlated with educational attainment, this could also reflect the dominance of English language content online.

Figure 8: English language ability and smartphone ownership

Adults who access the internet at least occasionally or own a smartphone

	Proportion of the total population using smartphones (%)	Proportion of English speakers using smartphones (%)	Proportion of non-English speakers using smartphones (%)
Nigeria	39	48	6
Senegal	28	65	12
Kenya	29	36	3
Ghana	21	30	3
Tanzania	19	41	5
Uganda	15	23	2

Source: Pew Research Center Spring 2014 Global Attitudes survey

Relevant local content will be important not only for driving demand growth overall, but particularly for addressing the social gradients in access to mobile broadband and enabling progress towards universal access to government services and civic engagement²⁴. Both the survey of micro-entrepreneurs in Ghana and the analysis of agriculture in India underline the importance of sufficiently local and relevant information in the value proposition for mobile broadband use.



OTT services

'Over the Top' (OTT) services are services provided over the internet – which means the same service can run seamlessly over different networks such as mobile and WiFi. OTTs are at the forefront of enabling people to have meaningful access to the internet. In the communications space, OTT services have had a huge impact on the structure of the traditional telecoms and media markets. Often one of the main features of OTT communications services featured in debates about inequality is that they are 'free' to consumers in exchange for access to and rights to use, to varying degrees, their personal data. OTT service providers share a common interest with traditional telecoms and media players in ensuring continual investment in high quality broadband networks.

In the context of this paper it is useful to distinguish between the three forms of OTT services. The first are services that run over broadband networks; the second are services that depend

on the operating platform (the two most significant are iOS and Android); and the third OTT services are either platforms (such as Facebook and Google Search) or content-providers, including much of the traditional media sector. Policy interventions need to take into account the dynamics across all types of OTT services and recognise that issues can exist across markets²⁵.

There has been an inevitable tension between the diffusion and adoption of OTT communications services and their delivery on public networks. To the extent that the use of OTT services is not accompanied by a volume and revenue increase in the market for access, and/or increases in expenditure by the consumer, and where the services substitute for traditional paid services (such as SMS messages and calls), these novel business models impact traditional revenue streams that have long been used to fund investment in networks.

However, these potential tensions can be mitigated, especially by regulatory policy. Where network operators are given the flexibility to restructure tariffs, combined with a regulatory environment that facilitates lower cost rollout of networks (for example, through spectrum policy), demand can be stimulated and new revenue streams, such as data, ensure that new investments are forthcoming. Regulatory frameworks need to further adapt to this new reality, both in relation to communications and the wider digital ecosystem to ensure that consumers have the same protection for the same services. Some operating systems and platforms in the ecosystem are gaining increasing influence through their position as 'digital gatekeepers'. These players are capable of controlling the development of, and access to, online markets and therefore the digital economy. Consumer trust can be reassured in this environment through legal frameworks that are flexible enough to adapt to address competition concerns in the digital age and that ensure that whatever service the consumer is using, they are afforded the same protection.

Drivers of investment and service provision

Market ecologies

Central to the policy debate are considerations around three interdependent but separate areas of the market ecology:

- The market structures that are most effective in delivering sustainable and ubiquitous broadband networks – these discussions centre on mobile as an infrastructure;
- How those market structures can lead to both more extensive use of a wide range of applications and more intensive volumes, which is also enabled by smartphone devices; and
- The policies to support the development and use of online services, taking into account the internet as an information resource.

This spills into policy debates not only over the nature of competition between network operators but also on the nature of competition between services running over those networks. Highly competitive markets fuelled the mobile revolution, bringing a transformation in the availability, cost and quality of voice services in almost all countries. Competition between networks drove the diffusion and adoption of mobile, while a sustainable return drove continuing network investment.

The smartphone has radically altered the nature of mobile markets. The old model saw the bundling of device, services and networks into a single co-ordinated economic structure. The obvious policy levers were for the creation of competitive markets in network provision. This delivered increased economic growth by fostering local investment and service delivery through large network providers.

The smartphone has ushered in a seismic shift in focus towards the device. This new eco-system brings myriad innovations, perhaps most notably new access and pricing models. For example, large – preferably global – scale drives sufficient advertising revenue to sustain free or freemium pricing.

Competition and investment

In this new ecology, the question that policymakers must ask is: what is the appropriate market structure to support sustainable network investment and innovation along the whole value chain including the service level?

From the user's perspective, the broadband market has brought a plethora of different services and communications channels, many of which appear to be free. The new models, with free offers to consumers, pose a disruptive challenge to other players in the market, and to regulators assessing whether there is enough competition in the market.

Network operators provide specific services that generate revenues directly from their customers. In contrast, OTT service providers generate revenue from advertisers; their business model requires the establishment of large user communities on one side of the platform to attract advertisers and revenues on the other side. Facebook built an advertising revenue stream from zero to 50% of its revenues in two years between 2012 and 2014²⁶.

WhatsApp illustrates this new ecology well. It is available free around the world, often pre-installed on a smartphone. While dependent on network connectivity, it is independent of any specific network or technological platform. Data suggests WhatsApp is predominantly used by younger generations²⁷. McKinsey has observed that network tipping is highly likely when an OTT service is embedded in this way²⁸.

In considering how investment in broadband networks can be funded in order to address inequalities through extensive or universal broadband access, part of the investment challenge is working within this new market ecology, where revenue streams are realigning.

Similarly, another policy challenge is that while 'free' services, often global, are obviously attractive, adequate incentives for sustainable investment in the provision of locally relevant services and apps are also necessary.





One of the key questions for policy makers is how to combine strong incentives for private investment, which have to generate a profit, with the widest possible access to networks and services

INFRASTRUCTURE INVESTMENT

SOUTH AFRICA CASE STUDY ERNST & YOUNG – PETER ARNOLD

Infrastructure is a vital asset for addressing inequalities. Indeed, for some people it can be the only asset to which they have access.

The failure to attend to infrastructure investment can cement or even exacerbate existing inequalities. Accordingly, ensuring ubiquitous access to networks and services has been a constant part of the policy debate and the basis of many public policy interventions.

Historically, communications technologies were provided by state-owned companies. However, over the last 30 years, this model has evolved through market reform into a private sector-led investment model. One of the key questions for policy makers now is therefore how to combine strong incentives for private investment, which have to generate a profit, with the widest possible access to networks and services. This includes consideration of how to ensure that policies do not unintentionally limit or distort commercial network rollout, thereby compromising opportunities to address inequalities.

The communications industry is capital intensive. A commercial business case for both network and service rollout will prioritise low cost (densely populated urban areas), and high return (usually high income) areas. This largely explains observable urban-rural disparities in coverage and usage, particularly in initial stages the rollout of new technologies. There is, therefore, a risk that, even if only for a period of time, rural and low income subscribers can be less well served in terms of access to affordable mobile services, and in particular to data services. However, population density, the scope to serve enough people in a given area even where average income is low, is a more important determinant than local incomes of the viability of investment in mobile as compared to fibre networks due to the difference in cost factors²⁹.

South Africa offers a good example of the impact of urban-rural disparity. Its geography presents particular challenges to the rollout of networks. It is one of the largest countries in the world by area (25th, 1,219,912 km²) but with a population of 52 million, it is less densely populated than other African countries such as Nigeria, Kenya, Ethiopia and Egypt. South Africa's population tends to cluster around the country's rivers and the coast and is increasingly urban; the proportion of people living in urban areas increased from 52% in 1990 to 62% in 2011³⁰.

South Africa has experienced rapid growth in mobile penetration, with the population today benefiting from near universal 2G population coverage, continued rollout of 3G, and the beginning of 4G (LTE) networks. Yet there are differences in the extent of access to mobile broadband-enabling 3G and 4G (LTE) data networks in rural areas. While the gap will close over time, as with previous generations of technology, the country's experience underlines the importance of investment. Yet investment is not the whole story. Where access to 3G and 4G (LTE) networks is available, it is primarily higher income subscribers who take advantage of data services.

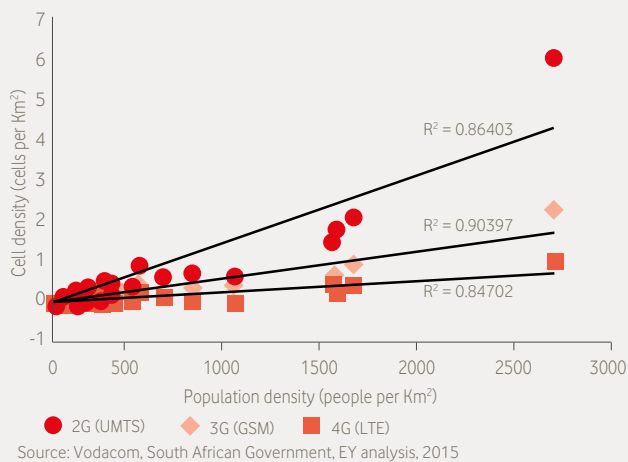
Using South Africa as a case study to examine infrastructure investment incentives, we have sourced information from Vodacom (the largest operator in the country) on its network, the underlying economics of its coverage, and on the usage profiles of its subscriber base. This has been complemented with general demographic and socio-economic data from the 2011 South African census.

When considering investment in mobile networks, in addition to overall coverage levels, density of cell-site coverage is relevant as well. Higher density can improve the quality of service provision, which may result in fewer dropped calls or frozen services and quicker download times. We have analysed simple correlations between cell density and population density of 2G, 3G and 4G (LTE) technologies by municipality, of which there are 250 in South Africa. Overall, and perhaps unsurprisingly, we find that there is a strong correlation between cell density and population density at municipality level. There is a stronger correlation for 2G than 3G and then again than 4G (LTE) (see figure 9). This is again as we might expect due to the later rollout of 3G relative to 2G and the relative infancy of 4G (LTE) and is supported by previous studies of African mobile phone coverage³¹.

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Figure 9: Relationship between population density and cell density for 2G, 3G and 4G (LTE)



Note: The coefficient of determination (denoted as R^2) indicates how well data points fit a statistical model. The R^2 statistic ranges from zero to one, with a value of one indicating that one variable is a perfect predictor of the other.

The clear correlation between population density and cell density also suggests that there may be a challenge in terms of providing quality and consistency of services in rural areas, even where coverage is available.

In contrast to population density, there does not appear to be a strong correlation between income and cell density. Further, there is not a strong relationship between average household income and population density (R^2 of 0.166), which likely reflects the existence of densely populated, low income areas in urban centres in South Africa.

Therefore, while affordability of purchasing a smartphone and continued access to mobile data services will continue to be an important driver of uptake and usage, all else being equal, an individual on a low income in a densely populated area will have better access to mobile internet services than their counterpart in a rural area.

The challenges of investment are highlighted by our analysis which shows that a relatively small number of sites generate the bulk of Vodacom's revenue. The top 10% of total sites contribute over 30% of total revenue, whereas the bottom 50% of sites contribute under 10%. Of the top sites, just 10% are in rural areas. Data revenues represent a much greater proportion of revenue at the highest earning cell sites than at the lowest earning sites; the top 1,000 sites contribute 37% of total data revenues, whereas the bottom 2,000 sites contribute less than 1% of total data revenues.

Analysis of individual cell site revenues and costs suggests that around 30% of Vodacom's cell sites would not be profitable on a standalone basis. This spread of profitability has implications for increasing capacity and upgrading the less profitable sites. This may become even more the case as data as a proportion of customer spend increases and as the potential to generate revenues from incoming voice calls from people outside of a particular rural area decreases.

South Africa provides a useful case study for infrastructure investment and considerations of inequality. Mobile provides an equalising opportunity to access a vital national infrastructure and the country is relatively well served by mobile operators for voice and 3G services. However, there are pockets of zero coverage, and a clear correlation between population density and cell density, suggesting that even where coverage is available, the service experience in rural areas may be different in quality or consistency to that in urban areas. It is clear that the commercial case for rolling out cell sites in low population density areas is challenging, even when the wider benefits around improved network coverage are factored in. It is also relevant to the inequality debate that where policy measures to increase coverage of mobile and/or fibre networks are considered, such as rollout obligations, these may increase costs and potentially impact on affordability.

In these circumstances, policy makers in South Africa and more widely face a balancing act in order to incentivise private investment and public-private partnerships in a way that can achieve both investment in infrastructure and affordable access to services in the journey towards greater equality.

For further thinking on rural rollout options, see Webb Henderson's paper *Rural solution options for governments in emerging markets to increase broadband coverage in unserved and underserved rural areas*. The solutions explored in that paper include public-private-partnership joint ventures for a backhaul network. They also consider operator-led solutions such as a designated rural services provider or operators with coverage obligations, compensated through a discount on spectrum prices, to deliver a rural broadband access network³².



Policy recommendations

This Report provides preliminary evidence that mobile broadband can offer an equalising opportunity between socioeconomic groups that hitherto have experienced marked inequalities. This topic warrants further research as the use of mobile broadband networks and smartphones could represent a fundamental shift in economic and social opportunities, and as there is need for early policy co-ordination to realise that potential. Equally, the Report indicates that there are risks in failing to make mobile broadband accessible to disadvantaged groups; existing inequalities could become embedded and deepened by the information-rich environment of those who do have access.

How can the potential be realised and the risks averted? The research reported here points to the following conclusions:

- **Education** is a vital part of the potential equalisation story. When it comes to communications technologies, digital literacy has a central role to play. Education, in part as a proxy for digital literacy, affects how people use their devices and what value they derive from mobile broadband access. That access appears to play a powerful role in reducing information asymmetries and equalising access to wider social networks and opportunities.
- The future usefulness of mobile broadband access for the various groups considered in this Report will depend on **the development of locally produced information and apps**. This is a challenge because of the high costs in developing 'hyperlocal' apps with information of value – for example, the detailed agricultural information highlighted in the research reported here. There is likely to be a role for the authorities and donors in helping local providers overcome the entry barrier of high fixed costs. Sustainable business models need to be enabled through partnerships and an appropriate competition policy framework.
- **Investment** is needed to provide access to reliable, high quality broadband networks from (3G, 4G (LTE), future generations and WiFi) as well as 2G networks for voice and SMS. Increasingly, broadband infrastructure will consist of a variety of competing and collaborative solutions meeting the demands of consumers across a range of highly differentiated locations. Investment incentives will need to reflect this. Issues of quality and security are becoming significant to enable the use of data services which people depend on more and more. The increasing use of data services provides another perspective on networks quality – poor quality that manifests as dropped calls and/or expressions repeated in a voice call become service failures for data traffic.
- In terms of the incentives to invest in broadband networks, access to sufficient **spectrum** at market-determined prices continues to be, and will remain, a critical area of policy³³. The broadband access networks and much of the transmission network will be reliant on radio spectrum. Population density, potential long-term revenues, and costs of rollout in different geographies combine to determine the practicality of alternative technical infrastructures, including fixed-line fibre optic networks. In many emerging markets these fundamental drivers of investment seldom combine to warrant substantial investment, especially in fibre access networks. Spectrum policy should therefore be designed to release into the market ample bandwidth in a timely manner and on conditions that stimulate sustainable broadband investment.
- Changing market structures are altering the nature of **competition** across different parts of the value chain at both the wholesale and retail level. While many policy measures address these matters, two issues are relevant from the inequality perspective.
 - The number of network, core infrastructure, players. There is a trade-off between competition and powerful economies and scale and scope. The terms of the trade-off can be improved, and investment in broadband networks facilitated, by a policy environment that encourages **collaboration between different players**.
 - The inter-relationship between OTT service providers and network operators. It will be important for authorities to allow operators the freedom to create new business models and enter into arrangements with OTT operators in order to support the huge investments required for broadband networks. Similarly, it is important for **businesses to innovate** in ways that enable their services to deliver value for all groups of customers, including business model innovations, and a range of price points or bundles.
- The evidence in this Report suggests that many government organisations have yet to ensure that their websites are **mobile friendly**. All departments can take a leadership position in developing services that citizens can access wherever they are through their mobile. This is important for stimulating demand for high-capacity networks and smartphones and, as shown in this Report, reducing the potential for differential access to government information in this way should be seen as a priority.
- Governments may also need to consider measures to **promote consumer trust**. Whatever platform the consumer is using when they use a service, they should be entitled to the same protection. This means introducing consumer protection measures that fit for the digital age; ones that are flexible and light-touch.

Smartphones and gender equality

In Kenya...



Women face barriers to education, entrepreneurial and social activities



The Gender Inequality Index ranks Kenya at 126 out of 155 countries due to inequalities



50–300% year-on-year growth in smartphone penetration since introduced in 2007



99% of internet access is through a mobile device

What affects smartphone ownership and use?



Education is a central driver of smartphone ownership and use, whereas income is not



Women place greater emphasis on the importance of smartphones in connecting them to their family and the world beyond



Gender does not affect spend on data unlike airtime where a woman tends to spend c.80% of a man's spend, all things being equal



Even with similar education and income levels, women use their smartphone for fewer tasks and/or less frequently

What are the benefits of owning a smartphone for women in Kenya?



New sources of information and current affairs



Closer connections with social networks



More business opportunities (extending business contacts and increasing business hours)



>66% of surveyed business women said a smartphone had increased her income

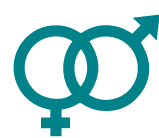
The use of smartphones by women in Kenya

Rachel Cowell

Mobile phones have allowed women over the world to feel more independent, to feel safer and, in Kenya thanks to M-PESA, to be financially included³⁴. Smartphone ownership is now increasing rapidly, bringing internet connectivity to mobile users. Experience from developed markets where there was a shift from dial-up connections to broadband suggests that faster and more seamless internet access can lead to step changes in behaviour and impacts. This paper explores smartphone use by men and women through a survey of smartphone owners in Kiambu County, Kenya. It examines predictors of, and barriers to, smartphone ownership, alongside evidence of whether smartphones are being used by women in ways that redress inequalities.



Women in Kenya face a variety of inequalities compared to men. Historically, women have been disadvantaged in access to education, which is reflected in the distribution of the population's educational attainment. However, significant progress has been made in recent years, as Kenya sought to meet the stretching Millennium Development Goals. Parity has been achieved for girls and boys enrolling in primary education and near parity in secondary education³⁵. However, this does not extend to college and university attendance³⁶ and this is not the case in rural areas, where girls are still less likely to be educated than boys. In fact, in the North Eastern Region, 75% of women have not received any education³⁷. Alongside this, women are disadvantaged in relation to entrepreneurial activities, as a result of unequal access to information, financial services and capacity-building opportunities³⁸. It has been estimated that agricultural productivity could increase by up to 20% if women's access to resources were equal to men's³⁹. Women perform the majority of unpaid domestic duties in Kenya⁴⁰, reducing the time available for paid activities, or unpaid activities such as personal-development or further education. Furthermore, Kenyan society is one in which men hold decision-making and planning power, leaving women more excluded from social participation⁴¹. In 2014, 23% of Kenyan women were not exposed to any source of mass media, compared to just 10% of men⁴². The 2014 UNDP Gender Inequality Index ranks Kenya at 126 out of 155 countries due to these inequalities⁴³.



The 2014 UNDP Gender Inequality Index ranks Kenya at 126 out of 155 countries due to gender inequalities

Penetration of smartphones in Kenya has grown at between 50% and 300% year-on-year since they were introduced in 2007⁴⁴. The research undertaken for this Report explores how the devices are being used by women and men to improve business opportunities, expand social networks, increase participation in society and increase points of reference when seeking information. We set out to discover if use of a smartphone could redress certain inequalities that women face, and if so, if it has led to economic and social

benefits. The findings indicate that smartphones have the potential to impact existing gender inequalities in access to information, entrepreneurial activity and social participation. In business, access to a smartphone gives women the same opportunities as men in extending business contacts, increasing working hours and lifting incomes. More than two-thirds of the business women surveyed said a smartphone had enabled her to increase her income.



Women, who have lower levels of tertiary education than men, are at risk of missing out on the benefits of the digital economy and society in the near term

It is apparent from the individual views and stories of those in Kiambu County that the smartphone has for many women had a transformational effect on their lives. Nearly all respondents rated the smartphone's ability to connect with both family and friends, and people outside of their immediate networks, as very important to them. The special emphasis that women place on the greater connectivity that a smartphone provides is an important finding for gender inequalities, as these can be improved through collective discussion and the questioning of discriminatory social norms and practices.

The research reveals that though women and men use smartphones differently. Fewer women make use of various features than men and all things being equal, they spend less money on airtime. We found that even if a woman reports a high level of education and monthly income, she will use her smartphone less than a similarly paid, well-educated man.

One finding with particularly important implications came out of the survey: education is a central driver of smartphone ownership and use. This was distinct from income, which did not impact the likelihood of smartphone ownership. Smartphone users are more educated and affluent than the Kenyan average but, among them, level of education is a key indicator of smartphone take-up, and of the extent and depth of the use of resources that it opens up. The better educated you are, especially after secondary school

and college, the longer you will have owned your smartphone, and the more data you will consume. Consequently, women, who have lower levels of education than men at this level, are at risk of missing out on the benefits of the digital economy and society in the near term. Failing to act to ensure that women have equal access to this vital enabling resource at the outset, and that they are empowered to use it, risks exacerbating gender inequalities instead of capitalising on this powerful equalising force.

The special place of mobile phones in Kenya

Thanks largely to the success of mobile payments solution M-PESA, the mobile phone holds a special place in a Kenyan's heart. The value proposition presented by M-PESA means that while a gap remains in access to a mobile phone between women and men in Kenya, at 7%, it is much lower than the average of 13% across Sub-Saharan Africa⁴⁵. A mobile brings communication where there are few landlines, access to information where infrastructure is weak, and efficient banking facilities to a previously largely unbanked population. Basic phones, which can bring information in easily digestible formats such as SMS market prices and farming tips via iShamba, iCow, Kilimo Salama, education services such as shupavu 291, and pregnancy and health advice from Totohealth and Afya Tips, have demonstrated this. For women, the use of mobile phones can have a powerful impact. The financial inclusion enabled by M-PESA was especially useful for women, those in rural areas and the illiterate, who are less likely to be banked^{46,47}. Women feel safer with a mobile phone⁴⁸, a fact significant in Kenya where 39% of ever-married women aged 15–49 have experienced spousal sexual or physical violence, compared to 9% of men⁴⁹.

The mobile phone is the device Kenyans would most like to upgrade⁵⁰ and many say they would forgo bus fare or food in order to buy airtime⁵¹. 86% of households own a mobile phone⁵². Since their introduction nine years ago, the penetration of smartphones has increased significantly, with mobile broadband accessed by 18% of all mobile phone connections by the end of 2015⁵³. In the first half of 2015, an estimated 58% of all phones sold were smartphones, around 150,000 devices per month⁵⁴. It is now the main route to internet access in Kenya; in 2016, 99% of internet subscribers (around 21.5 million or 48% of the population) accessed the internet through a mobile device⁵⁵. Gradually, this is filtering out from the urban centres; in 2011, 70% of smartphone sales on Kenya's primary online retailer, Jumia, were to Nairobi, but by 2015 that figure was just 43% of sales⁵⁶. However, the gap in terms of use of mobile internet use between Kenyan women and men is 22%⁵⁷.

Research on smartphone users in Kiambu County

The study of 861 smartphone users for this Report took place in Kiambu County, an area close to Nairobi where people are more likely to have the disposable income required to own such a device. Kiambu County is defined as 62% urban⁵⁸, as compared to Kenya's average of 32%⁵⁹ and 70% 'non-poor' as compared to just 45% of Kenyan population⁶⁰. In Kiambu County there are proportionately more 34 to 65-year-olds, the population is better educated with more people in paid employment and fewer in agricultural employment than the Kenyan average.



To explore the impact of smartphone uptake, the survey focused on analysing these questions:

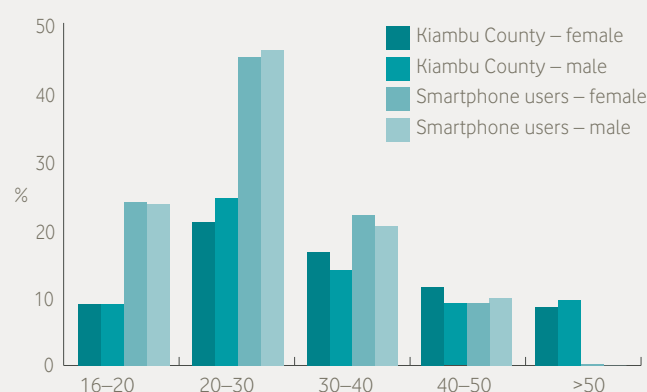


1. What characteristics predict who will be a smartphone user, and what barriers to uptake exist?
2. How do men and women use their smartphones?
3. What value do users perceive they get from smartphones?
4. How does smartphone ownership change behaviour?
5. What are the benefits of ownership for women?

Characteristics of smartphone users

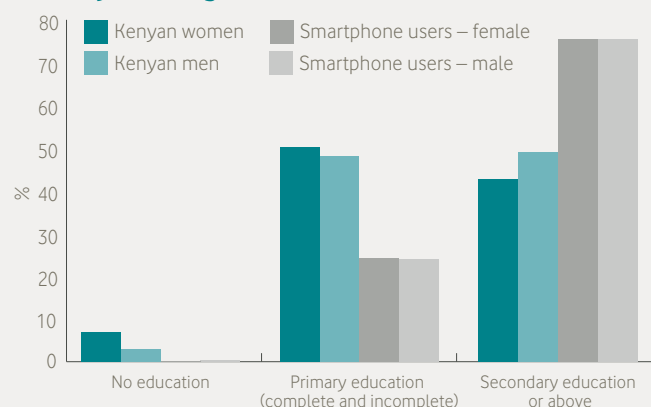
The survey was guided by an equal spread of men and women in both rural and urban areas, across a wide distribution of ages and distributed proportionately across the sub-locations in Kiambu as per the 2009 census⁶¹. However, as female smartphone users between 35–50 were harder to find, respondents were more likely to be millennials (aged 16–34) compared to Kiambu County as a whole. It was evident that survey respondents, that is, smartphone users, were substantially better educated than the Kiambu County and Kenyan average levels. The characteristics of the survey respondents show that education is a key driver in smartphone ownership.

Figure 1: Survey respondents' (smartphone users) age distribution compared to Kiambu County



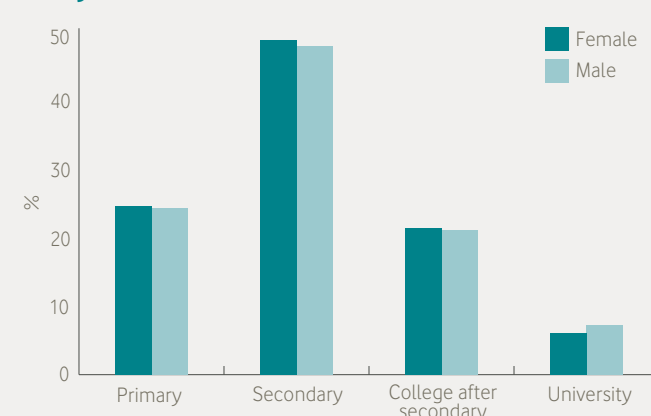
Source: Kenya National Bureau, 2009 and Rachel Cowell, 2015

Figure 2: Smartphone users are better educated than the Kenyan average



Kenya National Bureau of Statistics, 2014⁶² and Rachel Cowell, 2015

Figure 3: Education level of smartphone users surveyed



Source: Rachel Cowell

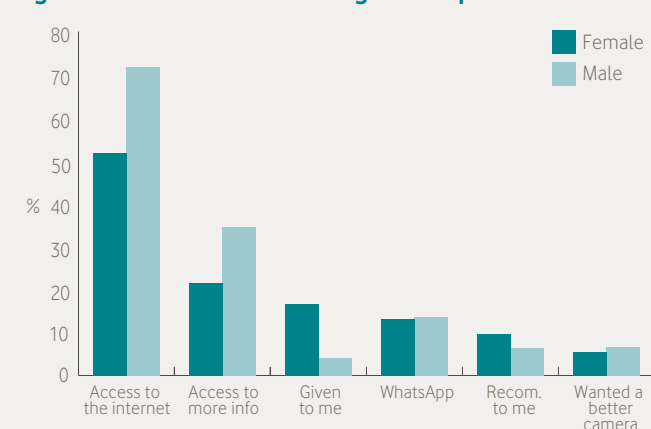
Figure 4: Mean length of smartphone ownership by education level



Source: Rachel Cowell

In examining the responses from the smartphone owners in Kiambu County, they proved to be users by design rather than by accident, having had a clear understanding of the benefits that a smartphone can bring before procuring the device. However, more women than men said that the reason they own a smartphone is because it was given to them. Contrary to anecdotal reports that a customer will seek a smartphone for the camera or for WhatsApp, access to the internet was the primary reason that both women and men had chosen to own a smartphone.

Figure 5: The reasons for having a smartphone



Source: Rachel Cowell

The selection of respondents was designed to produce an equal gender balance, making it impossible to use the data to directly assess whether men or women were more likely to own a smartphone. Instead, it was possible to look at the predictors of length of smartphone ownership, resulting in the discovery that the level of education affected how long a respondent had had their smartphone. Those attending college after secondary school, and then university, had owned their smartphones for significantly longer than those that reached just primary or a secondary level of education, with university graduates having had their smartphones for significantly longer than college graduates. The women and men sampled had surprisingly similar levels of higher education; this is not typical of Kenya or Kiambu as a whole. From the comparison with Kenya and Kiambu County, it is apparent that the level of education is higher in the sample of smartphone users. Education can sometimes be taken as a proxy for income. Currently, only primary education is free in Kenya. Therefore, this finding could be taken to suggest it is actually family income that affects length of smartphone ownership. However, within this group, level of income did not appear to affect the length of smartphone ownership. The sample consists only of users who are wealthy enough to afford a smartphone; indeed, the findings indicated that smartphone users tend to be financially independent with regards to their mobile, with 94% of females and 98% of males saying that they mainly paid for their airtime themselves. It could be that a longer education exposes students to the benefits of the internet, while reducing the fear of the unknown that poses a barrier to the adoption of new technologies. These findings are supported by an analysis of data spend, which shows that those educated to at least college level spend more on data each month, as discussed below.



Women's voices on the impact of a smartphone

"It makes the world a small village..."

"I have met new people and new ideas about life"

How women and men use their smartphones

Intensity of use

Kenyan women play a central role in families and communities, and patterns of people's time spent using a smartphone appears to reflect this. As found around the world, women perform the majority of unpaid duties in Kenya. UN Women reports that globally women do on average 2.5 times as much unpaid care and domestic work and work longer hours than men when paid and unpaid work are combined⁶³. In rural areas of Kenya, the task of sourcing firewood and water often falls to women, leaving little time for entrepreneurship. In fact, women collect 73% of the drinking water collected across Kenya⁶⁴. As shown in Figure 6, the under 20s in the survey are the most likely to spend over three hours per day on their smartphone. There is a noticeable gender gap across all age groups (from under 20 to 40). This may reflect the higher level of familial domestic duties undertaken by women.

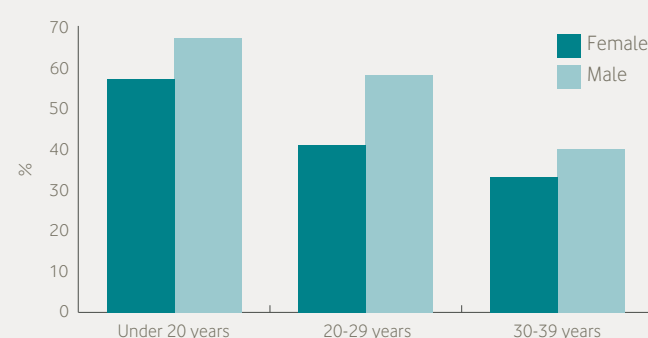
The vast majority of respondents said that their total monthly expenses, a proxy for income, were under KSH50,000 per month (approximately US\$500) with women reporting lower expenses on average than men. In addition to having less leisure time than men, the OECD reported that on average women tend to direct up to 90% of their income to their families and the community, compared to men who reinvest just 30–40%⁶⁵. Consistent with this, the women surveyed tended to spend slightly less on airtime for their smartphone, even when reporting the same amount of monthly expenditure. For example, a woman who had received only primary school education and had no job, would spend less than a man in similar circumstances. Likewise, a self-employed female university graduate would be predicted to spend less on airtime and data than a man in similar circumstances.

When asked to report their spend on data, just under a third could not answer, whether because they had used their airtime credit to buy data, rather than buying data directly, or due to irregular spend or reliance on WiFi. Women were more likely to report zero expenditure for data spend than men, but when the data spend was reported, gender was found to have no effect *per se*. That is, all things being equal, women and men spend the same amount on data. What does have an impact on reported data spend is education, income and if they reported using WiFi, which seems to indicate a more intensive user generally. The better educated consume significantly more data, which increased with their income (proxied by total monthly expenses). This was reflected in both male and female respondents. Furthermore, for all smartphone owners, time and money spent on a smartphone increases significantly over time since the device was first received. This could indicate that the user sees progressively more value in the device and so integrates it in more aspects of their daily lives. The increase in time spent is not affected by gender or wealth – both rich and poor, men and women, increase their time spent on their smartphone in similar ways. The increase in money spent on the device since they first bought the smartphone was, on average, across all respondents, KSH786 (approximately US\$7).

The trends in data use are in marked contrast to spend on airtime, primarily used for voice calls and SMS. As well as education and income, gender too has an impact on airtime spend. A woman tends

to spend around 75–85% of a man's spend on airtime, all other things being equal. But employment showed the biggest effect of all. It is clear that despite the multiple communication methods on a smartphone, those who select 'business/self-employed' or a job in government rely on voice calls and SMS more than any other group. The roles of these basic phone functions are still highly relevant; indeed, these are the only functions to reach near 100% use by both men and women. That a woman with the same level of income or total expenses will spend less money on her smartphone than a man could point to the different cultural roles of men and women. These findings highlight a potential equalising impact of data services, different from feature phones as spend on these are not affected by gender as a factor in and of itself.

Figure 6: Gender difference in most intensive smartphone users (>3 hours per day)



Source: Rachel Cowell

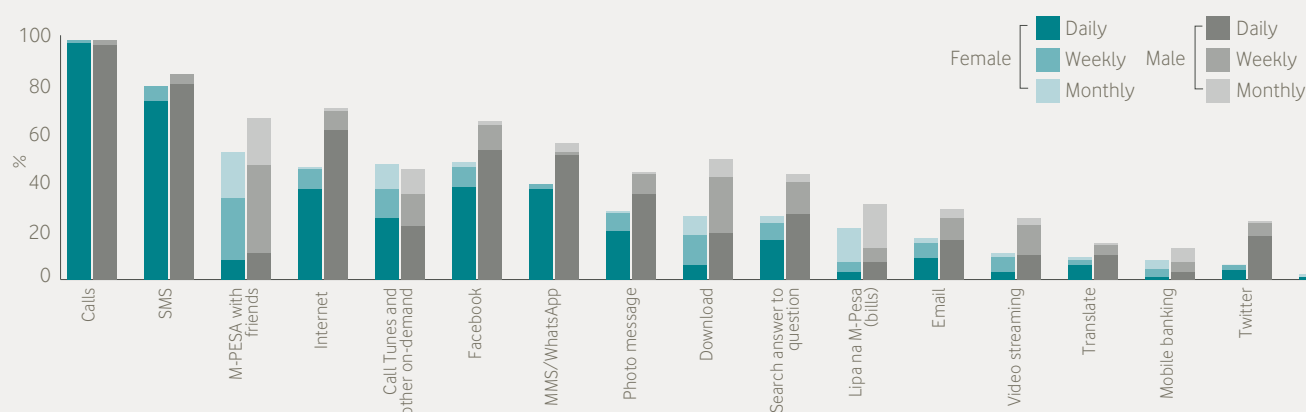
Variety of use

It became clear from the survey results that the Kiambu County women are less likely to use their smartphone for a variety of tasks than the men. There are many possible reasons for this. It could be a function of disposable time and income once domestic duties and family expenses are accounted for. It could be that men use the phones for entrepreneurial activities that are culturally less inclusive towards women. Even when women have the same income as men, there are certain features that they say they use less frequently, including video streaming or downloading video, games or apps, searching for the answer to a specific question and even using the internet. In fact, even when women have the same education level and income as a man, they use their smartphone to perform fewer tasks, and when they do perform the same task as a man, for example, using email, or searching for the answer to a question, they do that less frequently than a man.



Women's voices on the impact of a smartphone

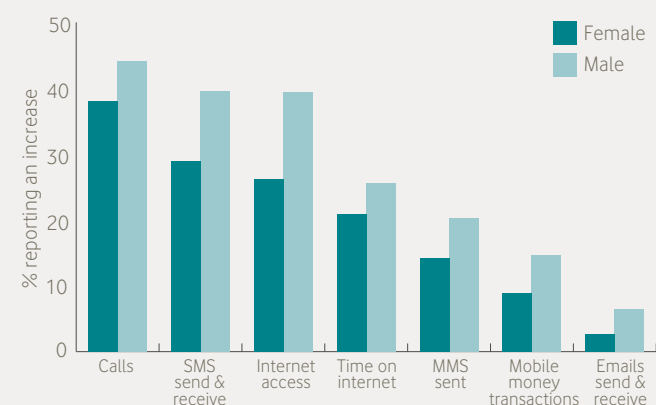
"It has connected me to the whole world and so I can communicate at the comfort of my seat"

Figure 7: Women use their smartphones for various tasks less frequently than men

Source: Rachel Cowell

When asked which areas of use had changed as a result of having a smartphone, more men than women said their use of a particular function had increased over time, consistent with their longer daily dwell time with the device. However, as discussed below, women's responses also indicated significant impacts as a result of having a smartphone, noting incremental benefits, beyond the independence, communication and security benefits resulting from having a mobile phone. We analysed the effect of gender in these responses and then whether the gender effect remained when we accounted for employment levels and education. We found that each of these variables – gender, education level and type of job – impacted on the respondent's likelihood of reporting an increase in usage. However, the gender-specific effect remained strong and consistent even when we compared this to models that accounted for income also. Models using only gender and a respondent's village had the strongest gender effect, but did not fit the data as well – suggesting that some, though by no means all, of the observed gender differences are due to gender patterns of education and employment.

Heavy users, both male and female, defined as those using their smartphone for over three hours per day, were more likely to use the internet, Twitter, use mobile instant messaging, download music video or games, and use Facebook than those who use it for less than three hours.

Figure 8: Impact of a smartphone on communications

Source: Rachel Cowell



In fact, Facebook and WhatsApp were not as intertwined with smartphone usage as might be expected. When asked what the impact would be on their Facebook and smartphone usage if their smartphone did not have Facebook installed on it, around 30% of female respondents said they would use either Facebook or the smartphone less, and for men this was closer to 40%. The overwhelming majority said it would not affect their usage of either platform or device.

Men tend to have a higher specification of smartphone than women, consistent with their relative level of income. During the survey, the total amount being stored on a smartphone compared to the available space on the device was examined, with the intention of surfacing whether the device was being used fully and to get an indication of the technical specifications of the smartphones in circulation. Of the 861 respondents, 170 participated in this question, of which 72 were female. Of these 170 smartphones, the space still available was recorded to be on average 1GB, with a median total space for females of 2GB and 4GB for males. This level of use of storage capacity also points to the growing demand for low cost, higher specification smartphones. The average price of a Kenyan smartphone is dropping. In 2011, there were 15 brands of smartphone at an average cost of US\$150 on Jumia; in 2015, there were 22 at an average cost of US\$100⁶⁶.

The impact of smartphones on women's lives

The benefits of a smartphone for women can be significant, numerous and wide-ranging. A large proportion of women of Kiambu County not only value their device, but testimonials from the survey spoke of the transformative effect of a smartphone. Clearly, the smartphone is a highly valued device. Though a higher proportion of male respondents placed the highest value on it, women see value in the smartphone helping them to perform well in their jobs, as well as to source local information, keep up-to-date on current affairs, access new markets and save time in business operations. Women place greatest emphasis on the importance of the smartphone in connecting them to their family and the world beyond.

Greater opportunities for women in business

Smartphones have high potential to improve business opportunities and increase income, and this is relatively equal



63% of business women have more income due to their smartphone

for women and men. It can ease communications with suppliers and customers, increase customer reach through social media, be helpful for arranging appointments, and useful in conducting online research. For those looking for work, smartphones provide access to information about available jobs through social networks. When asked for spontaneous answers to how it had supported their business, women, like men, gave a range of positive responses, from the ability to organise and manage their businesses, to communication with customers and the marketing resources available through Facebook and WhatsApp and OLX (an online marketplace similar to Amazon).



Women's voices on the impact of a smartphone

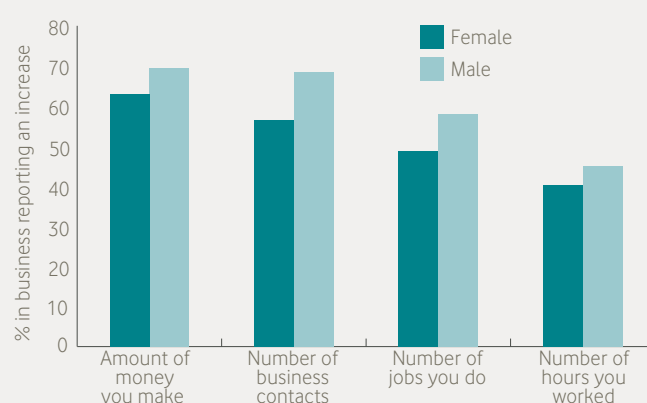
"I send my design through WhatsApp so if people like it I create it for them. My friends send it to their friends, so I get more customers, so I make money"

"I get orders from people even when I am not at my work place – it saves time and I get more work"

Women who are in business have been able to capitalise on the benefits of smartphones in the same way as men: 40% of business women reported an increase in number of hours that they work and 48% the number of jobs that they do; 56% of business women had a greater number of business contacts; and 63% of business women had more income, all because of their smartphones.

All other things being equal, gender appears to have no impact on increased income and number of hours and jobs worked that result from smartphone usage.

Figure 9: For both women and men, a smartphone has had a positive impact on their working lives



Source: Rachel Cowell



HOW A SMARTPHONE HELPS WOMEN IN THEIR ENTERPRISES

Jacinta's story: Jacinta runs a hairdressing salon with the help of her smartphone. By being more accessible, she is ready for clients whenever they request her services, reducing the risk that they'll go to a competitor if they can't reach her. She uses services such as WhatsApp and Viber to develop rapport with customers, and like many smartphone users around the world she spends her evening happily browsing the internet, on her phone. In her words, "(the internet) is wide – you can't know everything". See Jacinta's story at <http://www.vodafone.com/equalworld>.

Harriet's story: For clothes-maker Harriet, smartphones have impacted the entire value chain of her business. Once she would design clothes and then peddle them by foot and by bus, taking long trips away from her family in an effort to recoup costs. These days the fabric shop sends her photos of fabric swatches as they become available. If she likes a design she might place an order and it will be delivered by matatu (bus). She can send photos of her designs to friends via WhatsApp and post images on Facebook, which are then reposted and shared, resulting in an increase in customer reach and sales. Customers send their measurements to Harriet and she can make clothes to order before shipping them off in the next matatu. See Harriet's story at <http://www.vodafone.com/equalworld>.

Women's increased social participation through smartphones

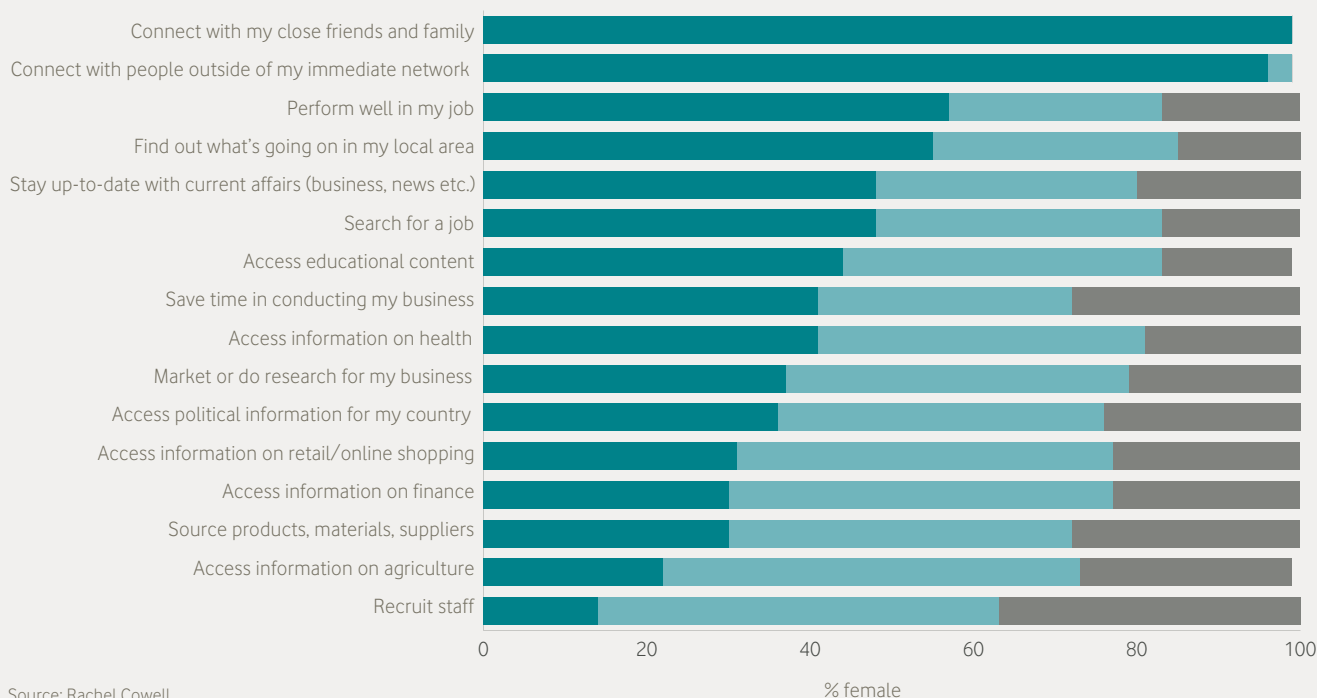
Through the smartphone there is easy access to information that allows the user to be engaged in society, to broaden their networks and spheres of influence. The number one positive impact cited by women was the connectivity the smartphone had brought to their family and the wider world. It can enable easy communication with existing networks, but it can also enable a user to broaden a social network, increasing their points of reference and go-to sources of information.

40% of female respondents said that the smartphone had increased the number of places they sought information and advice from (59% of male respondents agreed). This could be especially powerful for women in rural areas.

Both men and women credit smartphones with expanding their social networks, increasing the number of places they seek information from and allowing them to stay updated. An overwhelming number of respondents found the smartphone very important in connecting with both close friends and family and people outside of their immediate network.

Figure 10: The value of a smartphone to women
How important is your smartphone for enabling you to...?

Very important/important
Not that important
Not important at all



One of the key benefits of a smartphone cited by female respondents, when asked for a spontaneous answer, was the ease of communication and ability to connect with people. In the survey, 38% of total female respondents (both working and unemployed) said the number of people that they called and called them had increased since having a smartphone, which they attributed to the increase in contacts and connections, and 7.5% said it had increased the number of people they connected with outside Kenya. In a society in which men hold decision-making and planning power, in which cultural practices that adversely affect females are prevalent⁶⁷, a more extensive set of connections and social reference points could have a substantial impact for women.

Women's groups are a powerful source of support and development in Kenya⁶⁸. UN Women suggests that collective discussion is an important way of questioning discriminatory social norms, unequal power relations and unequal distribution of resources; encouraging poor and marginalised women to see themselves as rights holders⁶⁹. Where networks and groups hold such an important role for some women, the role of a smartphone in facilitating communication with both close friendship and family groups and those outside the immediate network is valued. By strengthening social connections through more frequent contact and finding contacts and new places to seek advice from, a woman's points of reference are increased and, in some cases, social norms can be challenged.

Exposure to alternative points of view is not without social costs, however. Negative social implications cited included the influence of "bad sites", and the risk of "spoiling" people, questioning whether it was good for children, in particular, to be able to access whatever they wanted on the internet. The smartphone was cited as creating suspicion in the house and causing tension. One woman said "It has exposed me to the world and in that way it is risky". Another expressed what many lament the world over, "I have missed on the outside life because I don't visit people. If I need to talk to you I just chat through social media."

Barriers to use cited included the cost of data bundles, the cost of fixing shattered screens and short battery life, which is particularly cumbersome in a country where recent estimates suggest 64% of Kenyan households do not have electricity⁷⁰ and some of those surveyed indicated they paid up to 300KSH (around US\$3) to charge their phone each month. It is interesting that when asked if they feel more protective of their smartphone than previous non-smartphone devices, the response from Kenyans was that they mostly did because it is useful to them, rather than because it cost more.

Policy recommendations

The survey conducted for this Report indicates that the impacts of owning a smartphone for women and men in Kenya are indeed transformational in terms of social and business activities and for access to information. Female respondents particularly value access to new sources of information and closer connections with social networks.

However, women continue to have less access to mobile technologies than men. For this reason, general policy measures that make smartphones more accessible – for example, lowered or eliminated mobile specific taxation – will disproportionately benefit women. Governments and operators should also consider programmes that specifically promote women's ownership of smartphones.



Women's voices on the impact of a smartphone

"I do online marketing and it's just like a computer. I do it even while walking"

But as this Report demonstrates, these measures alone will not be enough. Beyond the access gap, women are more limited in their use of a smartphone. Women use fewer functions than men and where they do use the same function, they tend to use it less often.

One of the strongest findings in the survey is that education is a clear precursor to smartphone ownership and level of use. For the benefits of connection to the community, business opportunities and access to the wealth of information provided through the internet to touch women and girls and help them to challenge existing barriers in these areas, the ability to fully use and create digital content in the same way as men and boys is critical. If more women are to achieve the benefits of smartphone ownership and use, ensuring equal digital literacy is paramount.

Relevant content for women is important too, as it forms a central element to the value proposition of owning and using a smartphone. Governments should take a leadership role in the development of content relevant to women such as the provision of e-health services. In combination with this, creating an enabling regulatory environment that gives mobile operators the flexibility to provide data bundles and tariffs that attract women to use these and other services will be important for redressing wider inequalities.

For women who fully access the resources of a smartphone, it provides a new equaliser, a way to connect with the community, and with others outside, to find out what's going on, to engage with government issues, to access information and increase their income or improve their business. Policy makers must seize the opportunity that this presents by promoting the equal take-up and use of this vital resource by women, which in their hands can help start to close gender gaps as Kenya and similar countries enter the truly digital age.

Survey methodology

The sample was distributed proportionately across the sub-locations in Kiambu in line with the 2009 census, structured to have equal rural and urban and representation across age groups. Sub-locations with a higher population had a higher sample size. In each sub-location, villages/residential areas were selected randomly from a list developed with the help of local administration. Within each village/residential area, the supervisor listed fixed landmarks (church, school, major junction, etc.) and the household nearest to those points were interviewed, after which four households were skipped on the left calling on the fifth household.

At household level, all persons with a smartphone had an equal probability of selection and only one person was interviewed.

Smartphones and micro-entrepreneurship



In Ghana...



90% of registered businesses are micro-enterprises



30% smartphone penetration at the start of 2016



Only 26% of micro-enterprises survived beyond 42 months



Micro-entrepreneurs with lower levels of education are less likely to access new revenue activities

How can smartphones enhance business survival and sustainability?



Greater access to new ideas, information and tools



Increased opportunities and access to mobile banking



7/10 micro-entrepreneurs would face difficulties continuing their business without a smartphone

What's the impact of smartphones on micro-entrepreneurship in Ghana?



Connect with customers, search for new business ideas and track competitors' prices



95% of micro-entrepreneurs using customer records for marketing see increase in sales



Monthly incomes positively associated with use of the internet to access government information and mobile banking



7/10 consider smartphones to be the most important ICT tool for their business

Smartphones and micro-entrepreneurship: evidence from Ghana

Richard Boateng

Micro-enterprises are a major source of employment in Africa, but often do not survive as long as bigger businesses. Smartphones, the most accessible technology for micro-entrepreneurs, offer them an opportunity to access new information and new revenue, enhancing the chances of business survival and a sustainable livelihood.

Micro-entrepreneurs face a number of challenges in their business operations that large businesses do not. In this chapter, we focus on Ghana, where almost 70% of people are engaged in vulnerable employment such as micro-entrepreneurship, as, for example, own-account workers or contributing family members⁷¹. Poor infrastructure, including a lack of facilities, access roads and consistent electricity supply, constrain business activities and increase operational costs. Legal, financial and regulatory requirements also impose an administrative burden on micro-entrepreneurs, while limited access to credit constrains their ability to expand the business. These challenges greatly disadvantage micro-entrepreneurs compared to larger enterprises⁷².



For this Report, we conducted a survey of micro-entrepreneurs who use smartphones for their business in Ghana. The micro-entrepreneurs are active in a variety of industries, including the manufacture of textiles, motor vehicle repair, wholesale trade, and hair and beauty services. The findings indicate that the new information and tools available through a smartphone are making a significant contribution to the sustainability of their businesses.

It appears, however, that these benefits are not being realised to the extent that they could and not by all micro-entrepreneurs. The smartphone presents a potential equaliser – micro-entrepreneurs who have lower levels of education and monthly income, and whose businesses are unregistered, consider smartphones to be the most essential communication technology for their business. However, some micro-entrepreneurs do not make full use of the smartphone features that present opportunities for them to grow and participate in the formal economy. This is particularly true of those in rural communities and those with low levels of education.

This Report argues that, in order to address the inequalities between micro-entrepreneurs and the larger, formal business sector, there is the need for a coherent policy framework that reduces discrepancies in access to and use of ICT technologies for micro-entrepreneurs⁷³. The framework should also encourage the development of services that directly support micro-entrepreneurship.

This Report calls for a framework that:

- makes government information and services mobile-friendly to stimulate demand;
- enables the development of more localised content and services;
- delivers an attractive value proposition through a combination of services, network quality, smartphone prices and data tariff bundles; and
- educates micro-entrepreneurs to use a wider range of internet and mobile app services.

Prospects and challenges for micro-entrepreneurs

Micro, small and medium enterprises (MSMEs) play a central role in developing economies. Formal MSMEs contribute around a third of employment in these economies⁷⁴. In Ghana, they account for about 90% of registered businesses⁷⁵. Some of these enterprises are or are becoming key players in the value chain, delivering supplies, products and services to large companies.



Micro, small and medium enterprises account for about 90% of registered businesses in Ghana

Despite their importance, these enterprises often do not survive long. In Sub-Saharan Africa, just 15% of enterprises survived beyond 42 months as of 2013. In Ghana alone, the rate was at 26%⁷⁶. Many of these Ghanaian MSMEs consist of one person, an owner-manager, who usually has limited formal education, limited access to and use of new technologies, market information and formal credit⁷⁷. Although there are government institutions available to provide business advisory and support services (such as the National Board for Small Scale Industries), Ghana is struggling in its efforts to foster the development of micro-entrepreneurs.

Mobiles, especially smartphones providing internet access, offer scope to improve the sustainability of these enterprises. In Ghana, there are an estimated 121 mobile subscriptions per 100 inhabitants as of December 2015. The mobile internet penetration rates are growing rapidly, having increased by approximately 30 percentage points in Ghana in the three years between January 2013 and December 2015⁷⁸.

These services are provided by mobile network operators (MNOs) MTN, Vodafone, TiGO, Airtel and Expresso. The mobile internet subscription services provided by the network operators are either 3G or 3.75G services. 4G internet services were introduced in the last quarter of 2014 by Surfline Communications. Yet access to and use of the technology are uneven⁷⁹. This chapter explores some of the barriers to more equal usage by examining specifically how smartphone services – voice and data – contribute to the businesses of different micro-entrepreneurs.

The survey

To explore the extent to which mobile internet access has the potential to increase the opportunities for micro-entrepreneurs, a survey was conducted covering 300 of these businesses from five regions in Ghana – Greater Accra, Ashanti, Eastern, Western and Volta. Out of the 10 regions in the country, these five account for 77% of mobile penetration⁸⁰. The five regions also contribute two-thirds of the economically active population.

The sample within the regions was constructed so that each selected micro-enterprise had these characteristics:

- A maximum of four permanent employees;
- Active operations for a minimum of three years; and
- Mobile internet used by the business for a minimum of 18 months.

Out of 300 questionnaires, 264 were successfully administered. Figure 1 presents a summary of characteristics of the survey respondents. It is interesting to note that 46% of the respondents could be classified as being millennials (aged 18–34), avid users of new technologies or 'digital natives'.

The main industries that the micro-entrepreneurs in the sample are engaged in are: cutting and sewing of apparel, like Alhaji Fuseini whose business is described in the case study below; retail of textiles, clothing, food and beverages; maintenance and repair of motor vehicles; and hair dressing and beauty treatments.

The micro-entrepreneurs in the sample are more heavily located in urban communities compared to the national census, which data found that only 51% of the economically active population are in urban areas⁸¹. The sampled firms are also longer-lived than the national statistics suggest is the norm. Of those in the sample, 63% of firms have existed for six years or more – the oldest having been in business for 29 years and the youngest for three years. The majority of firms in this study (61%) have at least two paid employees, and only 16% have own-account managers (no employees). Nationally, the 2010 census indicates that the economy is dominated by small-scale enterprises with few avenues for employing other people. Two out of every three employed are self-employed without employees⁸². Revenues are low among the micro-entrepreneurs surveyed and labour, rent and taxes are the main costs of the business.

Figure 1: Profile of respondents

Profile	Measurement	Proportion
Gender	Male	61%
	Female	39%
Age	Below 34	46%
	34–44	38%
	45 and above	16%
Educational level	Junior High	13%
	Senior High, vocational /technical	59%
	Tertiary (university and polytechnic)	28%
Position of respondent	Owner but not manager	8%
	Owner-manager	74%
	Manager but not owner	18%

Figure 2: Profile of micro-enterprises

Profile	Measurement	Proportion
Locality	Urban	78%
	Rural	22%
Industry	Manufacturing	25%
	Service	28%
	Wholesale and retail trade	47%
Age of the enterprise	Young firm (5 years or less)	37%
	Old firm (6 years and above)	63%
Paid employees – temporary, apprentice and family (2015)	At least one	34%
	None	66%
Average monthly income (2015)	\$150 or less	30%
	\$151 – \$300	36%
	More than \$300	34%
Average monthly labour costs (2015)	\$150 or less	61%
	\$151 – \$300	20%
	More than \$300	19%
Main costs of running a business in 2015 (not labour)	Rent	80%
	Energy	23%
	Materials	8%
	Taxes	70%
Average monthly sales revenue (2015)	\$500 or less	57%
	More than \$500	43%
Proportion of 2015 monthly sales made locally	50% or less	19%
	More than 50%	81%
Bank account ownership	Have a personal account	95%
	Have a firm account	52%
	Have a mobile money account	35%
Average monthly sales variation between 2014 and 2015	More than 50% decrease	4%
	50% decrease or less	54%
	No change	15%
	50% increase or less	27%



CASE STUDY

Alhaji Fuseini is a tailor in a market in Accra. The name of his enterprise is Alhaji Fuseini Fashion. He has a junior high-level education and has been working as a tailor since 2012. He currently works with one permanent employee and an apprentice. Customers in the local community contribute up to 50% of monthly sales. Mr Fuseini subscribed to Airtel in 2010 for voice services, and in 2011 for internet services. He spends an average of US\$10.35 per month on voice calls and US\$8 per

month on mobile internet. To put this in perspective, 56% of Ghanaian micro-entrepreneurs surveyed for this Report spend less than US\$10 on voice every month and 83% of entrepreneurs spend US\$10 or less on internet services. Before Mr Fuseini had access to these services, 90% of monthly sales resulted from face-to-face interaction. His customers had to come personally to his shop to check for new designs and order dresses. The use of a smartphone has changed this. In a day, he sends an average of 30 messages and receives 40 messages using WhatsApp. He says:

“I can’t do without this application ... when I sew a new design, I use it as my profile picture. Then, my suppliers and customers see it when they chat with me. It brings me closer to them.”

As a result, mobile voice and internet communications now contribute 50% of his monthly sales (20% and 30% respectively). Mr Fuseini is able to track prices of raw materials and of competing products. He looks for new business ideas online, and accesses training and other professional development information using his smartphone. He says:

“Most of my customers subscribe to mobile internet services, so I keep mobile records of my customers and I use this information to plan my production. As the name implies, I’m always smarter than my competitors. I now know what’s up in the world of fashion. I’m able to get new ideas.”

He reports that the usage of mobile services is frequently affected by network failure and dropped calls.

To address such challenges, he, like other users, subscribes to multiple mobile networks.

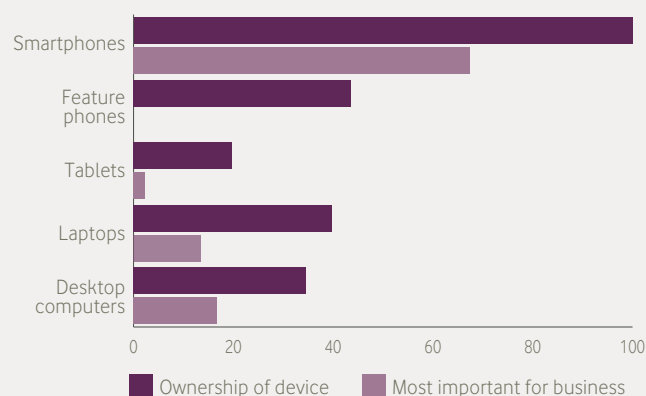
Importance of a smartphone to micro-entrepreneurs

Smartphones are of primary importance for the micro-entrepreneurs surveyed. All own a smartphone and about seven out of 10 consider it to be the most important ICT tool for their business, far ahead of other devices such as laptops or feature phones. Looking at the reasons given for selecting the most important technology, having only junior high education, lower income, being in manufacturing and having an unregistered business involved greater reliance on smartphones as opposed to tablets, laptops or desktops.



7/10 consider a smartphone to be the most important ICT tool for their business

Figure 3: Ownership of devices and most important ICT device for business



Source: Richard Boateng

Figure 4: Factors which influence the choice of smartphone as most important ICT for business (statistically significant factors)

	Which is the most important ICT device for your business?	Desktop, laptop or table proportion	Smartphone proportion
Registration status of micro-enterprise	Unregistered	11%	89%
	Registered	42%	58%
Level of education	Junior High	8%	92%
	Senior High, vocational or technical	32%	68%
	Tertiary	47%	53%
Industry	Manufacturing	17%	83%
	Wholesale and retail trade	31%	69%
	Service	49%	51%
Monthly income	US\$150 or less	21%	79%
	US\$151 – \$300	27%	73%
	More than US\$300	48%	52%

Use of smartphone for business

Extent of smartphone use

A majority of the micro-entrepreneurs sampled spend US\$10 or less each month on voice. The same is true for data. The survey explored the factors influencing a micro-entrepreneur's expenditure on voice and data. Respondents with a relatively high level of education, those with relatively high incomes, and those who run registered businesses, tend to spend more than their peers on voice and on data. Rural entrepreneurs also spend more on voice and data. More registered firms are in the higher spend category.

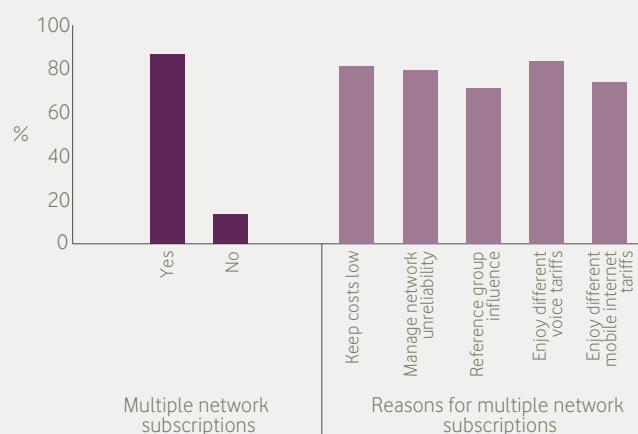
The average monthly expenditure is US\$14.4 for voice and US\$7.1 for internet. The expenditure with highest frequency is US\$6 for both voice (16.3%) and internet (17.8%). Seven out of 10 micro-entrepreneurs reportedly spend more than half of their monthly voice expenditure on business activities. Just under five out of 10 spend more than half of their monthly data expenditure on business activities.

Almost nine in 10 of the surveyed micro-entrepreneurs subscribe to multiple mobile networks to access different tariffs, keep costs low and manage network unreliability. The main challenges in using mobile services are network quality and power outages/lack of electricity. Approximately eight out of 10 entrepreneurs said they would pay more for faster or more reliable mobile voice and faster internet services. Registered businesses are more likely to say they would pay more for reliable services than unregistered ones. Urban businesses are more likely to complain about electricity supply.

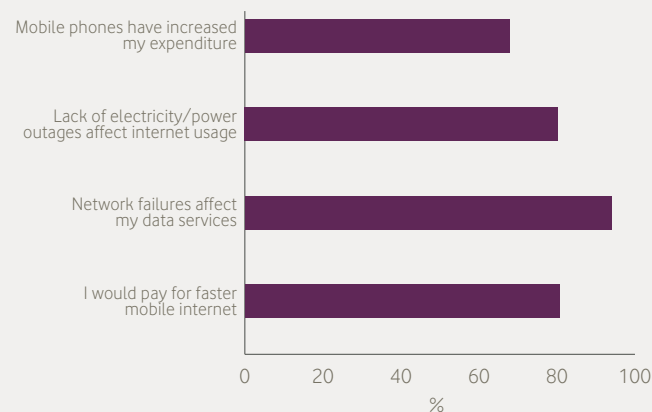


Figure 5: Factors which influence mobile expenditure (shaded = statistically significant)

		Voice expenditure		Internet expenditure	
		\$10 or less	More than \$10	\$10 or less	More than \$10
Enterprise location	Urban	61%	39%	86%	14%
	Rural	41%	59%	71%	29%
Gender	Male	52%	48%	83%	17%
	Female	63%	37%	83%	17%
Registration status	Registered	52%	48%	78%	22%
	Unregistered	66%	34%	93%	7%
Monthly income	\$150 or less	60%	40%	88%	12%
	\$151 – \$300	63%	37%	84%	16%
	More than \$300	46%	54%	76%	24%
Level of education	Junior High	67%	33%	86%	14%
	Senior High, Vocational or technical	63%	37%	87%	13%
	Tertiary	37%	63%	71%	29%
Industry	Manufacturing	74%	26%	82%	18%
	Service	50%	50%	80%	20%
	Wholesale and retail trade	51%	49%	85%	15%

Figure 6: Mobile subscriptions

Source: Richard Boateng

Figure 7: Mobile network challenges for micro-entrepreneurs using smartphones

Source: Richard Boateng



Almost all of the surveyed entrepreneurs said they accessed the mobile internet in some way each day

Depth of use for business activities

Almost all of the surveyed entrepreneurs (96%) said they accessed the mobile internet in some way each day. For seven out of 10, WhatsApp is their primary mobile application for business, while four out of 10 identify Facebook as the second most important application for their business.

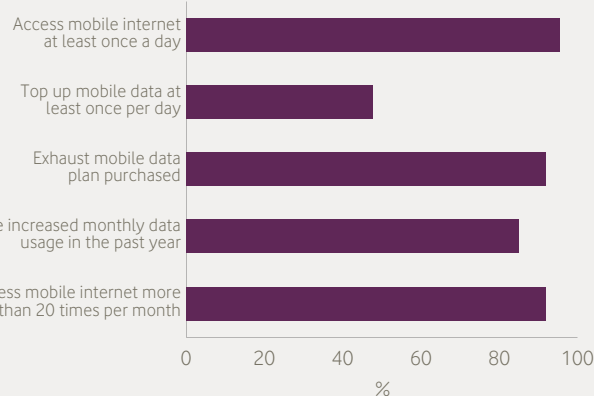
"From my perspective, the only app on my phone which I can't do without is WhatsApp messenger. God bless the creators of this app. It's very easy to use. And it requires little assistance in knowing how to use it. Most of my customers send me messages through WhatsApp. It's economical too. I'm able to send pictures of new hair styles to my customers. The cost of buying credit is high but what can I do about it? I'll gladly pay more if the telcos provide improved and better services for us in this part of the country."

Hair beautician, Eastern Region

WhatsApp users spend less on mobile data than their peers. They also make and receive fewer voice calls. Nine out of 10 entrepreneurs with a junior high education prefer WhatsApp as their primary mobile internet application. A typical comment from a WhatsApp user is that it is “Local and it does not take away their units as quick as Facebook”. In a culture where there is a preference for rich interpersonal communication (face-to-face), micro-entrepreneurs surveyed also appreciate the ability to visually depict their products or services to customers who are not physically present.

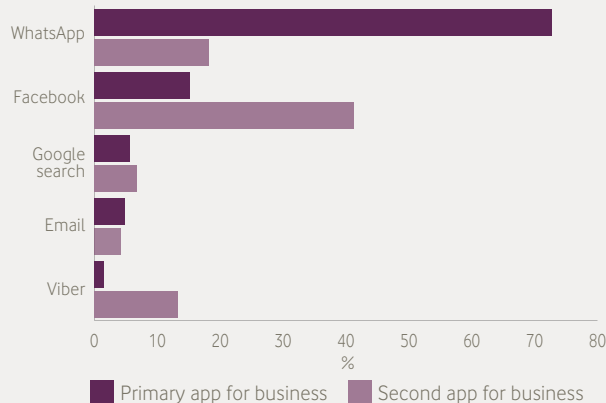
The use of Facebook, email, Viber and Google search is almost absent among micro-entrepreneurs with just junior high education. Those with greater levels of education tend to use a wider range of internet applications than their peers. There is also a network effect as more people sign up to WhatsApp, so the value of the application to each user increases. These users could also be drawn to WhatsApp through the social networks developed around it.

Figure 8: Level of use for business activities – intensity of data use



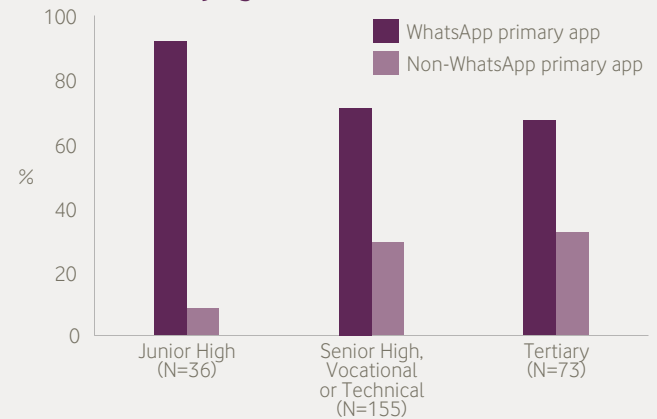
Source: Richard Boateng

Figure 9: Level of use for business activities – primary applications for business use



Source: Richard Boateng

Figure 10: Level of education and primary WhatsApp users (statistically significant)



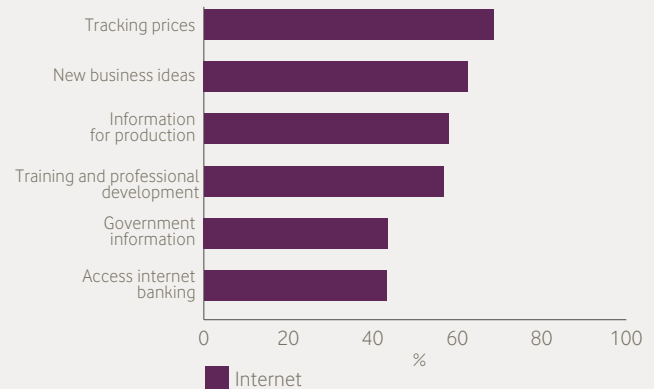
Source: Richard Boateng

Education therefore seems to enable the use of more knowledge-intensive applications, as micro-entrepreneurs with relatively high levels of education take advantage of a wider range of applications to advance their business.

How smartphones are being used by micro-entrepreneurs to sustain their business

Mobile services are most frequently used for tracking prices of competing products and of raw materials, followed by searching for new business ideas. However, not all micro-entrepreneurs are using these routes to new information.

Figure 11: Mobile internet services and access to new information



Source: Richard Boateng

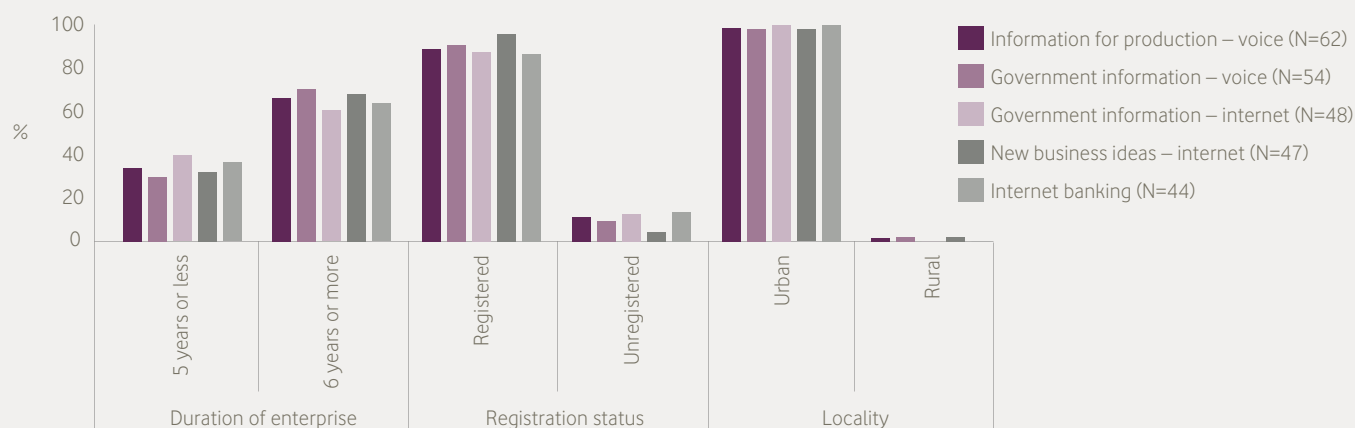
The results show that, despite the fact that rural entrepreneurs spend more on voice and data, urban entrepreneurs are making more use of their smartphones to access new business ideas, search for information on production, keep track of their competitors and use internet banking on their smartphones. It could be that rural entrepreneurs are missing out on the benefits of the more sophisticated applications for smartphones, despite spending more on them on a day-to-day basis.

Figures 12–14: Certain factors that influence access to information via smartphone (statistically significant)

Enterprise location			
	Urban	Rural	
New business ideas; search for competitor information – voice	73%	27%	
Information for production – internet	70%	30%	
Access internet banking	69%	31%	
New business ideas; search for competitor information – internet	70%	30%	

Registration status		
	Registered	Unregistered
Government information – voice	80%	20%
Government information – internet	80%	20%

Monthly income			
	\$150 or less	\$151–\$300	More than \$300
Information for production – voice	31%	30%	39%
Government information – voice	19%	31%	51%
Government information – internet	30%	28%	42%
Access internet banking	36%	25%	39%
New business ideas; search for competitor information – internet	35%	36%	29%

Figure 15: Characteristics of micro-entrepreneurs earning more than US\$300 per month and making use of their smartphones for various business activities (statistically significant)

Source: Richard Boateng

There is an encouragingly high rate of use of government services via smartphone among micro-entrepreneurs with a registered business. Of these micro-entrepreneurs, eight out of 10 use their smartphone to access government information, such as taxes and business regulations. This suggests that if government services are accessible via mobile services, registered micro-entrepreneurs will access them. There is still more that government agencies can do. Respondents noted that access to government websites via mobile is limited. A recent study of websites of 75 Ghanaian public agencies, using Google's tests on mobile responsiveness, reported that over 90% of the websites of the government and of other public institutions are not mobile-friendly⁸³. Addressing this could help to stimulate demand for mobile services and facilitate greater civic engagement by micro-entrepreneurs.



Micro-entrepreneurs with lower levels of education are less likely to access new revenue activities and may fail to experience the related benefits

Monthly income is positively associated with use of the internet to access government information, internet banking and new business ideas. High monthly income earners are predominantly running registered businesses that have been in operation for six years or more and are located in an urban area. These micro-entrepreneurs consider access to government information via mobile internet as critical to their sustainability.

The impact of smartphones on micro-enterprise sustainability

The evidence that mobile services can contribute to the development of new revenue is highly encouraging. The micro-entrepreneurs surveyed for this Report use their smartphones in critical business operations, such as improving the use of customer records for production planning and marketing campaigns. The story of one auto mechanic illustrates how mobile internet applications are used in a way that is now central to business. By keeping and using records on his smartphone he has enhanced the timeliness of communication and the delivery of services between him and his clients. Indeed, well over half of the micro-entrepreneurs said that without voice or data services, they would face difficulties in continuing their business (74% and 60% respectively).

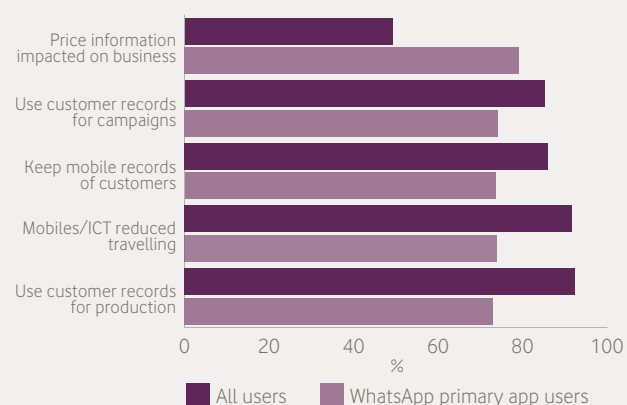
"I can actually chat with my friend and customers through the use of WhatsApp messenger. It is really helping me in managing my business. My customers can call me and send me messages any time their cars break down. For instance, last week one madam, WhatsApped me that her car has broken down along the high street, I quickly sent 'one of my boys' to fix it for her. The only problem I face now is with buying the credit, because any time I load my credit it seems to finish earlier."

Auto mechanic, Western Region

There is also evidence that using customer records stored on a smartphone to enhance marketing campaigns improves revenues. More than half of the micro-entrepreneurs surveyed (58%) experienced a decrease in monthly sales between 2014 and 2015. However, approximately 95% of those who experienced an increase in sales used mobile records of customers to inform marketing campaigns.

Consistent with other findings in this Report, micro-entrepreneurs in urban communities are doing more with their smartphone and its resources than their rural-based counterparts. Some seven out of 10 micro-entrepreneurs who use mobile services to find market prices in their sector, keep mobile records of customers, and use customer records for campaigns are in urban communities. Micro-entrepreneurs with lower levels of education are also less likely to access new revenue activities and may also fail to experience the related benefits.

Figure 16: Smartphone use and access to new revenue



Source: Richard Boateng

The importance of being local to micro-entrepreneurs

The final, important finding of the survey is that, of those micro-entrepreneurs using smartphones to access information for production, the vast majority (eight out of 10) source most of their sales locally. This is as true of the longer-established micro-enterprises as of the newer ones.

Given the emphasis often placed on external links, it is important to appreciate that micro-entrepreneurs might not seek growth beyond their local community. Some might be micro-entrepreneurs out of necessity or simply desire enough income to sustain their lifestyle; some might be owned by micro-entrepreneurs who wish to avoid regulation or the loss of control. These micro-entrepreneurs seek income security and not primarily income maximisation⁸⁴. They typically seek to grow by diversifying income sources within the local market. This growth is just as important to the economy as outward-oriented growth, as it builds demand and creates supply chains for bigger enterprises. The local orientation of micro-enterprise owners and managers will affect where they see value in the use of mobile services for their business. Local information and contacts will be the most valuable to them.

Policy recommendations

The findings of this Report suggest a number of elements are needed to enable the use of mobile voice and internet by micro-entrepreneurs looking to increase their opportunities in the local market and their revenues, and overcome some of their disadvantages of cost and opportunity compared to bigger businesses.

Mobile-friendly public services

The phenomenal adoption of WhatsApp suggests that the transition to smartphones and mobile internet services can be strongly driven by demand for certain applications. Governments are arguably the largest provider of services to both businesses and citizens. These services include business registration, health insurance, security, payment of taxes, issuing of passports, etc. Getting these essential services mobile-ready could help to both improve the quality and consistency of government services and to encourage smartphone adoption among micro-entrepreneurs⁸⁵.

Our study suggests that for micro-entrepreneurs, being registered matters. It gives micro-enterprises more access to government information, production information and new business ideas via voice and internet. Entrepreneurs who access government information, keep mobile records of customers, and use them in campaigns tend to earn more and have stayed in business longer. When registered firms earn more, government subsequently benefits through taxes and sustained employment. Making government information accessible via mobiles would encourage this virtuous cycle.

Local information

The survey shows that, for micro-entrepreneurs, deepening their reach within a local market is the preferred route to gaining customers and improving revenues. Services therefore need to be contextually relevant.

This requires consideration of communication and usage barriers such as language, culture, digital literacy and accessibility over a mobile device. Services that address these issues have a greater potential of attracting a critical mass of micro-entrepreneurs. In Ghana, the community of mobile service and application developers is quite fragmented and disaggregated. The provision of contextually relevant services will require effective partnerships between government and these developers. Mobile money services have already attracted the interest of the Bank of Ghana, leading to the development of operational guidelines and the deployment of such services by banks and mobile operators. A few public sector organisations have also launched web portals to their services, including business registration and driver's licence application. To be sure, these services still lack mobile-friendly sites and mobile applications. Targeted governance mechanisms and incentives may be needed to establish the necessary cohesion and integration in the mobile application development community, with a view to facilitating the emergence of mobile-friendly public service applications. In effect, Ghana, like many other developing countries, has successfully established the basic communications infrastructure to connect with citizens and facilitate connections between them. There is now a need for government to leverage this infrastructure to provide user-centric services to its constituents.

Digital literacy and affordability

Mobile internet access via smartphones needs to deliver sufficient value to make the cost worthwhile. There is a 20% tax on the importation of smartphones into Ghana, which is impeding the accessibility of smartphones. The Government of Ghana is yet to enforce its 2015 national budget plan to remove this tax and has announced that, even when the tax is removed, it will be replaced with the ECOWAS Common External Tariff of 10%. The Communication and Service Tax Act, 2008 (Act 754) imposes a further 6% charge for a communication service payable by consumers of the service. The government argues that communication is shifting from voice to data. As of December 2015, smartphone penetration in Ghana was 30%⁸⁶. There is opportunity to increase the use of smartphones through government interventions such as tax breaks for companies who wish to set up assembling plants for smartphones and devices in rural areas of the country.

This study indicates that smartphones enable entrepreneurs to access new information relevant to their businesses. An increase in smartphone penetration also provides the opportunity for mobile network operators to increase revenues from data and thus generate more in taxes for government. Moreover, the spread of smartphones has the potential to drive new forms of employment including through the development of mobile applications and services for the devices. Accordingly, the Government of Ghana's commitment to remove the 20% tax on devices is critical to bridging the digital divide and facilitating economic activity in the country, thereby increasing other sources of government revenue.



Smartphone penetration in Ghana at the start of 2016 was 30%

On average, Ghanaians pay 3 cents (0.114 GHS) per minute for calls on the same mobile network and 4 cents (0.134 GHS) per minute for calls to other networks. Similarly, on average, they pay 4 cents (0.134 GHS) per 1MB for mobile data. As the current daily minimum wage is approximately US\$2.00 (7 GHS), five minutes of mobile usage of 1MB of mobile data is almost 10% of the minimum wage.

There has been a range of promotions on voice and data bundles at various prices. For example, Vodafone ran a promotion offering 100 minutes on Vodafone, 100 free SMS, five minutes to other networks and 20MB of data for approximately 40 cents ('1Ghana for your Pocket'). TiGO's 'Drop That Yam' offer is aimed at encouraging customers who use feature phones to transition to smartphones. Customers who sign up for a subsidised smartphone enjoy 1GB data, plus one month unlimited music and six months double data. MTN offers a special data bundle for social media, which provides 400MB to access WhatsApp, Facebook and Twitter only for 30 days at the cost of US\$1.4 (5 GHS).

However, users often find it difficult to understand data bundles and their implications in terms of size and usage patterns. This is not the case with voice bundles, whose names and slogans are easy to remember and understand. Data bundles such as MTN Social are yet to be popularised and understood by subscribers like those surveyed in this study. Only one entrepreneur had subscribed to this bundle in our survey. Responses echo the need for internet services to become marketed for the average Ghanaian to understand. In this respect, respondents mentioned the 'Vodafone 1 Ghana for your Pocket' and 'Airtel Browse Chaw' as promotions that have attempted to do this. Mobile data bundles need innovative marketing strategies that are local.

That said, these marketing strategies should be targeted. The findings in this study suggest that more mobile services are needed for enterprise development. Not all micro-entrepreneurs seek vertical growth. Many may prefer to remain local, rather than to diversify their income sources. The use of mobile services in such enterprises may therefore not be growth-oriented but, instead, focused on deepening existing relationships with trading partners and customers. As a result, the social dimension of mobile services will be of concern to many micro-entrepreneurs.

There is an opportunity to develop special business packages for micro-entrepreneurs, perhaps made accessible through formal associations or groups such as the National Board for Small Scale Industries.

Summary

Among other objectives, the Government of Ghana in its national broadband policy sought to facilitate the provision of affordable access to broadband infrastructure to all, by 2020; and to promote the usage and uptake of broadband via suitable content and applications or services. The government has achieved its target of total broadband penetration of 50% by 2015. The next step is to ensure that mobile broadband via smartphone access can help address inequalities, including the one discussed here – the gap between small entrepreneurs and bigger, more established businesses.

The findings and recommendations discussed in this chapter are stepping stones towards reducing inequalities in mobile access and enhancing usage by micro-entrepreneurs, who play such an important role in the economy. Governments, regulators and the industry need between them to create an environment that provides access to relevant information and delivers value.

Stepping stones

- making government information and services mobile-friendly to help stimulate demand;
- making available other relevant and local market information;
- enhancing digital literacy so that people learn how to make the best use of their smartphones and internet access;
- facilitating an attractive value proposition across a combination of services, network quality, smartphone prices and data tariff bundles.

Smartphones and small farmers



In India...



Growth in agriculture is effective in reducing poverty and benefiting those on low incomes



Farming is becoming more complex and information requirements for producers are growing rapidly



Small farmers face poor yields, low prices and high costs



Small farmers have limited access to resources, services, information, markets and social networks

What's the impact of better access to information for small farmers?



50% increases in farming yields are seen when the correct inputs are used and better knowledge is applied



1% increase in yields leads to a 0.6-1.3% reduction in poverty – yields have a greater impact on income than prices

How can smartphones positively impact small farmers in developing economies?



Reliable weather information influences when to plant and when to harvest



Increased price transparency enables farmers to obtain better prices for their crops



Mobile insurance products reduce risk



Social networks and information about agricultural techniques improve business practice and drive revenue growth

Access to mobile and inequalities in agriculture in India

Jonathan Shoham

There is a wide gap between the fortunes of small-scale and large farmers. Large farmers have better access to credit, resources, risk reduction mechanisms and information. Could the adoption of smartphones create new opportunities to reduce rural inequalities in developing economies by addressing these asymmetries and boosting the incomes of small farmers? Mobile broadband offers the scope for access to the types of information needed to improve crop yields, which have a far more powerful effect on small farmers' incomes than information about market prices. But many existing agricultural information services may not be sustainable. Policy makers will need to work in partnership with commercial developers to enable viable business models – in effect, an agricultural extension services model for the mobile broadband era.

Growth in agriculture particularly benefits those on the lowest incomes: a 1% gain in GDP originating from higher agricultural production generates a 6% increase in spending by the poorest tenth of the population, who are predominantly small farmers in most developing countries. The same increase in GDP arising from non-agricultural sectors creates zero growth in the expenditure of the poor⁸⁷. When farmers have higher incomes, they reinvest in agriculture, resulting in further growth and enabling a virtuous cycle of development gains. One of the most powerful ways to initiate this is to improve yields: the UK's Department for International Development (DFID) has shown that a 1% increase in yields leads to a 0.6%–1.3% reduction in poverty⁸⁸.



1% gain in GDP from agricultural production generates a 6% increase in spending by those on the lowest incomes

Agricultural productivity improvement is needed as part of the broader process of economic development, in which an increasing proportion of output and employment are generated by sectors other than agriculture⁸⁹. It occurs through a process of agricultural transformation, involving individual farmers shifting from subsistence-oriented production – consuming their own output and bartering with others – to more specialised production for sale in the market. This process now involves a greater reliance than in the past on specialised networks of dealers and supply chains for crops. Small-scale agriculture is becoming more integrated with other sectors of the domestic and international economies.

This means the intensity of information needed in agriculture is increasing. The information requirements for producers are growing rapidly because farming is becoming more complex, volatile, subject to greater risks and to greater scrutiny⁹⁰. This is driven by a high rate of agricultural innovation, volatility from the changing physical environment, notably climate change, and demand for greater traceability and concerns over food safety and quality. As a result, it has been estimated that farmers are now making up to 40 output-critical decisions per crop during the course of a growing season⁹¹.

Access to information by farmers has therefore become a fundamental issue in addressing agriculture development and rural/agriculture inequalities. It is not just the rural-urban divide at issue. Differential access to information has the potential to create an even bigger divide than exists now between rich and poor farmers, in effect creating a new division between farming communities based on their access to information.

This Report reviews the ways in which the access to information enabled by smartphones could help address these inequalities. It focuses on those with farms of less than two hectares and on emerging markets, especially in Sub-Saharan Africa and India.

A focus on yields, and the information flows needed to enhance yields, is of fundamental importance for addressing inequality. Higher yields, enabled by better information, would have a much greater impact on small farmers' livelihoods than the well-known examples of the way mobile communications affect the prices received for agricultural goods. Getting a better price for crops is clearly welcome, but this chapter suggests that the use of smartphones to access the kinds of information needed to improve yields could have a much more powerful equalising effect on the incomes of small farmers including rural women.

The information needed to achieve this is far more localised than that supplied by most existing mobile and other ICT agricultural services. Such information is therefore more costly to provide but few of the services that exist today are yet commercially viable. Unless such services become more valuable to potential users in terms of the information benefits provided and improved incomes, they will not stimulate enough demand to become sustainable.

There are steps that governments can take to overcome this barrier, together with private providers. In particular, governments are in a position to enable the growth of mobile financial services to increase the supply of farmer credit and insurance and to create a favourable environment for the public-private partnerships which can build robust and commercially sustainable agricultural value-added services. Doing so could result in tangible progress in tackling rural inequalities.

What do we know about mobile services and agriculture?

There is a growing body of research on the use of mobiles in agriculture, motivated by the intuition that better access to information should improve the livelihoods of small farmers. Yet big gaps remain between poor and rich, small and large-scale farmers, in their incomes and in terms of access to mobile internet. The use of the internet via mobiles is generally increasing in rural areas in India and Africa, but lags behind urban access.

Vodafone's *Connected Farmers* Report looked at six mobile agricultural information platforms and systems supporting farmers around the world and modelled their potential social, economic, environmental and commercial impact in India should they be deployed at scale⁹². The findings underlined the potential of mobile as a key platform for service delivery in rural areas.

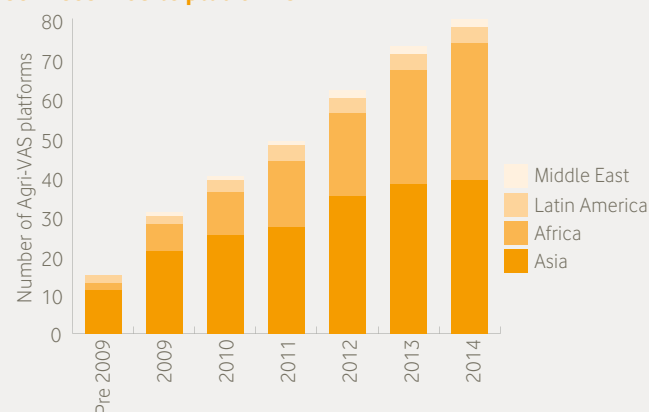
It outlined several important lessons:

- Usability, particularly simplicity, is the key factor for success;
- Investment in training and awareness is often needed; collaboration with an experienced partner is beneficial;
- Quality of content is critical for information services, as content needs to be tailored to a farmer's individual circumstances;
- Sustainable financing must be built in;
- Bundled services are most successful; and
- Innovation is needed in mobile marketplaces.

The GSMA maintains a directory of many of the mobile information services for agriculture⁹³. It shows not only a significant growth in the number of applications and platforms but also a significant bias towards markets in Asia and Sub-Saharan Africa – notably India and Kenya. The market opportunity has been estimated at US\$391 million for India and US\$91 million in Sub-Saharan Africa⁹⁴.

There is a diversity in the offers, business models and approaches of these services that is concealed in the broad data.

Figure 1: Recent growth in agricultural value-added services mobile platforms



Source: Agricultural value-added services (Agri-VAS): market opportunity and emerging business models; GSMA intelligence, 2015

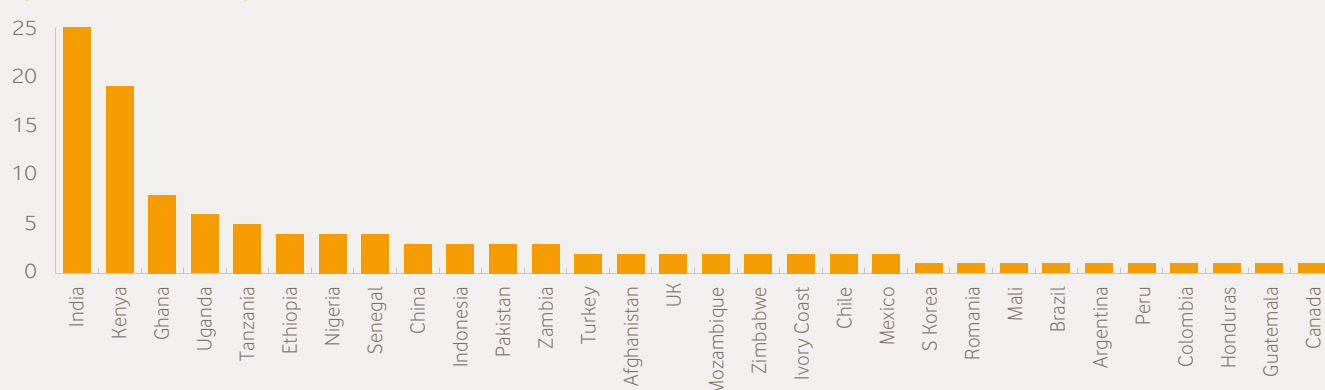
Lessons from India's experience of ICT platforms for agriculture

A detailed look at the mobile platforms on offer in India provides additional insight into the barriers to using mobile services. Of the 100+ platforms launched since the early 2000s, around 30 are offered in India, more than in any other country. These include several of the largest and longest-lived. India has the second-largest agricultural population in the world behind China, so there is large potential demand for such services there. The potential impact is significant too. Current yields are low, access to information on agricultural techniques and markets is poor, and the supply and value chains involved are long.



The market opportunity for mobile information services in agriculture has been estimated at US\$391 million for India and US\$91 million in Sub-Saharan Africa

Figure 2: Number of agriculture ICT platforms by country



Source: GSMA mAgri database, 2016

Figure 3: ICT/mobile platforms serving Indian agriculture

Platform	Launch year	Number of users	Services provided	Business model/owner	Comments
e-Choupal	2005	4 million	Extension Crop prices Disintermediation	Commercial; Embedded	Launched by ITC for its suppliers and customers
Gram Vaani	2009	>3 million	Radio, IVC, helpline	Commercial; Advertising	
IKSL	2007	3 million (2015)	Helpline	Commercial; Subscription fee; Profitable	A joint venture between IFFCO and Bharti Airtel
RML	2007	1.5 million	Helpline Crop prices	Commercial; Subscription fee	Various content partners Link to IDEA
Fasal		1 million	Virtual marketplace Crop prices	Commercial (advertising)	
KisaanMitr (Farmers Club)	2015	670,000 (July 2015 to March 2016)	Weather Prices Crop advisory Agriculture sector news Success stories of other farmers	Commercial business	Vodafone
Digital Green	2009	42,000 (2011)	Videos	Donor	Funded by Bill & Melinda Gates Foundation (BMGF)
aAqua	2003	17,000 (2011)	Forum	Non-profit	Peer-to-peer
Kisan Call Centres	2004	N/A	Helpline	Government	
MKrishi	2007	5,000 (2011)	Extension Crop prices Weather	Commercial	Tata
e-sagu	2004	Several thousand	Extension	Non-profit	
Avaaj Otalo	2010	N/A	Voice recording of questions and responses	Toll-free	Farmer forum IBM involved Funded by DSC – begs question of sustainability

Source: GSMA mAgri database and Jonathan Shoham, 2016

Figure 3 shows that the largest Indian platforms claim coverage of several million farmers. Some of them are growing rapidly too. However, the only one that appears to be profitable to date is IKSL, with revenue of US\$36 million and operating profit of US\$2 million in 2012/13 (2011/12 was also profitable). This raises a question around commercial sustainability. The start-up costs of these services are indicated by some of the government and foundation grants that were involved. For example, from DFID (US\$1.1 million) and Acumin Fund (US\$1.5 million) to esoko; and from BMGF (US\$4.7 million) to Community Knowledge Worker. The retail prices attainable will depend on the value proposition of the service for the farmer. For example, fees of around US\$15/year are charged by RML. It is instructive to compare the relatively slow spread of these information services with the rapid speed with which Indian farmers switched to GM cotton. The cost of GM cotton is approximately US\$15 per 0.4 hectare, 25% more than non-GM, and it attained 80% penetration in five years despite government efforts to prevent it.

There is big drop-off in coverage after Fasal (although Farmers Club launched only in 2015 and no figures are available for Kisan Call Centres) and the more successful platforms in terms of reach are commercial ones. Donor-funded platforms struggle to achieve scale. Two further case studies support this: Nokia and Reuters Market Light (RML). Nokia view their Nokia Life tool as, "a sustainable as opposed to a profit-generating entity"⁹⁵. RML concludes that: "Reliance solely on donor funding runs the risk of preventing the service from becoming self-sustaining. Instead, it is advisable to adopt a self-sustaining business model as soon as possible – if not right from the start"⁹⁶. IKSL's success is related to its partnership with IFFCO, which already had access to 40% of the Indian farm population through sales of fertilizer, its core business, and Airtel, which dealt with the technology aspects.

However, many of the services that have been launched have failed or stagnated. There are many reasons for this, some of which have been alluded to above. In launching and operating a mobile agricultural value-added service (Agri-VAS) there are many strategic choices to be made and a huge variety of potential models based on the combination chosen. Some of the choices are listed in Figure 4, a full analysis of the critical success factors is beyond our scope here.

Figure 4: Strategic choices in Agri-VAS

Content	Extension advice; credit; crop prices; weather; certification and traceability; electronic marketplaces
Business model	Commercial (subscription, advertising); donor; government; hybrid
Customer	Farmer (B2C); aggregator (B2B); hybrid
Partners	For content, technology, and farmer relationships
Technology platforms	SMS; USSD; Interactive Voice Response; helpline; peer-to-peer; mobile data

Source: Jonathan Shoham

The obvious question, given that most of these services fail to become viable, is whether access to mobile broadband via smartphones can change the value proposition enough to boost small farmers' profits, and thereby increase the potential market. That will depend on whether services can provide small farmers with more useful information.



How mobile services can raise small farmers' incomes

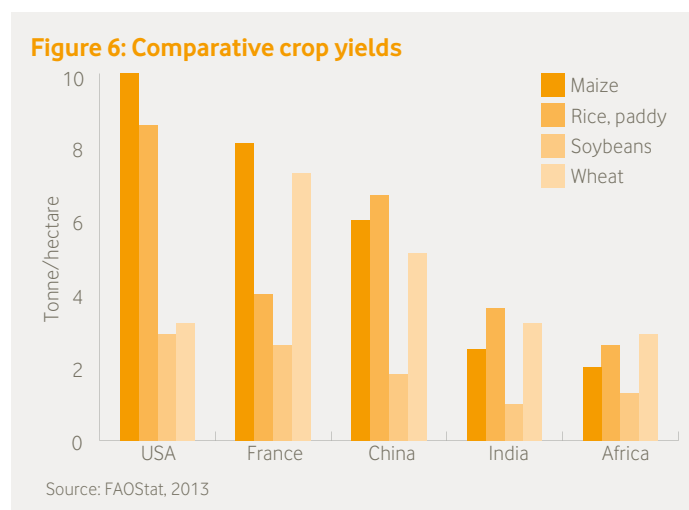
The different ICT-enabled interventions described above can impact small farmers' incomes through various pathways. These are described in the table below and are related to a small farmer's profit and loss account.

Figure 5: Impact of mobile-enabled interventions on factors affecting lines in the farmers' P&L account

ICT-enabled intervention	Impact on revenue-related factors			Impact on cost-related factors	
	Yield	Price	New market opportunities	Inputs and other costs	Interest rates
Credit/Inputs	✓			✓ Lower prices	✓
Extension	✓				
Weather info.	✓				
Prices info.		✓			
Disintermediation		✓			
Market access		✓	✓	✓ Avoid travelling	
Certification & traceability		✓ Higher prices	✓	✓ Reduced set-up and monitoring costs	
Overall revenue impact	Up to +50%	Up to 10%	N/A	Up to 10%	A few %

Source: Jonathan Shoham

Of these, the greatest potential for improving small farmers' incomes is through increasing yields **not** through attaining better prices as so much of the existing research in this area has assumed. Yields in many emerging markets are far lower than in developed markets.



Any increase in yield has a very large multiplier effect on small farmers' incomes; and yield increases of 50% or more often occur when improved inputs are used and better knowledge applied. This can translate into farmer benefits of hundreds or thousands of dollars, making a huge difference to their total income⁹⁷. For example, on a smallholding with 0.5 hectare of tomatoes yielding 20 tonnes/hectare at US\$500/tonne, a 50% rise in yield gives extra revenue of US\$5,000.



Yield increases of 50% or more often occur when improved inputs are used and better knowledge applied

Most of the other pathways, such as improved prices obtained and cost reductions lead to income improvements of the order of 10%. For example, esoko claims several cases where the benefits attained are of this magnitude, as described in the box below. Indeed, esoko recognises that provision of market price information needs to be supplemented with other information⁹⁸. Services providing information that helps improve yields will have the greatest potential to raise farm profits, and will therefore be most likely to find a market and long-term commercial viability. A recent review of 15 collaborations involving smallholders by Hystra reached the same conclusion: income gains of 20%–140% were observed and in all cases productivity increases were the dominant cause⁹⁹.

CASE STUDY: ESOKO

Esoko was launched in 2008 as a mobile-based service for African farmers pushing crop prices through SMS messages. Research in 2011 by INRA¹⁰⁰ found that maize, groundnut and cassava farmers using esoko received up to 10% higher prices for their crops than non-users. Even so, it recognised that its offer was insufficient and has evolved to provide weather information and agronomic tips for farmers, voice services and, in Ghana, access to a helpline. It is now present in 16 African countries. In order to provide crop prices, esoko has had to generate its own content and employed 20 enumerators to collect prices of around 30 commodities. It has yet to be profitable and depends on grants from donors and others. The goal is to reach 3 million farmers by 2020.

Aspects of inequality in agriculture and role of ICT

Rural inequality has several dimensions and the poor yields, low prices and high costs faced by small farmers in emerging markets can be related to its various aspects. Compared to most farmers in the developed world, small farmers in emerging markets are disadvantaged with respect to access to resources, services, information, markets and social networks. These same inequalities also play out within countries where there are large differences between small traditional farmers and larger, more progressive ones. In India, for example, on the one hand there are highly sophisticated and relatively large, rich wheat farmers in the Punjab, who benefited greatly from the new high-yielding varieties introduced during the Green Revolution of the 1960s and 1970s. In the same country there are also millions of small, poor subsistence farmers growing staple crops such as pigeon peas, potatoes and lentils.

The table below sets out how these different aspects of inequality affect small farmers.

Figure 7: Impacts of aspects of inequality on farmers

Form of inequality	Aspects affected	Impact on farmers
Access to resources	Credit and inputs	Limits yields and hence income; women particularly disadvantaged
Access to information	Extension advice Weather Crop prices	Limits yields Limits yields; affects decision on when to sell Information asymmetries with buyers
Access to markets	Disintermediation Poor infrastructure	Loss of value-added High transport costs; waste; lack of agro-dealer networks; lack of irrigation
Access to services	Certification schemes Insurance	Precluded from this premium sector Smaller farmers disproportionately exposed to risk
Access to social networks	Farmer organisations	Impact on small farmers of lack of access to or inefficiencies of farmers organisations?

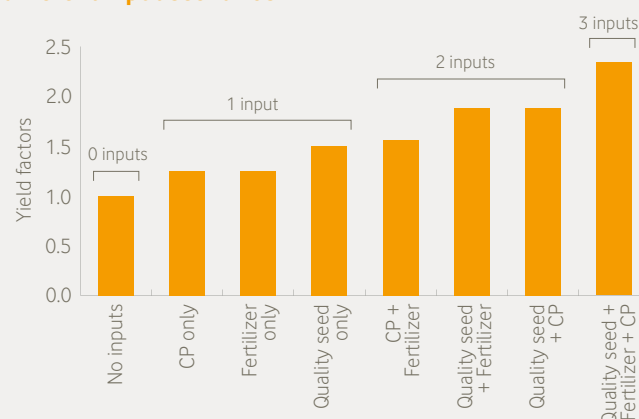
Source: Jonathan Shoham

Mobile platforms and smartphones can potentially ameliorate all of these types of inequality apart from access to physical infrastructure. We now turn to each of these in more detail, asking: what kinds of information do small farmers need and how can it be delivered?

Credit and inputs

We have seen that yield is the most powerful determinant of small farmers' incomes. The key to improving yields is use of the right inputs: good quality seed, fertilizer and crop protection (CP) products make a huge difference, especially in combination.

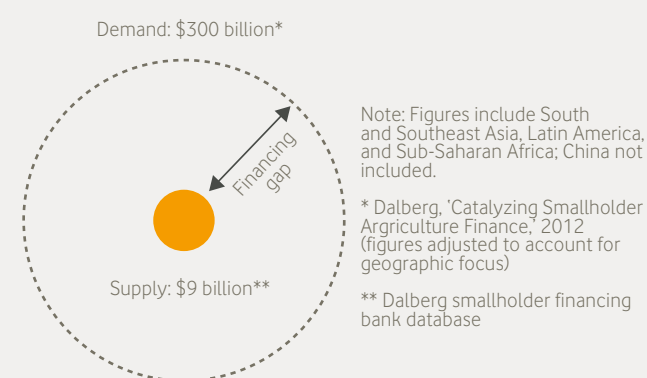
Figure 8: Schematic representation of yield under different input scenarios



Source: Jonathan Shoham

Access to inputs is particularly a problem in Sub-Saharan Africa where the agro-dealer network is poorly developed. However, even where inputs are available to be bought, in many cases farmers lack the necessary credit. Much of the rural population is unbanked. Women suffer disproportionately from restricted access to credit. One estimate puts the potential global demand for finance from smallholders – largely unmet – at \$300 billion¹⁰¹.

Figure 9: Social lending gap

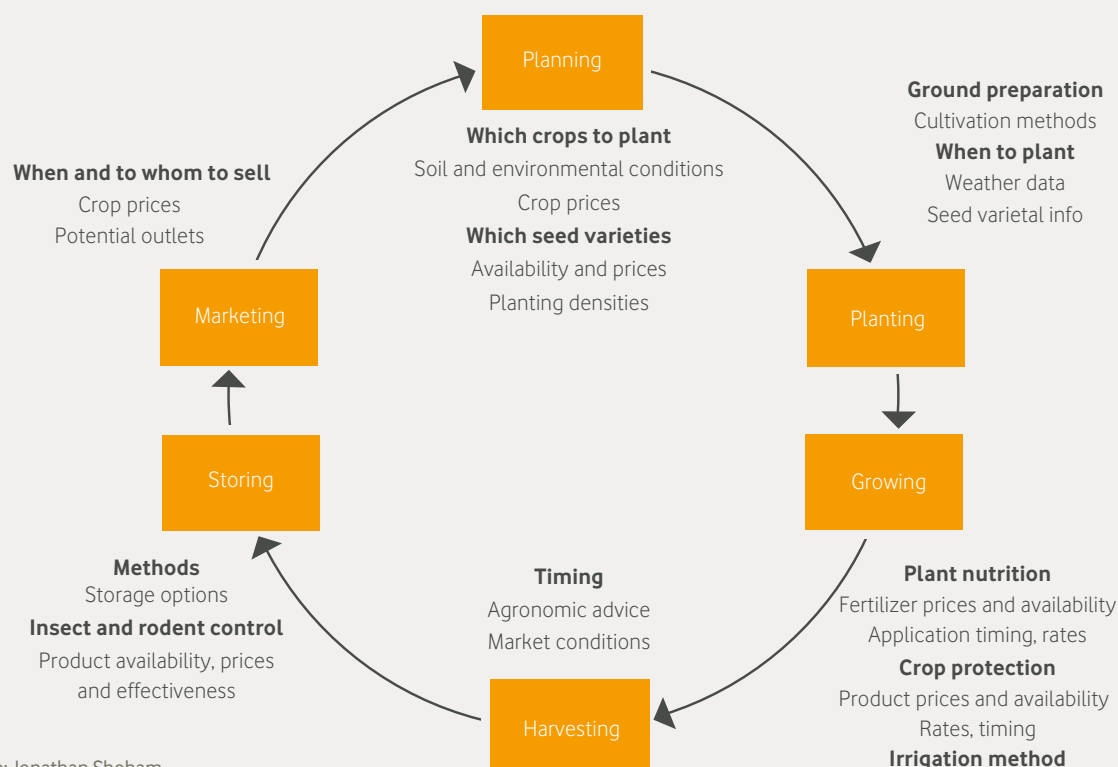


Source: The Initiative for Smallholder Finance, 2013

Agricultural extension and knowledge transfer

Lack of knowledge is thought to account for up to a quarter of the 'yield gap' between what farmers actually achieve and what they could achieve¹⁰². Agriculture is hugely knowledge-intensive, as Figure 10 sets out.

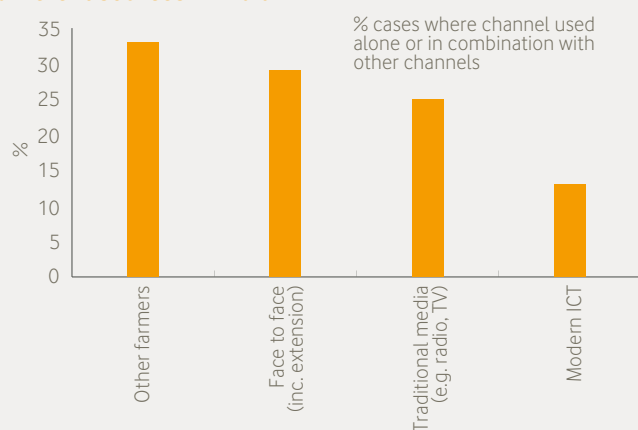
Figure 10: Information requirements at different stages of the crop cycle



Source: Jonathan Shoham

The leading source of information for farmers in most countries is other, progressive farmers. This is the case in India, for example.

Figure 11: Information accessed by farmers from different sources in India



Source: Mittal & Mehal, CIMMYT, 2013

The spread of mobile phones *per se* is likely to increase the degree of communication and aid the dissemination of agricultural knowledge between farmers. Some platforms formalise this through peer-to-peer networks, as in the case of the aAqua ('Almost all questions answered') platform in India.

Agricultural extension services, through which agronomists and other agricultural experts give advice to small farmers, are another important source of information. Traditionally, governments provided them as a public service, through the 'Training and Visit' model whereby extension services were merged into a single national service. This top-down model of extension promoted messages developed by research institutes with little input from farmers. While appropriate for the era of the Green Revolution, by the 1990s, this model had become discredited and began to give way to a more pluralistic approach in which the private sector and NGOs and foundations also have a role¹⁰³.

The coverage and effectiveness of extension services varies enormously between countries. In China, for example, there are almost one million extension workers, each of whom serves around 300 farmers; around 30% of the farm population is reached. In India, the ratio of farmers to extension workers is 1:3,000 and only 6% of the farm population is reached. This creates a large potential for mobile-phone-enabled extension systems to improve small farmers' access to knowledge.



Lack of knowledge is thought to account for up to a quarter of the 'yield gap' between what farmers actually achieve and what they could do

Most ICT platforms have an extension component, although they differ greatly in depth and approach. The 'push' approach, whereby farmers receive a set number of SMS texts per week, was a first generation model and is still common. However, several platforms also operate a 'pull' model with a helpline that farmers can access to receive customised advice. It has become increasingly apparent that a more customised and interactive approach is often needed, because the information needed in agriculture is so location-specific¹⁰⁴. This has major implications for resourcing mobile services. Large numbers of specialist agriculturalists are required. RML in India, for example, employs 300 such advisors to reach its customer base of 1.4 million. The blend of macro data leveraged by increasingly hyper-local data can perhaps open new opportunities for demand-led extension services.

There is often also a gender dimension to access to extension services. In some societies, social norms preclude male extension workers, the majority of the profession, from working directly with women farmers. The provision of extension services through ICT channels can overcome this barrier to women's access to information. This is particularly important for overcoming inequalities. In India, more than 60% of all employed women work in the sector and in rural areas the percentage of women who depend on agriculture for their livelihood is as high as 84%¹⁰⁵. Those women earn around two-thirds of the wages of the income of their male counterparts¹⁰⁶.

Weather

Access to reliable weather information is critical to farmers' operations. It influences decisions about when to apply various inputs and when to harvest. Nearly every agricultural ICT or mobile platform has a weather component, differing in their granularity and frequency. Advances in 'big data' and satellite technology are permitting hyper-local weather forecasts down to a grid size of several square metres. Various agro-meteorological service providers are offering not only weather forecasts but also related services which help farmers predict crop yields as well as guiding them in their operations.

While these services are currently aimed at larger farmers in developed markets of the Americas and Europe, they are gradually spreading to emerging markets. Sufficiently detailed weather information has the potential to be an important element of mobile agricultural services.

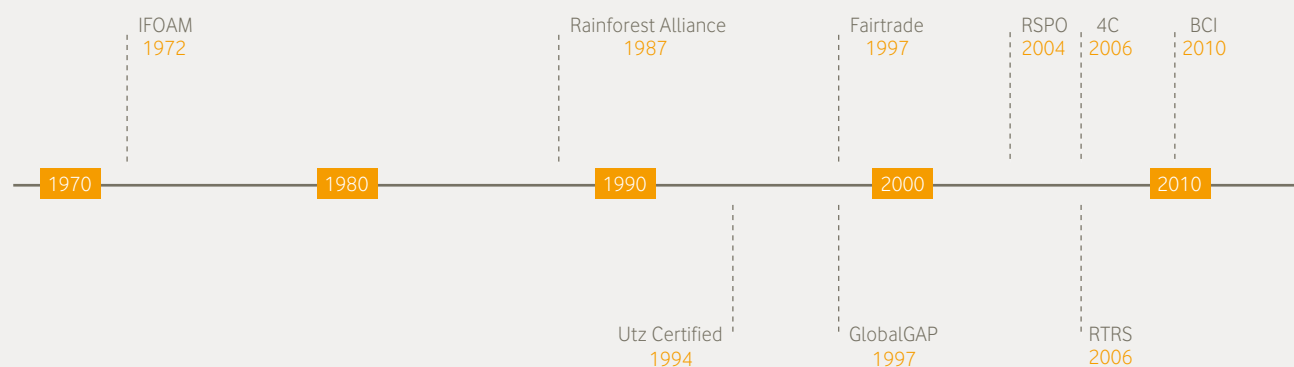
Crop prices

Crop prices can vary widely over time, in response to short-term supply and demand fluctuations and to distance, in cases where there are infrastructure barriers. In some markets, small farmers depend on traders for price information and have little knowledge of other price options available to them. In certain circumstances, access to mobiles can greatly increase price transparency, enabling small farmers to obtain better prices for their crops. There are several examples of farmers achieving price increases of the order of 10% or more, including esoko in Ghana (see Esoko case study on page 40). Researchers have found similar effects in a number of countries and markets, for perishable foods, with both consumers and farmers benefiting from greater effectiveness in matching demand and supply¹⁰⁷.

Market access and disintermediation

A major problem often faced by small farmers is lack of access to output markets. They do not have much knowledge about potential new customers. Several platforms address this by increasing visibility of who the buyers are and putting buyers in touch with sellers. Such systems offer the potential for disintermediation, where information on and direct links with the end user can allow the farmer to by-pass the trader and appropriate some of the extra margin. A good example of this is India's e-Choupal: farmers on average achieve 2.5% better prices and the end-user achieves a 2.5% cost reduction. e-Choupal could be described as a 'first generation' platform, launched in 2005 and based on internet kiosks placed in villages. Since then some new mobile-based trading platforms have appeared, such as esoko in several African countries and Krishidoot in India. However, depending on the market structure it can be better to work with traders rather than by-pass them. Being a small-scale seller in a market with large buyers can be a significant disadvantage, and large intermediaries lend some market power.

Figure 12: Timeline for certification schemes



Source: Jonathan Shoham

Key: IFOAM: International Foundation for Organic Agriculture; RSPO: Round Table on Sustainable Palm Oil; 4C: Common Code for the Coffee Community; BCI: Better Cotton Initiative

Traceability and certification

Over the last 20 years there has been an explosion in demand for certified foods produced according to environmental and social standards. It started with organic farming before moving on to schemes like Fairtrade and the Rainforest Alliance (a timeline is shown in Figure 12).

Participating in such schemes can give farmers access to new markets and better returns by appropriating some of the premium pricing involved. Price premia of 10% or more are obtainable¹⁰⁸. However, there are considerable set-up costs of around US\$1000/farmer, which militate against the inclusion of smaller farmers. The demands of compliance in terms of record keeping and information provision are also considerable. ICT platforms can significantly reduce these barriers. Farmforce is directed very much towards this sector and, since its launch in 2013, is growing rapidly. While the clients are food companies and aggregators rather than farmers, it encompasses many of the farmer benefits of other systems. These include credit in the form of in-kind provision of inputs, extension advice and weather information. The difference is that it is not the farmers who pay but the aggregators. A particular feature of Farmforce is that it offers the potential to electronically record and print out the weight of crop delivered to the buyer, which can reduce fraud. Future developments could offer the use of smartphones to geo-reference details of the crop production and thereby further enhance traceability.

Risk

The smaller the farmer, the greater his likely exposure to risk. This is partly due to the inequalities identified above, such as lack of access to information on weather and prices. But it also stems from a lack of scale. Opportunities for diversification and economies of scale are much more limited. Traditionally, small farmers would not have had the same access to insurance as larger farmers, reflecting their general lack of access to financial services. However, some systems, such as ACRE (formerly the Syngenta Foundation's Kilimo Salama), are now meeting this demand. While not an ICT system *per se* – many other elements are involved – ICT plays an important part in the offer. There is rapid growth in the number of mobile insurance products available as part of the growth in mobile financial services in general and primarily as part of a bundled package. In 2014, there were 100 such services which issued 17 million policies covering 30 countries¹⁰⁹. Among these, accident and agricultural insurance are also growing.

In addition to the clear and important role for governments in creating an enabling environment for mobile banking, the rules governing data use will be critical to determining the success of insurance products. Farmers must be confident in the security of their data while being granted the flexibility to allow their data to be used to enable access to credit and insurance products.

Access to social networks

The social context for new mobile technologies is important. Farmers are most likely to use their mobiles for access to information about agricultural techniques or extension services if a trusted source vouches for its use, and if their family and neighbours start doing so too¹¹⁰. The impact of information on income opportunities also depends on social structures and networks. For example, in some contexts the improved flow of information seems to have cemented existing relationships with middlemen or wholesalers, while in others the use of mobiles has by-passed existing intermediaries¹¹¹. There is a risk that in some situations, unequal access to information within a rural community could exacerbate existing patterns of inequality – for example, making the situation worse for those in a weak bargaining position or with no access to credit to take advantage of new opportunities¹¹².

Therefore, in addition to the delivery of agriculture ICT platforms and mobile financial services, access to social networks through mobiles will have an important role to play. Indeed, given the mixed success of farmers' organisations as a mechanism to overcome these types of inequalities in the past, new social applications accessible through mobiles could provide a real opportunity to make small farmers' networks stronger and more effective.



Policy recommendations

Access to smartphones and new mobile services has the potential to play a significant role in reducing inequalities in agriculture: between rural and urban communities, between small and large farmers and between women and men.

Increasing crop yields through improved information and advice would have by far the biggest impact on addressing these inequalities. The well-known benefits of mobiles in terms of price information have a less effect on small farmers' incomes.

Other ways in which mobile data access can help address inequalities are the provision of market knowledge and access, and traceability and certification.

However, few of the many mobile and ICT agricultural services currently available have achieved sustainable scale or profitability. It is likely that there will be a shake-out, leaving larger and more commercially sustainable platforms.

If these services are to succeed long term and help address inequalities, they need to provide improved – and most importantly, more localised – information, including 'extension' advice and weather. This is something that is already being addressed by start-up companies in the US and Europe and should be encouraged to spread. More granular information is needed to enable increases in small farmers' incomes via better yields. This will increase the value to small farmers, expanding the potential market for these services and helping to improve their commercial viability.

Looking at the evidence from India, the critical steps that service providers can take to help achieve commercial success include:

- Offering a broad range of services – weather and crop price information is not enough for a product to be successful; there is already a trend towards bundling and diversification of services and this will be a strategic decision in the design of each platform and product, involving a balance between the value and cost of each element added;
- Forming appropriate partnerships, particularly with respect to more detailed content, financial services and technology; and
- Achieving minimum efficient scale, which is to some extent a function of the preceding points.

Governments can also promote the diffusion of mobile platforms to small farmers by:

- Enabling the growth of mobile financial services to increase the supply of farmer credit and insurance; and
- Creating a favourable environment for the public-private partnerships, which can provide robust and commercially sustainable agricultural value-added services. From the study of such partnerships in mobile agriculture, several critical elements for success can be noted. There must be clear roles for each of the partners, full use of the commercial and operational expertise of the business partner, the possibility of commercialisation without long-term dependencies on the public partner, and the ability to move swiftly to respond to the commercial environment.



End notes

1. <https://gsmaintelligence.com/> and <http://www.statista.com/topics/840/smartphones/>
2. <http://www.ericsson.com/res/docs/2015/ericsson-mobility-report-june-2015.pdf>
3. http://www.mckinsey.com/insights/high_tech_telecoms_internet/offline_and_falling_behind_barriers_to_internet_adoption
4. Cisco, http://www.cisco.com/assets/sol/sp/vni/forecast_highlights_mobile/
5. Cisco, http://www.cisco.com/assets/sol/sp/vni/forecast_highlights_mobile/
6. The Changing Mobile Broadband Landscape, Understanding the diverse behavior and needs of smartphone and mobile internet users in urban India, Ericsson Consumer Insight Summary Report April 2015
7. <http://www.cchubnigeria.com/mxlab/how-i-use-my-phone-series-nigerian-blue-collar-workers/>
8. <http://www.cchubnigeria.com/mxlab/how-i-use-my-phone-series-nigerian-blue-collar-workers/>
9. The data are available at the World Wealth and Incomes Database <http://www.wid.world/>
10. For an overview, see Trends in Income Inequality and Impact on Economic Growth, OECD, 2014, http://www.oecd-ilibrary.org/social-issues-migration-health/trends-in-income-inequality-and-its-impact-on-economic-growth_5jxrnjcwv6j-en; and Causes and Consequences of Income Inequality: A Global Perspective, International Monetary Fund, 2015, <https://www.imf.org/external/pubs/ft/sdn/2015/sdn1513.pdf>
11. See B Milanovic, *Worlds of Discontent*, 2014; F Bourguignon, *Globalization of Inequality*, 2015. On the political economy of developing countries, see Daron Acemoglu and James Robinson, *Why Nations Fail*, Crown Business, New York, 2012. Profile Books, London, 2013.
12. Figures 6 & 7, p.7, from Even it Up: Time to end extreme inequality, 2014 is reproduced with the permission of Oxfam GB, Oxfam House, John Smith Drive, Cowley, Oxford OX4 2JY, UK. Oxfam GB does not necessarily endorse any text or activities that accompany the materials. <http://policy-practice.oxfam.org.uk/publications/even-it-up-time-to-end-extreme-inequality-333012>
13. Ricardo Hausmann, <http://www.project-syndicate.org/commentary/inclusiveness-key-strategy-for-growth-by-ricardo-hausmann-2014-11>, accessed 27/03/15.
14. WDR 2016 team calculations, based on World Development Indicators. World Development Report 2016, World Bank.
15. Amartya Sen's *Development as Freedom*, Oxford University Press, 1999.
16. '\$30 smartphones are here', Quartz, <http://qz.com/314285/30-smartphones-are-here-and-theyre-getting-better-every-day/> accessed 5/3/15;
17. '\$30 smartphones are here', Quartz, <http://qz.com/314285/30-smartphones-are-here-and-theyre-getting-better-every-day/> accessed 5/3/15; <http://www.idc.com/getdoc.jsp?containerId=prUS25224914> accessed 27/3/15.
18. <http://www.idc.com/getdoc.jsp?containerId=prUS25224914> accessed 27/3/15.
19. <http://www.vodacom.co.za/vodacom/shopping/power-bundles>, accessed 10/08/2015
20. WDR 2016 team, based on Research ICT Africa (various years). World Development Report 2016, World Bank.
21. Peering Into The Minds Of The 4.3 Billion Unconnected | TechCrunch, <http://techcrunch.com/2014/11/29/peering-into-the-minds-of-the-4-3-billion-unconnected/> Accessed 01/05/15
22. See for example Effects of social network structure on the diffusion and adoption of agricultural technology: Evidence from rural Ethiopia, Yasuyuki Todo, Petr Matous, Dagne Mojo, working paper September 2014, University of Tokyo.
23. Social Networks of Mobile Money in Kenya, Kusimba et al, Institute for Money, Technology and Financial Inclusion, Working Paper 2013-1.
24. <https://gsmaintelligence.com/research/2014/09/local-world-content-for-the-next-wave-of-growth/445/%E2%80%9DLocal/>
25. European Commission press release http://europa.eu/rapid/press-release_MEMO-15-4782_en.htm, accessed 26/04/2016
26. http://www.slideshare.net/a16z/mew-a16z/30-3001234Jun11_Sep11_Dec11_Mar12_Jun12
27. Ofcom 2014 communications market report
28. The future of mobile messaging: Over-the-top competitors threaten SMS, James Chavin, Aadil Ginwala and Max Spear, McKinsey 2012
29. Luke Van Hoot 'Building Next Generation Networks in Emerging Markets', Making Broadband Accessible for All, 2011
30. <http://www.southafrica.info/news/urbanisation-240113.htm#.V1acRjUrLIU>
31. Buys, Dasgupta, Thomas and Wheeler, 2009
32. <http://www.vodafone.com/content/dam/group/policy/downloads/rural-solution-options-webb-henderson.pdf>
33. See Spectrum Policy in Emerging Markets, Vodafone Public Policy Paper Series no. 15, August 2014. https://www.vodafone.com/content/dam/group/policy/downloads/Spectrum_Policy_in_Emerging_Markets.pdf
34. Vodafone (2014) Connected Women: https://www.vodafone.com/content/dam/vodafone-images/foundation/thought-leadership/VF_WomensReport_V12%20Final.pdf
35. UNESCO (2012) Kenya Fact Sheet: http://www.unesco.org/eri/cp/factsheets_ed/KE_EDFactSheet.pdf
36. KDHS (2014) p. 34 http://www.knbs.or.ke/index.php?option=com_content&view=article&id=352:2014-kenya-demographic-and-health-survey-kdhs&catid=82&Itemid=593
37. KDHS (2014) p. 34 http://www.knbs.or.ke/index.php?option=com_content&view=article&id=352:2014-kenya-demographic-and-health-survey-kdhs&catid=82&Itemid=593
38. Oino, P., Auya, S., Luvega, C., (2014) Women Groups: A Pathway to Rural Development in Nyamusi Division, Nyamira County, Kenya. International Journal of Innovation and Scientific Research Vol 7 No 2 August 2014 p111-120: <http://www.ijisr.issr-journals.org/abstract.php?article=IJISR-14-150-07>
39. DFID (2007) Gender Equality – At the heart of development. P.13 <http://webarchive.nationalarchives.gov.uk/+http://www.dfid.gov.uk/Documents/publications/gender-equality.pdf>
40. KDHS (2014) p. 12 http://www.knbs.or.ke/index.php?option=com_content&view=article&id=352:2014-kenya-demographic-and-health-survey-kdhs&catid=82&Itemid=593
41. KDHS (2014) p. 275 http://www.knbs.or.ke/index.php?option=com_content&view=article&id=352:2014-kenya-demographic-and-health-survey-kdhs&catid=82&Itemid=593
42. KDHS (2014) p. xxi http://www.knbs.or.ke/index.php?option=com_content&view=article&id=352:2014-kenya-demographic-and-health-survey-kdhs&catid=82&Itemid=593
43. UNDP GII (2014) p. 5 http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/KEN.pdf
44. GSMA Intelligence (2015): <https://gsmaintelligence.com/>
45. GSMA Connected Women (2015). Bridging the gender gap: Mobile access and usage in low and middle-income countries: <http://www.gsma.com/connected-women/resources-2/gender-gap/>
46. Wandibba, S., Nangendo, S., Mulemi, B. Gender Empowerment and Access to Financial Services in Machakos County, Eastern Kenya: http://www.imtfi.uci.edu/files/docs/2014/wandibba_imtfi_final_report.pdf
47. White, D. (2012). The Social and Economic Impact of M-Pesa on the Lives of Women in the Fishing Industry on Lake Victoria: http://digitalcollections.sit.edu/isp_collection/1246/
48. GSMA Connected Women (2015). Bridging the gender gap: Mobile access and usage in low and middle-income countries: <http://www.gsma.com/connected-women/resources-2/gender-gap/>
49. KDHS (2014) p. 291 http://www.knbs.or.ke/index.php?option=com_content&view=article&id=352:2014-kenya-demographic-and-health-survey-kdhs&catid=82&Itemid=593
50. Southwood, R. (2014). Feature Phone User Survey: Ethiopia, Ghana, Kenya, Nigeria and South Africa. Balancing Act: <http://www.balancingact-africa.com/sites/balancingact-africa.com/files/products/3.%20Feature%20Phone%20Report%20FV.pdf>
51. iWorld Bank (2012) Mobile Phone usage at the Kenyan Base of the Pyramid p.21: https://www.infodev.org/infodev-files/mbop_kenyasa_web.pdf
52. KDHS (2014) p. 11 http://www.knbs.or.ke/index.php?option=com_content&view=article&id=352:2014-kenya-demographic-and-health-survey-kdhs&catid=82&Itemid=593
53. GSMA Intelligence (Accessed 2016): <https://gsmaintelligence.com/>
54. Zab, S. (2015). Whitepaper: The growth of smartphone uptake in Kenya: <http://www.jumia.co.ke/blog/whitepaper-the-growth-of-the-smartphone-market-in-kenya/>
55. CAK, Sector Statistics Report Q1 (2016) p.20 <http://www.ca.go.ke/images/downloads/STATISTICS/Sector%20%20Statistics%20Report%20Q1%202015-16.pdf>
56. Zab, S. (2015). Whitepaper: The growth of smartphone uptake in Kenya: <http://www.jumia.co.ke/blog/whitepaper-the-growth-of-the-smartphone-market-in-kenya/>
57. GSMA Connected Women (2015). Bridging the gender gap: Mobile access and usage in low and middle-income countries: <http://www.gsma.com/connected-women/resources-2/gender-gap/>
58. KNBS Population Situation Analysis (2013) p.210: <http://kenya.unfpa.org/publications/kenya-population-situation-analysis-report>
59. KenyaOpenData (2009, Accessed 2016): <https://www.opendata.go.ke/Urbanization-/County-Urbanization-Kiambu/epe7-u648>
60. KNBS (2014). Highlights of the Socio-economic atlas of Kenya. P.25 http://www.knbs.or.ke/index.php?option=com_content&view=article&id=280:highlights-of-the-socio-economic-atlas-of-kenya&catid=82&Itemid=593 and KNBS (2013)

61. The 2014 census has been recently published, it was not available at the time of the survey. http://www.knbs.or.ke/index.php?option=com_content&view=article&id=308:2014-kenya-demographic-and-health-survey-2014-kdhs&catid=82:news&Itemid=593.
62. 2014 census http://www.knbs.or.ke/index.php?option=com_content&view=article&id=308:2014-kenya-demographic-and-health-survey-2014-kdhs&catid=82:news&Itemid=593.
63. The recently released 2014 census data shows a decrease in the number of men and women citing "no education" Kenya wide including Kiambu, however smartphone users remain more educated than Kiambu, Urban, Rural and Kenyan average.
64. UN Women (2015), Progress of the World's Women 2015-16 p.13: <http://progress.unwomen.org/en/2015/download/KDHS> (2014) p. 12 http://www.knbs.or.ke/index.php?option=com_content&view=article&id=352:2014-kenya-demographic-and-health-survey-kdhs&catid=82&Itemid=593
66. OECD (2008) Gender equality: empowering women so that development is effective: p.3 http://www.gendermatters.eu/resources_documents/UserFiles/File/Resource/DAC%20guiding%20principles.pdf
67. MEA smartphone Market Rockets as Cheap Devices Spur Surge in Demand, International Data Corporation, April 26, 2015. As cited by Zab, S. (2015). Whitepaper: The growth of smartphone uptake in Kenya: <http://www.jumia.co.ke/blog/whitepaper-the-growth-of-the-smartphone-market-in-kenya/>
68. Zab, S. (2015). Whitepaper: The growth of smartphone uptake in Kenya: <http://www.jumia.co.ke/blog/whitepaper-the-growth-of-the-smartphone-market-in-kenya/>
69. WHO (2015): Instances of Female Genital Mutilation: <http://www.who.int/reproductivehealth/topics/fgm/prevalence/en/>
70. Oino, P., Auya, S., Luvega, C., (2014) Women Groups: A Pathway to Rural Development in Nyamusi Division, Nyamira County, Kenya. International Journal of Innovation and Scientific Research Vol 7 No 2 August 2014 p111-120: <http://www.ijisr-issr-journals.org/abstract.php?article=IJISR-14-150-07>
71. Ghana Statistical Service (2014). Labour Force Report, Ghana Living Standards Survey. Retrieved 20 March 2015
72. Esselar, S., Stork, C., Ndiwalana, A., & Deen-Swaray, M. (2007). ICT Usage and Its Impact on Profitability of SMEs in 13 African Countries. Information Technologies and International Development, 4(1), 87-100; Allen, E., Langowitz, N., Elam, A.E. and Dean, M. (2007). The Global Entrepreneurship Monitor (GEM) 2007 Report on Women and Entrepreneurship Executive summary, www.gemconsortium.org, 5/05/2010; Mensah, S. (2004). 'A Review of SME Financing Schemes in Ghana', Chapter Presented at the UNIDO Regional Workshop of Financing Small and Medium Scale Enterprises. Accra, Ghana, 15-16 March 2004. Ghana: SEM International Associates Limited.
73. Boateng, R. (2011). Mobile Phones and Micro-Trading Activities – Conceptualizing The Link, Info: The Journal for Policy, Regulation and Strategy, 13(5), pp. 48-62; Sey, A. (2009). "Exploring Mobile Phone-Sharing Practices in Ghana", Info, Vol. 11, No. 2, pp. 66-78; Milne, C. (2006). Improving affordability of telecommunications: cross-fertilisation between the developed and the developing.
74. Kushnir, K., Mirmulstein, M., Land Ramalho, R. (2010). Micro, Small, and Medium Enterprises around the World: How Many Are There, and What Affects the Count?, World Bank/IFC. Retrieved 20 March 2015
75. PricewaterhouseCoopers (2013). Ghana Banking Survey 2013: Harnessing the SME potential. Retrieved 20 March 2015 <http://www.pwc.com/gh/en/publications/ghana-banking-survey-2013.html>
76. José Ernesto Amorós, J.E. and Bosma, N. (2014). The Global Entrepreneurship Monitor (GEM) 2013 Global Report. Fifteen Years Of Assessing Entrepreneurship Across The Globe. Retrieved 20 March 2015 <http://www.gemconsortium.org/report>
77. Mensah, S. (2004). 'A Review of SME Financing Schemes in Ghana', Chapter Presented at the UNIDO Regional Workshop of Financing Small and Medium Scale Enterprises. Accra, Ghana, 15-16 March 2004. Ghana: SEM International Associates Limited
78. Groupe Speciale Mobile Association (GSMA) (2014). The Mobile Economy 2014, Retrieved 20 March 2015 http://www.gsma.com/mobileeconomy.com/GSMA_ME_Report_2014_R2_WEB.pdf; National Communication Authority (2015). Market Share Statistics Telecom Voice and Broadband Subscription Trends in 2015. Retrieved 20 March 2015 <http://www.nca.org.gh/40/105/Market-Share-Statistics.html>
79. Esselar, S., Stork, C., Ndiwalana, A., & Deen-Swaray, M. (2007). ICT Usage and Its Impact on Profitability of SMEs in 13 African Countries. Information Technologies and International Development, 4(1), 87-100; Boateng, R. (2011). Mobile Phones and Micro-Trading Activities – Conceptualizing The Link, Info: The Journal for Policy, Regulation and Strategy, 13(5), pp. 48-62
80. Ghana Statistical Service (2013). 2010 Population & Housing Census National Analytical Report. Retrieved 20 March 2015
81. Ghana Statistical Service (2013). 2010 Population & Housing Census National Analytical Report. Retrieved 20 March 2015
82. Ghana Statistical Service (2013). 2010 Population & Housing Census National Analytical Report. Retrieved 20 March 2015
83. Dowuona, S. (2015). Government, NCA, 2 Telcos Websites Mobile Unfriendly – Google Test Reveal. Adomonline.com Retrieved 25 April 2015 <https://www.modernghana.com/news/613344/1/government-nca-2-telcos-websites-mobile-unfriendly.html>
84. Degenhardt, S.S. Horvath, B. and Maddock, N. (2012). Private Sector Brief - May 2012 - Micro-enterprise growth: evidence-based policy implications. UNDP
85. OECD/International Telecommunication Union (2011), M-Government: Mobile Technologies for Responsive Governments and Connected Societies, OECD Publishing. <http://dx.doi.org/10.1787/9789264118706-en> and ITU Bookshop at www.itu.int/pub/D-STR/m-gov
86. GSMA Intelligence, January 2016
87. African Union Concept Note: 2014 Year of Agriculture and Food Security in Africa
88. Thirtle, C., Irz, X., Lin, Lin McKenzie-Hill, V., & Wiggins, Steve. 2001. Relationship between changes in agricultural productivity and the incidence of poverty in developing countries. Report 7946, DFID
89. 'What is Agricultural Transformation? John M Staatz, Michigan State University, October 29th 1998
90. The Agriculture and Food Chain: Entering a New Era of Cooperation, KPMG, May 2013
91. Monsanto presentation by Kerry Preete to UBS Best of Americas Conference, September 2014
92. Vodafone Connected Farmers Report, 2015 <https://www.vodafone.com/content/dam/sustainability/2015/pdf/connected-farmers.pdf>
93. GSMA m-Agri Tracker: <http://www.gsma.com/mobilefordevelopment/programmes/magri/tracker>
94. Agricultural value-added services (Agri VAS): market opportunity and emerging business models; GSMA intelligence, February, 2015
95. M4D Impact Nokia Life case study, September, 2013
96. M4D Impact Reuters Market Light case study, October 2014
97. The IKSL Annual Report for 2012/13 cites several case studies with benefits of this magnitude <http://www.iksl.in/Performance/Annual-Reports>
98. Esoko case study, M4D Impact, April 2013 <http://www.m4dimpact.com/analysis/case-studies/esoko>
99. 'Smallholder farmers and business, Hystra, July 2015
100. Esoko press release December 2011
101. Catalyzing smallholder agricultural finance, Dalberg, September 2012 http://dalberg.com/documents/Catalyzing_Smallholder_Ag_Finance.pdf
102. Yield trends and gap analysis of major crops in the world, Hengsdijk and Lageveld, 2009, Wageningen University, Work document 170 https://www.researchgate.net/publication/43609724_Yield_trends_and_yield_gap_analysis_of_major_crops_in_the_world
103. Transforming Indian Agriculture: India 2040 – Productivity, Markets and Institutions, Ed. Marco Ferroni
104. Socio-Economic Impact of Mobile Phones on Indian Agriculture, Mittal et al, Feb 2010
105. Impacts of the EU-India FTA on Human and Social Rights, European Institute for Asian Studies, http://ec.europa.eu/europeaid/projects/impacts-eu-india-fta-human-and-social-rights-issues_en
106. UN FAO, <http://www.fao.org/docrep/007/j2602e/j2602e04.htm>
107. Mobile Phone Coverage and Producer Markets: Evidence from West Africa, Jenny C. Aker, Marcel Fafchamps Development Policy Department, World Bank, July 2014, WPS6986. The Digital Provide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector. Quarterly Journal of Economics, 2007. 22 (3): 879-924 (Described in <http://www.economist.com/node/9149142>)
108. Monitoring the scope and benefits of Fairtrade, Sixth Edition, 2014
109. GSMA. Mobile Money for the Unbanked, 2014
110. Effects of social network structure on the diffusion and adoption of agricultural technology: Evidence from rural Ethiopia Yasuyuki Todo, Petr Matous, Dagne Mojo, Kyoto University Working Paper, June 2014.
111. Mobile Phones for Agricultural and Rural Development: A Literature Review and Suggestions for Future Research, Richard Duncombe, European Journal of Development Research online publication, 5 March 2015; doi:10.1057/ejdr.2014.60.
112. Molony, T. (2009). 'Trading Places in Tanzania: Mobility and marginalisation in a time of travel-saving technologies'. In de Bruijn, M., F. Nyamnjoh, I. Brinkman (Eds.) Mobile Phones: The New Talking Drums of Everyday Africa, Yaoundé/Leiden: Langaa/Afrika Studiecentrum, pp.92-109.

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