

Mobile technologies – The digital fabric of our lives

A Study by Cologne Institute for Economic Research Commissioned
by Vodafone Institute for Society and Communications

INTIMACY | NETWORKS | INNOVATION | SOCIAL DEVELOPMENT | ECONOMIC DEVELOPMENT



**Vodafone Institute
for Society
and Communications**

Index

| **Introduction** p. 3

| **Executive Summary** p. 4

01 | **Intimacy** | Closer Links, New Boundaries p. 6

02 | **Networks** | Being connected, Being Constrained p. 16

03 | **Innovation** | Mobile Networks for Innovation p. 26

04 | **Social Development** | New Connections, New Opportunities p. 38

05 | **Economic Development** | Mobile Technology Powers Growth p. 44

| **Country Profiles** p. 50

| **Methods** p. 70

Introduction

Promoting growth and social development with mobile technology

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Mobile phones are communication tools that connect us to the rest of the world. Once a status symbol, they are today used on a daily basis by practically everyone. These are well known facts, but they don't tell us anything about the role of mobile technology in modern-day society. This report has revealed a statistically verifiable correlation between the level of mobile technology penetration in a society and important progress in the area of social development. Political participation, education and gender equality profit from high mobile technology prevalence. It is, in fact, a central infrastructure enabling the evolution of modern society and a growth-driving innovation platform.

Mobile phones are today indispensable in the business environment - both in developing and emerging nations and in western economies. Faster and more efficient workplace processes and new mobile technology-based products and services are facilitating economic growth. The Cologne Institute for Economic Research's figures provide an international comparison of mobile technology's contribution to growth in gross domestic product. For example, economists assume that its contribution to GDP growth per capita will be the equivalent of USD 742 in Germany between 2010 and 2020. That corresponds to 1.7 percent of the country's current GDP per capita. Mobile technology's contribution to GDP growth is expected to be higher in emerging and developing countries. During the same period, mobile technology will contribute approximately 2.8 percent of Kenya's current GDP per capita.

The report presents a global picture which calls the traditional divide between developing and developed countries into question. It shows that the M-Pesa SMS-based payment system which Vodafone helped to develop is still taking the Kenyan market by storm, with almost 16 million people using it. In Europe, on the other hand, mobile payment systems are still in their infancy. And while Western economies are making the mobile internet an integral aspect of their industrial sectors as a means of process mobilisation and automation, it isn't available in developing countries due to the infrastructure and broadband access rates there. The fact that, despite these shortcomings, mobile technology is triggering society changing processes indicates the vast empowering potential that it has. The Vodafone Foundation's 'Mobile for Good' programme provides resources to support the development of mobile solutions to resolve challenging social issues. That's why I'm delighted that the report published by our partner, The Vodafone Institute, provides both generalised considerations about the social impact of mobile technologies and insights into specific applications, such as those supported in the Mobile for Good programme, that can bring about positive changes in society. The Vodafone Institute for Society and Communication is committed to identifying the society changing potential of mobile technology and how it can be utilised in business, politics and society in future. This is why the correlations identified in this study will form the basis for the Institute's work in coming years.

Enjoy reading the report!

Executive Summary

Mobile technologies – the digital fabric of our lives

Mobile technologies and in particular the mobile phone have changed our lives fundamentally. They shape how we interact with each other and how we organise friends and family as well as broader networks. In essence, they have become the digital fabric of our lives. The present study sets out to investigate the different levels and types of impact that mobile technologies have on individuals, society and economy.

Intimacy

p. 6

The mobile phone and SNS have fundamentally changed how we form weak-tie relationships. Moreover, the mobile phone and mobile communication have altered how we negotiate relationships with family, spouses and close friends. In fact, although we are able to call anyone at any time, more than half of our calls and text messages are directed to four to six people close to us. Essentially, the mobile phone enables us, for the first time, to call a person directly instead of calling a place hoping that whoever we would like to speak to is there. Already knowing who we are going to talk to, the opening question for the usual telephone conversation has changed from who to where. Indeed, the whereabouts of the person we call sets boundaries for the level of intimacy appropriate for the particular conversation.

On the one hand, mobile communication fulfils the function of micro-coordinating our daily activities, for instance, who is going to buy the milk, or who is going to pick up the children today. Such responsibilities within a family are now negotiated 'on the go' instead of planned in advance. On the other hand, mobile communication allows us to keep relationships close regardless of geographical distance. Being always with us, mobile phones extend the direct and immediate contact needed.

However, their presence also infringes our intimate space. Mobile phones are present and rarely if ever turned off during face-to-face conversations or even sex. Consequently, there is always the possibility of someone entering into our private sphere. Further-

more, while keeping up contact with close friends and family is a good thing, constant contact might prevent us from interacting with our environment and thus engaging in new experiences.

Networks

p. 16

The major part of the innovations investigated in this study build on the networked infrastructure that mobile technologies provide. Connected devices drive innovation. Furthermore, mobile devices enable people to connect to each other directly or via social network sites (SNS). These sites provide a platform to get to know each other and to interact. Through a standardised format, they mediate to some extent how we communicate e.g. twitter limits messages to 140 characters. Despite the limitations, however, they enable immediate connectedness. That means that anyone can easily disseminate texts, pictures or videos from their mobile phones. This connectedness has played an important role in the recent Arab Spring movement in North Africa and the Middle East. Also, user-generated content (UGC) has supported the coordination of help in the aftermath of earthquakes in Jamaica and Japan as well as the oil spill in the Gulf of Mexico.

Innovation

p. 26

The study finds evidence for two broad trends in relation to mobile technologies and innovation. In developed countries, devices and applications show continuous improvement. First and foremost, mobile phones have turned into a platform for innovators. Standardisation and easy access enable even people with little or no programming knowledge to develop successful products and services; however, mobile technologies find their way into other parts of our lives as well. More and more previously unconnected devices are now able to communicate with each other. Such connected devices can help older people in our aging society to live a comfortable life in a familiar environment. For example, physicians can easily monitor these people's well-being and nurses

can provide the relevant day-to-day health services. Furthermore, smart devices have been changing supply chains around the world. This trend is likely to continue with factories that require little or no manual input and products that monitor their own state, continuously interacting with control systems or triggering an alert when necessary. Indeed, Machine-to-Machine (M2M) communication is likely to lead to a new industrial revolution. In developing countries, mobile phones have changed everyday lives for many people. Often, mobile phones are the only accessible and functioning infrastructure. As a result, it is unsurprising that people have become inventive by using their mobile phones to replace or create other societal and economic institutions that were inefficient or sometimes non-existent. M-Pesa, for instance, has enabled millions of Kenyans to transfer money without having to travel. It is the most successful mobile banking service in the world, but by far not the only one: around the globe, more than 150 mobile banking systems have been introduced, mainly in developing countries.

Social Development

p. 38

A similar pattern was found regarding the impact of mobile phone subscriptions on social development. The models show that more mobile phone subscriptions correlate with more democratic participation, less gender inequality and more time in education.

Lots of qualitative and anecdotal evidence supports the role that mobile phones and the communication they enable play in the democratisation of countries around the world. Recent developments in North Africa and the Middle East known as the Arab Spring have illustrated this well. Our results support this evidence on the macro-level across a sample of 202 countries. They show a significant relationship between the number of mobile phone subscriptions and the voice and accountability index, which is taken as a proxy for democratisation. This relationship is more pronounced in developing countries as there is naturally more scope for improvement in relation to political participation. Women and girls are often the most vulnerable members of communities in developing countries. Their access to the outer world is often very limited and they have to cope with numerous hurdles. First and foremost, they have to ensure the health and well-being of their families and changing their traditionally assigned roles is often the only way forward. The connectedness and communication without intervention by (male) others can facilitate such a change and reduce gender inequality. Our model across 148 countries supports this idea based on macro-economic data. It shows that with increasing mobile phone subscriptions gender inequality decreases. Again, the effect is most visible in developing countries.

Mobile phones can have two major types of effects on education: the most direct impact is the use of education via SMS texts or mobile applications, which can reach children as well as adults

even in remote areas. The second effect is evident where mobile phones' various other benefits free up time and resources that can be used by people to educate themselves and/or their children. The evidence gathered in this study highlights that mobile phones help to coordinate our lives, improve our interaction in networks and enable new services that potentially facilitate quicker and better information access or service provision. All this taken together is likely to change people's livelihoods, especially in developing countries where we have found the most pronounced effects relating to mobile phone adoption. These changes may encourage and enable people to fulfil (at least some of) their aspirations, the most prominent often being a better education and life for their children. Our model supports this second effect as the number of mobile phone subscriptions is positively related to the time spent in the formal education system.

Economic Development

p. 44

The results of the estimated econometric models indicate a statistically significant effect of the increase of mobile phone subscriptions on GDP growth across the ten countries selected for this study. The effects are all positive for the years 2010 to 2020 and grow continuously in this period. They range between 1.8 % in the UK and 24.9 % in Egypt.

Effects tend to be larger in developing countries. This theory is explained by the significantly higher growth rates of mobile phone subscriptions in these countries. In practice, mobile phones fill the gap that other poor or non-existent infrastructure in these countries leave wide open. It is therefore not surprising that many innovations related to mobile phones are adopted more quickly in developing countries than in developed countries. Finally, mobile phones are often the first and only way of communication without having to travel under difficult circumstances. In developed countries, we find smaller effects for mobile phone subscriptions on economic growth. In these countries, effects are likely to be less pronounced due to less growth in mobile phone subscriptions in forthcoming years and generally good infrastructure. The objective of our study was to build a model that is comparable across the ten countries in our sample and offers a sufficient longitudinal perspective. Consequently, we were not able to include mobile broadband in the model, which plays an important role for the effect of mobile phones in developed countries.



MORE THAN HALF OF OUR **CALLS AND TEXTS** GO TO ONLY 4 TO 6 DIFFERENT PEOPLE

01 | Intimacy

Closer Links, New Boundaries.

Our intimate spheres consist of things and persons that are physically or psychologically close to us. This chapter investigates how the mobile phone affects this intimate sphere. On the one hand, it enables us to extend our relationships across geographical and temporal distances, which affects the relationships themselves as well as the possibilities we have in life. On the other hand, the mobile phone's closeness to us and what we do enables new services based on recorded data. Turning such intimate data into applications can alter our behaviour in positive ways, but the question remains whether people may choose to distinguish between the lives they know are recorded and the ones they actually lead.

In September 1956, *Mechanix Illustrated* featured an article on the 'Telephone of Tomorrow'. In this report, Harold S. Osborne, retiring chief engineer at AT&T, was quoted with his idea of the telephone's future. He conceived a future when 'a telephone number will be given at birth to every baby in the world. It will be his for life' (p. 71). So, logically Harold S. Osborne concluded that when in this future someone does not answer his or her mobile phone, he or she must have died.

Today, not picking up one's phone clearly does not imply one's death. However, we are bound to recognise that the mobile phone has enabled us to call people instead of places, just as Harold S. Osborne implied. However, this also necessitates that we take mobile phones with us all the time and everywhere. Indeed, 84 % report in a poll that they could not go for one entire day without their mobile phone in their hand. And most of us do not turn off the phone in meetings, at the cinema or even when having sex (Mobile Life 2006). First and foremost, it is this bodily closeness that renders the mobile phone a most intimate device. This link between device and person has obviously altered our conversations. The information about who is on the phone is replaced by where the person we are calling is. 'I'm on the bus' or 'I'm in bed' have become important pieces of information at the start of a conversation as they quickly negotiate the level of intimacy appropriate for the following conversation given the surroundings of the persons involved. As a result, the mobile phone becomes

a part of you. The fact that the Finnish word for mobile phone *kanny* means 'extension of the hand' illustrates this well. This intimate connection is, however, not without problems as this chapter discusses.

Obviously, the ability to connect directly with a person has altered how we stay in contact with loved ones and how we negotiate relationships. While on the one hand mobile technology enables us to keep in touch with loved ones even across vast distances, it also limits our contact to others outside our intimate circle as well as our own intimate space, which can be intruded anytime and anywhere. So, the first part of this chapter focuses on how the mobile phone has changed how we negotiate intimacy.

Referring back to the role of mobile phones as an extension of our body, the second part of this chapter discusses different ways in which the data modern mobile technology records, stores and transfers can affect our lives. Such data can help us intensify relationships at a distance, for instance, by sending pictures or videos. They can inform us about our life and behaviour as well as the behaviour of others. While such information has numerous positive applications like scheduled exercise or traffic management, it is worth questioning what impact such information may have beyond its obvious applications. How do information and our knowledge about the fact that our behaviour shapes this information affect our actions?

Negotiating Intimacy

Theoretically, having a mobile phone we can call anyone at any time very much like Harold S. Osborne predicted. However, actual patterns of mobile phone use look very different. Rich Ling's contribution highlights this. We perpetually sustain a nuclear circle of people closest to us everywhere we go, but become largely disengaged from our surroundings (Gergen 2002) supporting closure instead of openness (Geser 2005). As a result, mobile phones decrease instead of increase the size of our relational networks (de Gournay 2002; Koskinen & Kurvinen 2005). Within this, it has to be noted that the reasons for calling someone can range from mundane tasks of coordinating our lives to long and deep conversations that reinforce intimate bonds (Licoppe 2004).

The concept of extending our social ties via mobile devices can both create intimate space and encroach on it. If one seeks to be alone, the mobile phone on display can be a powerful tool to impede contact with others, for example in a bar. Such behaviour sends the clear message to others that one is not to be disturbed. Actual as opposed to staged continuous contact with others, however, ultimately threatens the most important part of intimacy, namely being alone with one's thoughts and one's own inner resources (Plant n.d.).

Besides threatening our most private time, phone calls may also intrude the intimate space we share with someone else. The fact that anyone who can call can also be called necessitates new ways of negotiating intimacy boundaries (Sørensen 2011). As today one usually knows who is calling due to screen displays, not picking up the phone when it rings sends a message to the caller. Consequently, one has to consider whether to pick up the phone or not carefully. This is why we feel obliged to at least check who is calling even if this means breaking the intimate space shared with someone else at that time. Plant (n.d.) cites a study on mobile phones on display during conversations of pairs in London cafés in Soho and Covent Garden. More than half of the observed pairs had at least one mobile phone on display during their meetings with the highest percentage found among male-only pairs and lowest among female-only pairs. While the reasons for displaying one's mobile phone during a conversation may vary considerably from practical to competitive ones, these observations nevertheless illustrate how the mobile phone has entered our intimate spaces.

Another facet of direct and immediate contact is the control that can be enforced through it. Spouses can check on each other regularly when they are not together. This may take the form of a well-perceived ritual, but can also turn out to be quite intimidating. Furthermore, parents can check on their adolescent kids, which can immensely infringe on the free space they need to become adults. Conversely, research shows that the mobile phone can provide exactly that space as parents have less control over what is done and said via this device than over the landline phone at home (Mobile Youth 2006).



Rich Ling

Professor at IT University of Copenhagen

Mobile phones in the European social sphere

The mobile phone is an instrument of the intimate sphere (Ling 2008). That is, we use the mobile phone in order to stay in contact with our closest family and friends. We coordinate our daily interactions and we use it in an expressive mode to share our feelings. We call one another to decide what to buy for dinner and we interact (with calls, texts and through social network sites) when we are down and need an understanding interlocutor. In general, our instrumental and expressive interactions are the core use of the mobile phone, at least in its use as a communication device.

When we look at the number of different people with whom we interact, analysis has shown that more than half of our calls and texts go to only four to six different people (Ling, Bertel, & Sundsøy 2012). These are often the people with whom we spend the most time during the day such as our immediate family and our closest friends. Much of this interaction is simply the mundane calls and texts that allow us to carry out our daily tasks. The genius of the mobile phone is that it makes us individually available to one another. We do not call a particular location in the hope that our intended conversation partner is there; we call the person directly regardless of their location.

Clearly there is a 'long tail' of other people with whom we interact. We will call a somewhat distant friend who we have not talked with since last Christmas and we will call the car mechanic to schedule an oil change. We will call our dear old aunt who always sends a birthday card, we will put an update on our mobile Facebook account and we will text a friend in Berlin or Delhi. We use the device for all these forms of communication (not to mention all the maps we look at, things we check on the mobile internet, etc.). We do all this. The fact of the matter is, however, that a central use of the mobile phone is to communicate with our closest social ties. Indeed, these ties are close to us in both the emotional (Ling 2008) as well as in the physical sense of closeness (Ling et al. 2011). We talk to one another in order to tell a joke or to share a bit of gossip. We text

short notes of encouragement to our children before a big exam and we share bits of the latest 'water cooler' news with a close friend from work.

The sum total of these small interactions contributes to the broader project of being a friend, parent or partner. It is through our small talk on the phone, our silly text messages and re-posting of a notice on Twitter that we show one another our recognition of their role in our lives. There are obviously other ways of doing this in other venues, but the mobile phone has become an important channel.

Being accessible via the mobile phone is a way of being social.

How has this come about? Why is it that we rely on the mobile phone to maintain these close bonds? As noted, the mobile phone is increasingly always near at hand for us and for those with whom we interact. Indeed, we have come to expect it of one another (Ling, 2012). The device has become an intertwined part of the kit that we have with us when we leave home. At one level this can be read as being a slave to technology. There is a narrative that we have somehow been beguiled into using the device and now we are collectively hooked. There may be something to this, but it is not necessarily a fully satisfying explanation. Being accessible via the mobile phone is a way of being social. Not to have it with us is being irresponsible towards our social sphere. This idea operates at two levels. One is simply in terms of coordination. We use the mobile phone to arrange and to change our social activities. Increasingly, we are moving away from using specific times and locations in order to coordinate our meet-ups. Instead, we might simply decide to meet a friend 'in the city centre tomorrow afternoon'. In this scenario, we both have the sense that at some point between, for example 2 and 4 p.m., we will both be in the city centre doing errands and

that it would be great to meet. In this interaction, however, we wait until we are actually in the centre before we call our eventual coffee partner. If they have forgotten their phone or the battery has run out, we are not able to confirm the coffee date. We can leave them a voice mail or send a text, to which they cannot respond until their phone becomes operative again. By the time they get the (perhaps increasingly frustrated) message, it is probably too late for coffee. This scenario, i.e. using the mobile phone to micro-coordinate our interactions, is becoming increasingly common. Our willingness to rely on mobile-based interaction shows how the device, and our use of it for planning, is becoming a structured part of the routines of our daily lives.

There is also a way in which the mobile phone is becoming part of the expressive side of our interactions. When considering how the mobile phone is used for concrete coordination there is one type of expectation. However, when thinking about the expressive side of interaction the ability to communicate is more complex. In this case, it is not necessarily the actual ability to communicate, but it is the ability to communicate, in the words of a focus group participant, 'just in case'. Here, the mobile phone is more akin to an insurance policy. It is something that we have in case the need arises. We have it in case we get a flat tyre on the journey home or in case we are unexpectedly delayed. We have seen this in the reaction of people who were in Oslo in the minutes after the bombing on 22 July 2011. Analysis of the number of mobile calls shows a rush to call one another. Indeed, the data shows that people, on the whole, called their strongest tie first, next strongest tie second, etc. This speaks to the fundamental importance of the mobile phone in the intimate sphere (Ling et al. 2013). In interviews, we saw how people used the mobile phone to touch base and to inquire as to the welfare of their family and their friends. They wanted to check in, exchange some words of concern and perhaps share information that they had come across. The mobile phone enabled this type of remote care giving. Indeed, the fact that this channel was used to the degree that it was shows how the mobile phone has become a central channel for communication in the intimate sphere.

Having shed some light on the ambiguity as well as the relevance of mobile intimacy in developed countries, we now turn to the impact that mobile phones have on intimacy in developing countries.

As Rich Ling's contribution highlights, keeping in contact with loved ones is particularly important to us during times of crisis. Knowing that the ones closest to us are well is essential. In the developing world where family and kinship is often the only and final safety net, keeping in contact with loved ones is even more important. Mechael's (n.d.) case study of mobile use in Egypt supports this. She finds that mobile phones significantly help to maintain physical and psychological health when family members move physically away from home e.g. to take up work or education elsewhere. Furthermore, they enable women to maintain three roles within the household, simultaneously being wives, mothers and wage earners. Consequently, the mobile phone also takes the role of a catalyst to social change. It shifts the power distribution within the sphere of the family. In particular, youths and women gain more freedom as they have significantly more technical knowledge about mobile technologies than their parents and respectively find it easier to take new, more powerful roles within their family. For instance, mothers reported being able to take up jobs because they can monitor the progress of their children's recovery from illnesses, such as colds, flu bugs and stomach viruses, when they are off-site. This is similar to the concept of micro-coordinating our lives via mobile phones which we find in developed countries (Ling, 2004), but has more far-reaching consequences.

In sum, the ability to contact someone directly has many advantages. However, Mechael (n.d.) also raises some concerns. In the Arab world in particular, where interaction between males and females is subjected to numerous rules, being able to directly and with little perceived risk approach a member of the opposite sex can be offensive and even harmful to young girls. Inappropriate contact with a boy can significantly harm a girl's social status and prospects in life. Thus, being contacted directly on their mobile phones can be considered harassment for young females and can negatively affect their psychological well-being. While strict rules about male–female interaction aggravate this issue in some countries, harassment and the intrusion of the intimate sphere via the mobile phone as such is naturally not limited to these countries.

Overall, the impact of mobile phones on relationships with other persons and in particular the ones who are closest to us is ambiguous. On the one hand, they enable us to stay in touch with most loved ones irrespective of geographical distances. On the other hand, this type of hyper-connectedness threatens the individual's intimacy. The following section moves on from how the mobile phone enables closeness across long distances to how its closeness to us and our body enables new services, but also raises issues of data protection.

Recording Live – Recorded Life

The transition from calling places to calling persons is only really possible because we have our phones with us all the time and take them everywhere we go. Indeed, the mobile phone has become an essential item to us just like our keys and wallets. This is true for developed and developing countries. Equipped with built-in microphones, cameras and location awareness they can collect images, sound and GPS data that until the advent of this device were largely invisible.

Such data can support our mobile intimacy with our loved ones. For instance, they enable us to not only talk on the phone, but also to transfer video, to take and send pictures/videos or quickly check whether anyone we know is close and may be available for a cup of coffee. They also enable us to take account of our lives much like a diary. According to research conducted by SAY (n.d.) in the US, mobile phone users use their devices to track their personal and social lives. These records include recording exercise (36 %), food intake (35 %), day-to-day expenditures (35 %) or meeting notes (54 %). Focusing on the 18 to 24 age group, all these figures increase to around 50 %. In the context of developing countries, self-reported data for instance on personal well-being, conflicts or elections allow more accurate data collection and potentially more focused support for those at the bottom of the pyramid (Croke et al. 2013).

In addition to the data we actively choose to collect, store and share on our mobile phones, mobile phones also act as sensors collecting data themselves automatically. In fact, the advent of the mobile phone and in particular smartphones has resulted in the largest network of sensors ever. Data collected by them can lay the ground for numerous innovations. Shilton and Estrin (n.d.) name some positive examples:

PEIR (Personal Environmental Impact Report)

This application allows participants to track their carbon footprints as well as exposure to air pollution throughout the day. The system maps the combination of location, time and activity to Southern California regional air quality and weather data. Using this, it estimates individual carbon footprints and exposure to particulate matter. Such previously unavailable information is supposed to change individuals' behaviour towards more environmentally friendly lifestyles.

Biketastic

Cyclists who carry GPS-enabled mobile phones can participate in this network. The mobile phone measures speed, roughness of the road as well as the volume of surrounding traffic transferring and pooling these data on a website. These data enable cyclists to make the best route choice for their commute.

Inherent in all these applications is an implicit call to action to change one's behaviour e.g. to rely more often on the bike than the car for short distances or to pick the best route for commuting

>> continue page 15

MOBILE TRACKS OUR LIVES

■ Age Group: 18+
■ Age Group: 18-24

percentage of mobile phone users who use tracking applications

Record Exercise



36%

55%

Take Meeting Notes



54%

48%

Record Food Intake



35%

52%

Track Personal Health



33%

51%

Track Day to Day Expenses



35%

50%

Track Finances



41%

48%

Source: SAY (n.d.)



Dr. Wendy Hein

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A Close View on Human Behaviour

Our mobile phones have not just become tools for communicating and interacting with others, they may also contain our most intimate and private possessions. Mobile phones contain information about us that nobody else may be aware of. These may be in the form of text, such as messages (personal thoughts, notes or diaries, or even our bank account details and PINs); recorded messages (from us or others); photographs (from holidays, family visits or nights out with our best friends); and videos. The wealth of information stored in our mobile phones is endless. In case we have advanced to the use of a SmartPhone (SP), we may even connect our photographs directly to our facebook or Twitter account, and from there to everyone within our networks. We may also be the secret record holder of the highest 'Angry Birds' scores.

What do we record with our mobile phones? Our dearest, most precious moments. Our football team scoring the winning goal and raising the trophy; our baby's first steps; last year's Christmas rituals or New-Years-Eve party; or the birthday celebrations of our 100 year-old grandfather. Mobile phones are not just a means of communicating with others, they have become treasure chests.

Ultimately, mobile phones enable us to record our lives.

Looking at what one person may perceive worthy of capturing with their mobile phone may differ significantly between us. Ultimately, mobile phones enable us to record our lives, and have the potential of showing what it means for us to 'be there'. Our perspectives, and our everyday practices that make us who we are, are certainly unique and different. While for some, these everyday practices may

appear mundane and routine, for others they may provide significant insight into diverse perspectives. We may be able to observe what it means to be a woman at work in India, or a man at Wall Street. Our day-to-day routines, as well as our precious moments, make us who we are, and mobile phones are one way of how we have come to capture these.

As a female researcher studying young men's experiences and practices, this became invaluable (Hein, O'Donohoe & Ryan, 2011). Facing the task of 'hanging out' with a group of guys on a regular basis and attempting to become accepted as one of them was certainly one challenge. But trying to act as a researcher and record as much detail as possible was an additional burden. A mobile phone became a research tool that may change the relationships between those who research and those who are researched. Firstly, it allowed me to record my own text and voice-messages, making it less intrusive than any regular recorder. I wrote entire fieldnotes on my phone, which to others appeared as writing a text message. I also took pictures and videos of the places we went, the beers we drank, and football games we watched. I soon noticed that I was not the only one – everyone else around me did the same. Taking photographs and videos was just as common a practice for study participants. My photos and videos were certainly important, but could only capture my own perspective, that of a participant-researcher. On the other hand, videos and photographs of participants were often 'trophies', representing hard-earned experiences, joy and emotion. I certainly shared these emotions, but the recordings of others enriched my own perspective and understanding of what it meant to 'be there' with and for them.

Of course, in some instances it was difficult for me to physically be there. We naturally miss out on certain events and activities, which can now be equally shared through mobile phones. One only has to think of the number of mobile phones that are visible at sporting events, parties, or concerts (at which point mobile phone footage may often fall within a grey zone of privacy and legality). On the other hand, certain

places are still hidden from men or women – some for good reasons, but others for the potential maintenance of exclusivity. This was for example the case in a traditional Burn's Supper celebration on the 25th January, where traditionally only men were allowed to attend. A mobile phone can provide a glimpse into the interactions here too.

Considering all these insights as data, I was therefore not the only researcher, nor were my recordings, photographs or videos the 'correct' ones. Rather, it was through the sharing of recorded experiences that further insights were gained into what mattered, and what was valued in certain contexts.

We may all think that we are just 'regular people' – but one look at your mobile phone and one can see how unique each and every one of us is.

Beyond this, the diverse experiences and photographs also showed the multiplicity of participant's practices in everyday lives. „We may all think that we are just 'regular people' – but one look at your mobile phone and one can see how unique each and every one of us is.“

Our phones combine our lives as workers and job-seekers, as mothers and fathers, brothers and sisters, partners, children, adults, friends, acquaintances – our public and our very private selves. Some things we may very happily share with others, and may even look for competition (for example

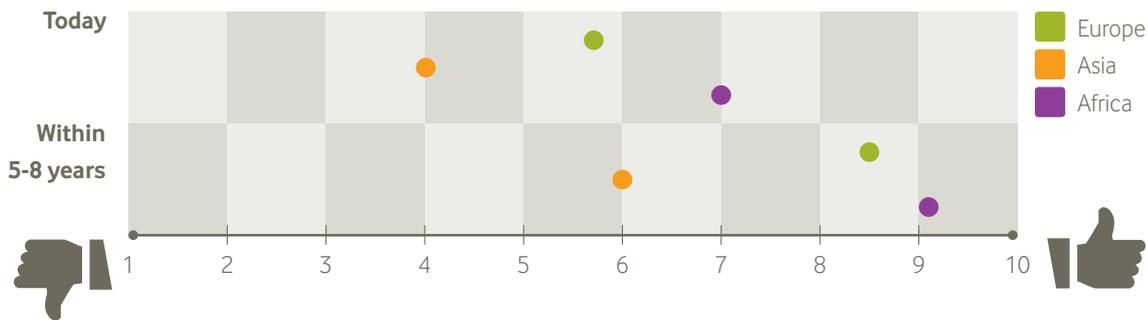
when comparing the better seat in the football stadium, or my personal scores of fantasy football). Others can be our own private thoughts and secrets. In fact, a mobile phone may even blur boundaries between our public and private lives, as our work may increasingly infiltrate our private homes due to the multiple applications of a phone. It allows us to combine all these multiple roles and practices we perform on a daily basis, without a question of complexity or contradiction. It may not just be a part of us, but it can become 'us'. What would happen if we lost our phone?

This may also point to the bad side of our mobile phone, and using it to record our lives. What about privacy issues? As observers, at what point are we crossing a line and invading too much into what people hold dear? Should some things not remain 'private'? And, as users, at what point do we 'switch off'? Mobile phones may provide a recording of our lives, but should we not focus on living these lives first? Are we becoming too reliable on mobile phones, on sharing with others what we had for breakfast, when we should just 'have breakfast'? Do mobile phones pose a danger of the represented becoming privileged to the real? Are we living too much in the public and are our phones contributing to this? Mobile phones and their growing ubiquity therefore allow us to understand and gain increasing insights into everyday lives across the globe, and hopefully, through sharing these on a wider scale, allow us to develop a further appreciation for the difficulties that some people face. On the other hand, we should not neglect the challenges that may come with an increasing tendency of living our lives through mobile phones.



WHAT THE EXPERTS SAY ...

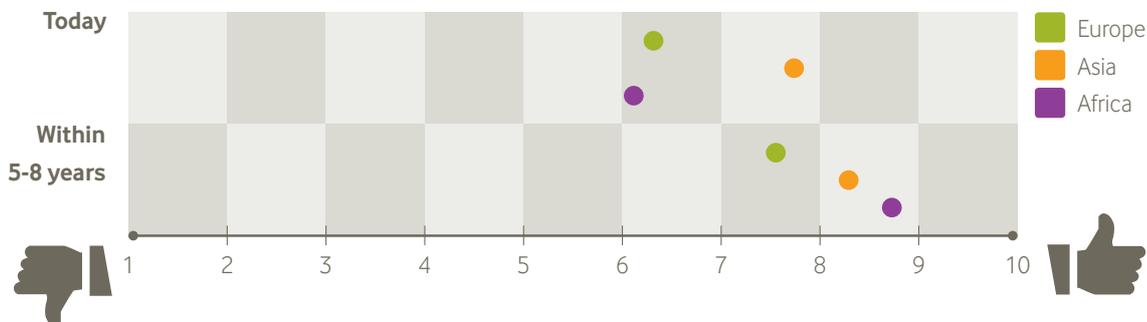
Consumers in your country use their mobile phones as the major device to store important data on them e.g. personal data, passwords.



Scale: 1 = strongly disagree; 10 = strongly agree

Source: IW Consult (2013) Expert Survey among Vodafone Country Managers

Consumers in your country are concerned about the private data that is stored on their mobile phones.



Scale: 1 = strongly disagree; 10 = strongly agree

Source: IW Consult (2013) Expert Survey among Vodafone Country Managers

The surveyed Vodafone experts appraise the relevance personal data stored on mobile phones have across all regions in our sample. They also agree that the importance and concerns about the security of these data will increase within the next 5 to 8 years. The importance that mobile phones have in particular in developing countries reflects in the role they play for Africans concerning personal data storage. Often the mobile phone is a person's only ICT device. Therefore, all important data are stored on it. There is relatively little difference as regards the concerns about data security across the regions. The small differences that we find seem to be referring to the general culture in these regions rather than a specific relevance of the mobile phone.

>> continued from page 10

by bike. They are just two of many potential examples of how data collected from mobile phones can trigger individual and social change. However, mobile phones do not only collect and transfer data when we explicitly ask them to do so. Many applications use our data without us being aware of it. It remains to be seen whether this will also have an effect on our behaviour as data collected from within our intimate sphere is used in new ways.

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THE ESTIMATED

600



MILLION

ACTIVE USERS OF FACEBOOK
CREATE APPROXIMATELY

30



BILLION
PIECES

OF CONTENT PER MONTH.

02 | Networks

Being Connected, Being Constrained.

With the help of digital and mobile technologies people as well as devices can connect and interact in networks. Social network sites (SNS) and Machine-to-Machine (M2M) technology have been affecting our lives in recent years and are likely to continue to do so. However, their effects are shaped by paradoxes. This chapter sets out to address these contradictions. Social networks create the perception of immediate contact with people we might not even know. At the same time, however, social networks mediate how we perceive others and how we interact with them. While they do so, networks and in particular SNS provide impartial platforms for disseminating user-generated content (UGC), which has changed the role of journalists within the media and amplified social and political protests against regimes in North Africa and the Middle East. However, as these SNS provide direct access to users, they are also sought after by political campaigns that use their presence to foster partial interests. Finally, networks are not limited to human connectedness anymore. Data are used by and shared among mobile devices in various ways thereby materialising into innovative products and services while the networks themselves become more and more immaterial.

A mobile phone's key function is enabling connectedness, be it via voice, text or the internet. As mobile phones bring this connectedness physically and psychologically close to us, they have had an immense impact on our intimate sphere and how we (need to) negotiate intimacy and access to us. However, the connectedness induced by the mobile phone as well as other mobile and digital technologies does not only affect our intimate sphere but it also affects our idea of networks and their impact. Networks have always existed; however, their properties have changed through the use of digital and mobile technologies. Their effects on our lives, our social and political sphere and the way in which we construct connectedness are shaped by paradoxes. This chapter elaborates on the effects that networks have had on how we connect to and with each other, how we share information and what these changes are able to initiate. Finally, the chapter highlights how networks can connect ideas as well as devices leading to continuous innovation.

Within each dimension, the chapter seeks to address the paradoxes that have resulted from the influence that digital and mobile technologies have had on networks. The chapter is structured along the contradictions of (im)mediate connectedness, (im)partial connectedness and (im)material connectedness.

(Im)mediate Connectedness

The first paradox of digital and mobile networks this chapter looks at is that of (im)mediate connectedness. Social networks and the ability to produce and share content from anywhere at any time have taken immediacy of contact between ourselves to a new level. We can instantly connect to others, even strangers, and learn about their whereabouts, habits and feelings. This has significantly changed how we form relationships as well as increasing the number of our weak-tie relationships.

On average, Facebook users have around 120 to 130 friends on the social network site (SNS). While similar to mobile phone

FACEBOOK PENETRATION IN THE 10 COUNTRIES SELECTED FOR THE STUDY

	 Number of Facebook Users	 Male users (in %)	 Female users (in %)	 Number of Facebook Users as Penetration of People Online (in %)
Turkey	32,408,540	64	36	111
South Africa	5,534,160	50	50	90
Italy	23,028,220	53	47	71
India	61,499,220	74	26	67
UK	32,175,460	48	52	61
Egypt	13,010,580	64	36	60
Spain	17,055,040	50	50	56
Germany	25,063,880	52	48	37
Kenya	1,883,280	64	36	18
China	597,520	61	39	0.1

Facebook penetration among people online differs markedly across the countries selected for the study. From just over 0 % in China where Facebook is officially not accepted to more than one Facebook account per online user in Turkey. While in half of the countries males and females contribute roughly half of the Facebook users, there are significantly more male users in Turkey, Egypt, Kenya, India and China.

These figures offer some insights about the representativeness of the political and social discourse taking place on the SNS. It seems that this discourse is often driven by a relatively small

and male part of the population. Interestingly, the politicians or political movement with the most local fans does not necessarily have to originate in the country itself. In fact, Barack Obama has claimed the political social media far beyond the United States. He is the politician with the most fans in five out of the ten countries in the study. Often the current president or prime minister of the respective country does not even rank among the top three political Facebook sites or does not have an official Facebook site. This is quite surprising given the impact SNS have had on political change recently.

Source: Socialbakers (2013)

TOP 3 FACEBOOK-SITES IN POLITICS

() Number of Local Fans



use as such, frequent interaction is limited to a small number of friends (around six to ten) though the content posted by the individual user is commonly visible to all his/her friends. This way of communicating, which can be described as narrow or broad depending on the privacy setting of the information posted on the SNS, has changed the way a significant number of people communicate with each other (Economist 2009). Through user-generated content (UGC), people can relate to each other more immediately than previously imaginable despite a lack of physical contact. In addition to UGC, the interaction with others on the SNS completes the impression people create about each other. Within this, the mobile phone plays an important role. Modern mobile phones with built-in cameras, microphones and internet connectivity enable us to create UGC wherever we are. This further enhances connectedness within any context independent from space and time. People on our network can thus participate immediately in our activities. In sum, digital and mobile technologies enable a new immediacy of connectedness. This resonates well with our human urge for social connectedness. Thus, the popularity of SNS is less surprising. Nonetheless, the figures are remarkable.

Facebook alone has attracted more than 950 million users (Socialbakers 2013). The average Facebook user creates 90 pieces of content every month. That translates into approximately 30 billion pieces of content created by the estimated 600 million active users per month (McKinsey 2011). The number of registe-

red Twitter users is estimated to have reached 500 million in late February 2012 (Twoplog 2012). Google+ has also crossed the 500 million registered users mark (Google+ News 2012). Most users visit these SNS for information and entertainment. Indeed, when we think of UGC, we most often think of entertaining texts or videos. However, there is also a more serious side to what can be achieved by UGC. One of the most prominent examples is Ushahidi. The word Ushahidi means 'testimony' in Swahili. The project was originally conceived as a way to track violence in Kenya during the post-election fallout in 2008. Back then, an ad hoc website was installed to map incidents of violence and peace efforts in the country based on reports by citizens via the web and their mobile phones. In the following years, the project has evolved into a focused organisation with supporters in Europe, South America and the US. Ushahidi is effectively lowering the barriers to crowdsourcing information quickly and with qualified location data. It builds on mobile phones as both a means to sending and receiving information about incidents. Today, organisations and activists around the world use the platform as it is easy to access and use (Ushahidi n.d.). For instance, the platform has helped to report pollution by the BP oil spill in the Gulf of Mexico as well as to coordinate help in the aftermath of the earthquake and following tsunami in Japan. Independent from the task, Ushahidi's objective is to capture information immediately in its context and disseminate it effectively.

Social Networking in China

On the whole, the Chinese cannot access Facebook or Twitter. However, they seem to be even more social media savvy than people in other parts of the world: consumers in China spend 46 minutes per day on SNS compared with an average of 7 minutes per day in Japan and 37 minutes per day in the US. A fair part of the success of SNS can be attributed to the early adoption of Instant Messaging (IM) services in China with QQ by Tencent Holdings (McKinsey 2012). With the launch of the QQ phone by HTC in 2011, which enables quick and direct access to the service anywhere, the network has gained additional pace. In the third quarter of 2012, there were 783.9 million active users on the QQ IM service peaking at 167.3 million people being online simultaneously (Tencent 2012). Thus, it is not surprising that the firm's Qzone SNS is one of the most popular sites in China. Other popular SNS include Sina Weibo

(similar to Twitter) and RenRen (similar to Facebook). However, China is possibly unique in how this perceived immediate contact of so many people across such great distances is actually tightly controlled by government regulators. Both the government and service providers employ automatic and human filter systems such as keyword controls. Furthermore, the Chinese government reserves the right to shut down any internet service at its own discretion (Elmer 2012). Nonetheless, connectedness through online networks has already brought some changes into China. Given the ability to record evidence of official misbehaviour and share this evidence on SNS, public outrage about such misconduct has in some instances become quicker and more pronounced despite the control mechanisms (Göbel & Ong 2012).

Both SNS and Ushahidi draw their success from the perceived immediacy of their UGC. This perception is based on the idea that connectedness via data streams is per se unbiased and direct. Paradoxically, what SNS actually do is mediate UGC. Their service is not to transmit, but to facilitate UGC. Through their structures, protocols and interfaces, they shape UGC. They give it format and context as well as directing users towards the intended use of it. Every platform carries a specific branded meaning in the social practices of everyday life (van Dijck 2012). Thus, connectedness is turned into a well-defined service that can be easily consumed. While this may be deceptive in some sense when it comes to personal relationships, it is exactly the ease of use that renders UGC so powerful in the context of projects like Ushahidi.

(Im)partial Connectedness

As the communication landscape gets denser, more complex, and more participatory, the networked population is gaining greater access to information, more opportunities to engage in public speech, and an enhanced ability to undertake collective action.’ (Shirky 2011)

The (im)mediate connectedness digital networks offer is a prerequisite for the (im)partial connectedness they are able to offer. While it is true that SNS integrate UGC into their respective formats, for example mediating it by how it is shared, they are usually impartial regarding what is shared. Naturally, certain minimum requirements have to be met in terms of sexually explicit, radical or spam content as too much of this would severely disturb the user base and therefore undermine the business model of SNS (van Dijck 2012).

In general, however, networks facilitated by digital technologies and in particular SNS enhance freedom of speech. Today, anyone can participate in political and social debates. While lots of this interaction takes place on desktop and laptop computers in developed countries, the mobile phone is the main access method to SNS in developing countries. Political and social discourse is therefore less limited to small elite circles.

The recent revolutions in North Africa and the Middle East have often been tagged as Facebook and Twitter revolutions. During the so-called ‘Arab Spring’ or ‘Jasmine revolution’, SNS and immediate connectedness via mobile phones have enabled large parts of the population to speak their minds about the regimes and organise protests against them. While this is true, one has to be careful not to revert to Western techno-utopianism, which has shaped the beginnings of the ICT for development (ICT4D) movements. The role of technology in these revolutions is that of a facilitator and amplifier. Ultimately, people not technology overturn regimes.

This role of technology and in particular mobile technologies has also been witnessed long before Facebook and Twitter. Political transition processes in the Philippines exemplify this. During the 1980s, community radio in the Philippines helped to overthrow

the Marcos regime (Jallov 2012). In 2001, Filipinos forced President Estrada to resign. Internet use in the Philippines was meagre at this time, but mobile phones were already widespread among the population. Mostly by passing on text messages, 700,000 demonstrators gathered in Manila demanding the resignation of the President. These text messages apparently did not originate from an official source or any type of mailing list, but rather started from within people’s personal networks (movements.org n.d.; Adelman 2004).

Modern SNS, however, allow people not only to communicate with each other and organise protests, but also to take agency as citizen reporters producing UGC illustrating their personal experience of events. The recent Arab Spring movement is without doubt the most prominent example of the power of UGC on SNS as regards political impact. Here, SNS, in particular Facebook and Twitter, offered impartial platforms to people where they could post content that was not shown on other state-controlled media channels. Surpassing filters of state control and thus being able to report acts of violence or repression has enhanced freedom of speech in these countries and elsewhere.

As a result, users can take social and political agency; however, they also have to take responsibility for evaluating and interpreting the content generated by other users. What content can be trusted? When was the footage recorded? Where was it recorded? Usually, no one has carried out fact-based checks on the information or background checks on the sources (Attingsberg 2012). This is why there is still an increasingly important role for journalists and mass media. It is they who give power to UGC as they filter, confirm and distribute it. UGC has thus changed the role of the journalist as the flow of information provided by citizen reporters on Facebook and Twitter cannot possibly be produced by individual journalists on the ground. Without journalists and media though, UGC is unlikely to reach and convince anyone outside a relatively limited circle of already well-informed protesters. In sum, networks based on digital and mobile technologies provide largely impartial platforms for ultimately partial interests. While social and political movements may start by the interaction of a few, SNS have the unique ability to connect minds thinking alike quickly. A sense of collective identity can form that reassures people that they are not alone (Ndavula & Mberia 2012). Interestingly, as communities grow, interaction reduces. The Facebook and Twitter representations of initiatives with increasing size of the movement often become more and more professional not in the least to attain a certain level of credibility in the media. This often leads to less interaction and a more traditional one-way communication of partial interests (Attingsberg 2012). The way in which political campaigns in developed countries have been using SNS to their advantage exemplifies this. The campaigns run by Barack Obama illustrate how SNS can be used to communicate the interests of a specific political party in a most effective way.

A COMPARISON OF BARACK OBAMA’S CAMPAIGNS IN 2008 AND 2012

Social Media Presence		Campaign 2008		Campaign 2012	
		Obama	McCain	Obama	Romney
 <p>Number of Fans</p> <p>Facebook</p>	2,444,384	627,459	28,764,427	7,123,368	
	<hr/>				
 <p>Number of Followers</p> <p>Tweets</p> <p>Twitter</p>	115,623	4,911	19,528,902	5,082,536	
	262	25	2,004	242	

Although the US do not feature among the countries selected for the present study, there is no other country where mobile technologies and networks have played such a pronounced role in political campaigns. The case of the US is used to illustrate the influence and potential mobile technologies and networks for supporting political campaigns.

Barack Obama’s political campaigns illustrate the power of SNS for politics very well. His engagement in Social Media has brought him a base of currently more than 35 million Facebook fans. Even his first campaign in 2008 heavily built on SNS. He had almost 2.5 million Facebook fans and 115,000 followers on

Twitter. His supporters contributed more than 500 million US\$ to his campaign. Most of the donations were significantly lower than 100 US\$. Equally, SNS enabled him to bring his messages directly to the people. McCain had only around 600,000 fans on Facebook and a meager 5,000 followers on Twitter.

The 2012 campaign illustrates the importance Social Media have gained over the last four years. Obama was able to reach out to almost 29 million Facebook fans, he tweeted to almost 20 million followers more than 2,000 times during the campaign. Romney was less active, tweeting only 242 times to around 5 million followers.

Source: Socialbakers (2012); Quilty (2008)

(Im)material Connectedness

The content that users generate on SNS more often than not using their mobile phones materialises human interaction in a consumable form. As the sections above have illustrated this development has had an impact on how we connect to each other and how we organise. However, mobile and ubiquitous technologies enable networks among devices that no longer rely on a material link such as a cable. Personal area networks of Bluetooth connectivity create intimate links between devices around the individual. Local area networks create through WiFi Internet and inter-device overlaid lily pads of high-speed interconnectivity. Global wireless 3G and 4G infrastructures both support long distance connectivity and the assemblage of personal and local connections into flexibly reconfigurable interaction-spheres. The advent of information technology marrying physical, digital and infrastructural aspects where parts reside in the cloud (or the ground), other parts embedded within walls and streets, and

some parts are carried by individuals, embedded into cloths, mounted to hats and glasses, and maybe even operated under the skin of individuals.

We are in the midst of a significant (im)material transformation of society where paradoxically we come to increasingly rely on digital materiality, which is characterised by both physical and non-physical elements. We are yet to fully comprehend the consequences and our ability to shape such a world. What we do know is that the transformation will not only relate to the way institutions and organisations operate but significantly be a matter of individuals experimenting with new intimate socio-technical relationships. Here the emerging opportunities will create new social practices, which in turn will fertilise the ground for further technological opportunities. Carsten Sorensen’s contribution highlights different facets of this dimension of connectedness in networks and argues for digital material as a unifying characteristic of the 21st Century.



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The Age of Touchable Digits

'The Stone Age did not end because humans ran out of stones. It ended because it was time for a re-think about how we live.' William McDonough, architect
Stones in the Stone Age, iron in the Iron Age, bronze in the Bronze Age, plastic in the 20th century and digits in the 21st century. If we make the rather simplistic mapping of one material uniquely defining the essence of a specific period, then the latter part of the 20th century was to a large extent shaped by replacing expensive materials with inexpensive plastic. As its name indicates, plastic is plastic. It can be shaped, bent, formed, melted and inject-moulded to a multitude of purposes. Whereas a range of new materials are emerging, such as the one atom thick graphene, the 21st century is still very much set to be dominated by a radically more plastic material than plastic, namely the digit. Most poignantly, the most radical aspect of this 'Age of the Digit' was initiated by Apple when they lured customers in their millions to purchase a telephone begging to be touched by a pointing index finger.

Very powerful forces for transformation have come out of merging digital material with user-friendly physical devices, for example smartphones, and communication infrastructures.

Digital materiality carries the promise of innovation and changes to match the impact of other materials through the ages. Combining global digital infrastructures and material products as (im)material connectedness renders the bits tangible (Ishii and Ullmer 1997; Tilson et al. 2010; Yoo et al. 2010). Very powerful forces for transformation have come out of merging digital material with user-friendly physical devices, for example smartphones, and communication infrastructures, such as Bluetooth, WiFi, 3G and 4G. The first wave of digitising music took the manufacturing process from vinyl to 0s and 1s on CDs with dramatic reductions in production costs. As a result, the music industry experienced a massive profit increase (Tilson et al. 2013). For high street stores, the second wave of digital materiality has spelled doom and gloom, for example in the UK Tower Records, Blockbusters, Curries, Jessops and HMV (DigitalInfrastructures.org, 2011a). The digitisation of analogue entertainment in books, music and film has made it possible to remove boundaries for easy distribution of this entertainment through the internet as simple streams of 0s and 1s. Customers can share to the detriment of copyright owners and stores. Platform owners, such as Apple, Google and Amazon, have benefitted from this digital materialisation and dramatically reduced distribution costs and increased global reach. Digital material has a number of radically different properties than other materials. It continues to be editable and open after it is 'manufactured' into products and services. It can be cut up, recombined, edited, distributed and reprogrammed (Kallinikos et al. 2010; Yoo et al. 2012). The short YouTube video 'Charlie Bit Me' of the toddler Charlie biting his toddler brother Harry has been viewed well over 500 million times. However, more importantly the possibilities of digital material have resulted in a wave of creativity where people have created entire new remixes of this video (Yoo, 2012). (Im)material connectedness creates arrangements that at the same time are both fixed and fluid. The impending »

» doom of the internet due to traffic congestion has been predicted several times, yet each time the brink of doom has been averted due to new reconfigurations. The 'anything machines', such as the increasingly similar-looking smartphones, are simply generic platforms on which a global community of developers and users can continue experimenting with new and undiscovered possibilities long after the hardware devices are launched. This generativity means constant discovery of new opportunities for (im)material connectivity. The smartphone with associated app stores forms a highly effective self-service platform for users themselves continuously populating, updating and using apps that makes sense to their lives without any direct intervention from IT support staff.

The current configuration with a few physical form factors hosting individually unconnected apps is only one possible (im)materialisation.

However, the current configuration with a few physical form factors hosting individually unconnected apps is only one possible (im)materialisation. Already now the iPhone ecosystem is producing complements that challenge Apple's 'there's an app for that' mantra. As an example, the Audiobus app (audiob.us) offers a mechanism for stringing together a range of compatible music apps and thereby provides a much richer set of opportunities than provided by each app on its own. A not-so-distant-future may very well see an explosion in such abilities to provide app-integration, thereby providing the user with a replacement to the current set of distinct buttons and instead offering a Rubik's Cube of instant recombination where apps can be reconfigured, recombined and adapted to suit constantly changing user needs and desires (DigitalInfrastructures.org, 2011b).

Such ability to recombine will not remain a software issue only. The expected growth in diversity of devices connected to the internet and to global telecommunications infrastructures, The Internet of Things, provides further possibilities. Interconnecting a variety of sensors, meters and computers in machine-to-machine (M2M) networks allow the automation of a whole range of organisational tasks, such as meter readings or water level monitoring.

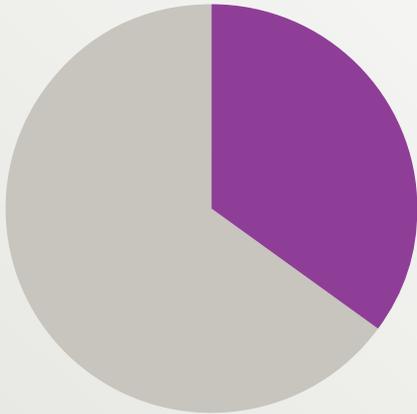
We have so far only seen the initial scratching of the surface of the generative potential of digital materiality.

However, the possibilities are far greater than those currently realised when expanding such M2M capabilities beyond the enterprise. The addition of a range of micro-devices to the current generative smartphone platforms will allow distributed generativity of sensing, metering, interacting and computing beyond the current state-of-the-art technologies. Square (squareup.com), for example, produces a simple card reader that connects to a smartphone and interacts with an app transforming a smartphone to a credit card transaction terminal. Leap Motion (leapmotion.com) is a generic gesture interaction box for computers similar to Microsoft's Kinect for the Xbox.

Such expansion with novel ways of (im)materially connecting can greatly expand what we can do and how we can physically interact with digital infrastructures. We have so far only seen the initial scratching of the surface of the generative potential of digital materiality.

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35%

OF KENYANS HAVE AN ACCOUNT WITH M-PESA, KENYA'S LARGEST MONEY TRANSFER SERVICE.

CURRENTLY, M-PESA HAS OVER

15.8 MILLION

CUSTOMERS.



03 | Innovation

Mobile Networks for Innovation.

Innovation is one of the key drivers of economic growth. Mobile technologies are both dependent on innovation and drivers of innovation. In developed countries, Machine-to-Machine communication offers great potential for future developments across all areas of our lives. They are likely to transform our health system, energy supply and traffic management. In developing countries, mobile phones have created an infrastructure, on which innovators can build novel solutions. For instance, M-Pesa has enabled more than 15 million Kenyans to transfer money for the first time.

Mobile technologies depend strongly on infrastructure. Clearly, we have come a long way since Lars Magnus Ericsson's first 'mobile' phone in 1910, which involved using sticks akin to fishing rods connected to a pair of telephone wires. Innovation has led the way to overcome such impracticalities. Today, mobile devices and mobile data transfers happen (for the most part) seamlessly. Based on these capabilities, mobile devices are considered an infrastructure in themselves on which entrepreneurs and others build innovative solutions.

Although a lot of innovative activity is going on in the background of mobile technologies such as cloud-computing or IPv6, this chapter focuses on the innovations that are happening as a direct result of mobile devices, looking at different aspects of innovations in developed and developing countries. This chapter begins by illustrating the innovation advantages that can be gained from infrastructure developed specifically for mobile devices. It proceeds to elaborate on selected projects based on mobile infrastructure referring mainly to developing countries as the impact of innovative solutions is more pronounced there. The chapter culminates in the question of where the next mobile revolution is likely to originate.

Mobilising Innovation

The way in which mobile technologies depend on and act as infrastructure at the same time is paradoxical. In many developed countries the applications building on the connected nature of mobile phones and their ubiquity result in an ever-increasing demand for quicker data streaming. The infrastructure behind mobile phones has to cope with this demand. Technological progress and bandwidth seem to be directly linked to innovativeness in this environment. In the context of developing countries, a different picture emerges. Here the infrastructure that mobile phones offer is crucial for the success of innovations as it is often the only functioning technology that is actually available to the general population. Often, there is even a lack of the most basic infrastructure such as access to sanitation. Transportation networks suffer from few and poorly kept roads. Communication networks based on fixed landlines either do not exist or do not work reliably.

Thus, the infrastructure created by mobile phones in developing countries is a major part of the innovation ecosystem. Standards and platforms shape this ecosystem. They set boundaries, but can also be generators for new applications. Ian Graham's case study clearly illustrates the role these two building blocks have across developed and developing countries.

BASIC INFRASTRUCTURE IN DEVELOPING AND DEVELOPED COUNTRIES

	 Improved sanitation facilities (% of population with access, in 2010)	 Road density (km of road per 100 sq. km of land area, in 2010) ¹	 Roads, paved (% of total roads, in 2009) ²	 Mobile phone subscriptions per 100 inhabitants (in 2010)
Kenya	32	11	14	62
Egypt, Arab Rep.	95	14	89	87
India	34	125	50	61
China	64	42	54	64
Germany	100	180	100	127
United Kingdom	100	172	100	131
Italy	n.a.	162	100	155
Spain	100	132	99	112

Mobile phones represent perhaps the most widespread and versatile infrastructure in most developing countries. Often more people have access to a mobile phone than to a toilet. Equally, the structure and quality of roads is generally poor making travel difficult. Thus, communication is critical.

n.a. = not available

¹ road density data for India refers to 2008, for Italy it refers to 2005, for Spain it refers to 2007

² Share of roads paved data for Italy and Spain refers to 2003

Improved sanitation facilities (% of population with access)

Access to improved sanitation facilities refers to the percentage of the population with at least adequate access to excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta. Improved facilities range from simple but protected pit latrines to flush toilets with a sewerage connection. To be effective, facilities must be correctly constructed and properly maintained.

Road density (km of road per 100 sq. km of land area)

Road density is the ratio of the length of the country's total road network to the country's land area. The road network includes all roads in the country: motorways, highways, main or national roads, secondary or regional roads, and other urban and rural roads.

Roads, paved (% of total roads)

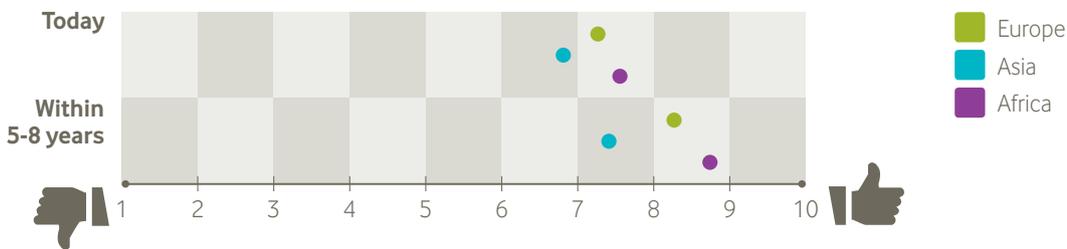
Paved roads are those surfaced with crushed stone (macadam) and hydrocarbon binder or bituminized agents, with concrete, or with cobblestones, as a percentage of all the country's roads, measured in length.

Source: World Bank Data (2013)



WHAT THE EXPERTS SAY ...

Mobile technologies are one of the key drivers of innovation.



Scale: 1 = strongly disagree; 10 = strongly agree

Source: IW Consult (2013) Expert Survey among Vodafone Country Managers

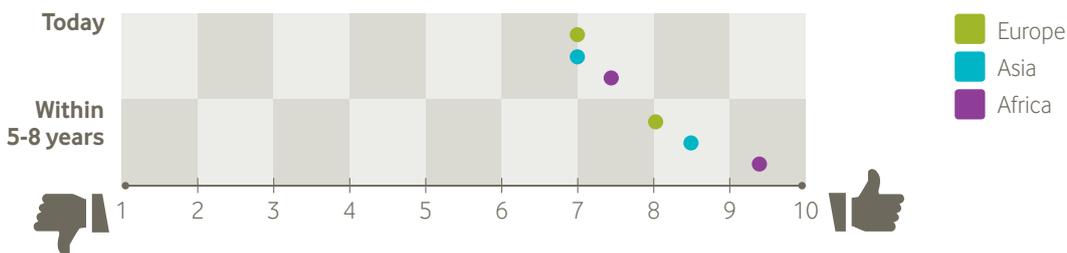
New businesses (entrepreneurs) in your country frequently build on mobile technologies.



Scale: 1 = strongly disagree; 10 = strongly agree

Source: IW Consult (2013) Expert Survey among Vodafone Country Managers

Mobile technologies play a significant role for the development of new services in your country.



Scale: 1 = strongly disagree; 10 = strongly agree

Source: IW Consult (2013) Expert Survey among Vodafone Country Managers

The experts in our survey concur in their assessment of the relevance of mobile technologies being one of the key drivers of innovation today and within the foreseeable future. They all predict that mobile technologies will become even more important

for innovations in the future. In line with the insights gained in this chapter, it is not surprising that especially the African experts expect many service innovations to build on mobile technologies within the next 5 to 8 years.



Dr. Ian Graham

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Standard Flexibility, Flexible Standards

For the last ten years, my research has followed the international standardisation of mobile telecommunications from 2G to 3G and now to 4G. This has been a process of steady international convergence towards single global standards. I might therefore argue here that thinking about national differences in mobile communications use is increasingly less relevant. However, I have also been researching how the flexibility increasingly embedded within standards combined with the growth of open innovation, open source software and open data have allowed new players to enter the innovation system. These changes have lowered the barriers to innovators everywhere, but I argue that their effects are uneven, so rather than seeing convergence in mobile usage we may start to see increased localisation and national idiosyncrasy.

Standardisation has underpinned this global convergence of mobile telephony.

A few years ago I climbed Kilimanjaro in Tanzania. When I finally dragged myself to the top of Kilimanjaro, just as the sun was rising over the plains below, instead of the solitary moment of quiet reflection I may have been hoping for, I found a crowd from all round the globe using their mobiles to update their Facebook status, upload pictures to Flickr and call their friends in the bars of Melbourne, eating breakfast in Milan or fast asleep in New York. Like global cosmopolitan commuters they could shout 'I'm on the mountain ... I'll be home soon'.

Standardisation has underpinned this global convergence of mobile telephony, with LTE promising near-universal roaming if you have the multiple frequency bands on your phone and the credit in your account.

Behind the standardisation of the connection lies internet standardisation. We expect to go anywhere in the world and access our internet voice services, email and websites. Superficially, all of this standardisation is flattening out variations between countries: we can almost imagine a world where everyone is on their smartphone tweeting away while playing Angry Birds. However, there is a standardisation paradox in mobile telecommunications. The standardisation of the internet, mobile telecommunications and the devices connected to them builds into them flexibility about how they are used. To gain international agreement for global standards requires that they can accommodate almost everything anyone can imagine them being used for and device designers do not want to constrain potential applications. In the early days of programmable handsets, programmers had to work for either the handset manufacturer or for a service provider developing applications to differentiate themselves from competitors. Unsurprisingly, the rate of innovation was slow. Independent hackers were developing home-brew applications for jail-broken phones, but this was a subversive niche. This model of tightly controlled development broke down with the launch of the iPhone by Apple in 2007, or more particularly Apple's creation of the App Store and their supply of Xcode to independent developers as a low-cost development environment. With these changes the barriers to developing and supplying applications to run legitimately on mobile devices was lowered, with anyone with programming skills now having the means to develop apps and a channel to supply them to users. The barriers were further lowered by the Open Source software movement allowing code to be adapted and reused, and by cloud computing services, like Microsoft's Azure and Amazon's EC2, making it easy to start services at a small scale and expand if demand took off. The model of low-cost support for software development and accessible channels to market pioneered by Apple has now been followed for Android and Windows phones. This has led to an explosion in innovation, with hundreds of apps per day being added to Apple's App Store. Developers can follow their hunches about a new app.

Usually they will be wrong, often they will be delusional, but by luck or inspiration some apps will become successful. We teach students that product innovation should be a highly rationalised process, with a detailed understanding of customer needs feeding through into the design of products and services, but it is hard for large corporations to analyse all the possibilities in this maelstrom of creativity.

This democratising of innovation lowers the barriers to innovation for all, including developers in emerging economies.. There are vibrant app development sectors of small firms in emerging economies across Eastern Europe, Africa, South America and the Indian sub-continent. These sectors have pools of programmers and cost advantages in providing programming services for Western clients. But as low-cost smartphones become more widely used in these countries, these developers are becoming reservoirs of human capital that can turn to developing apps and services for their local markets. This may mean they have the local knowledge to compete with foreign developers or it may be that the local services do not need all the complexity of the global services. The term 'frugal innovation' is used to describe the development in emerging economies of products with fewer features than in the developed world, but priced more competitively. In some services there may be a convergence to global brands providing global services, but in other areas we will see local services, often using the global infrastructure of cloud services, built using the global development tools and drawing freely on business and service models that are successful elsewhere. This is an example of what anthropologists term 'hybridity': instead of global applications flattening out diversity we are seeing local developments mingling the local with the global.

If I ever climb Kilimanjaro again I know that at the summit I will be able to access all my mobile internet services, and down below in Arusha people will be using a mix of Tanzanian, African and global services.

Poor general infrastructure in developing countries comes hand in hand with poor access to institutions of all kinds that people in developed countries are used to. The following sections highlight two main areas where innovation-based mobile phone infrastructure has resulted in the shaping of institutions previously unavailable or only poorly available to the local population. The first section looks at the case of M-Pesa in Kenya as one of the most successful examples of mobile banking while the second section describes how mobile phones create and support health services in developing countries.



Got Some Change?

Mobile technologies can't make us richer, but obviously they have brought huge change into the pockets of many people who, for the first time, can now pay their bills in a cashless environment. In fact, in some countries they have fundamentally changed the way people interact with money. Especially in countries where there is a limited banking system, trust in official institutions is low and a larger portion of the population actually lives outside the system. One of the most well-known examples of a successful m-banking initiative is M-Pesa, which started in Kenya.

What is M-Pesa?

The mobile money transfer service M-PESA has become so natural and useful to most Kenyans that daily life without it is hard to imagine. M-PESA is used by over 15 million people to deposit, withdraw and transfer money via their mobile phone. The service is also used for bill payment ('M-PESA pay bill') and purchase of goods ('M-PESA buy goods'). M-PESA also allows subscribers to transfer money from their bank account and to M-PESA and vice versa. The service is entirely run by Safaricom.

M-PESA was introduced in 2007 by Safaricom, Kenya's biggest mobile operator was not conceived as a commercial mobile money service, but as a microfinance project, funded by Vodafone and the British government. Safaricom (2013) reported that within only one year of its launch, nearly 2 million people had opened an M-Pesa account, and more than 2,000 small shops or petrol stations had registered as so-called M-Pesa agents. In June 2010, the company reported more than 10 million registered customers. Two years later, the number of registrations reached a remarkable 14.7 million (March 2012), which represents about 35 % of Kenya's population. Currently, M-PESA has over 15.8 million customers.

How Does it Work?

The M in M-Pesa stands for mobile, while Pesa is the Swahili word for money. The simplicity of this term is reflected by the simple usage of the service. To use M-Pesa, customers have to open an account at an M-Pesa outlet. These outlets or agents, usually a

small shop, petrol station or chemist, can be found all over the country and, most importantly, in rural areas. The registration procedure to become an agent is quick and non-bureaucratic, so it did not take Safaricom long to build up a country-wide network. According to its latest annual report, the network has around 40,000 agents.

Opening an account usually takes two to three minutes. Once the account is opened (and the customer is registered with Safaricom), he or she is able to 'cash-in', i.e. to deposit a sum of money in the M-Pesa account. The value of the cash is stored within the system and becomes virtual or 'e-money'. It can now be (a) withdrawn i.e. transformed into cash at any time and at any M-Pesa agent ('cash-out'), or (b) sent to a third party (registered with M-Pesa or not) via SMS and a PIN number. The recipient of the message can collect the money at the nearest agent, presenting the message and code number. The transfer functionality has enabled younger family members in particular, who have moved to bigger cities in order to earn their living, to send money to their relatives in remote, rural parts of the country.

Why is M-Pesa so Successful?

The majority of Kenya's population does not have access to financial services such as bank accounts as most people cannot afford banking fees e.g. account maintenance charges. Also, most people are not able to save sums of money that would be worth being deposited in a bank account. This means that prior to the introduction of M-Pesa, nearly all financial transactions were cash only. Individuals, including small traders or owners of small companies, had to travel or use parcel transfer services in order to pay or transfer money. Often these transfer services were conducted by 'matatus', privately owned minibuses that represent the most important means of Kenya's intra- and inter-city public transport. Money would also be sent through friends or relatives. The nature of these transfers was highly informal and insecure. The demand for a remittance system enabling safe money transfer was strong.

The second factor for M-Pesa's success is Kenya's mobile phone penetration. Kenya is one of the developing countries in which the mobile phone has become the most frequently used means of communication – the landline infrastructure, if ever fully in operation, has become virtually obsolete. In 2011, the ITU (2012) registered 67 mobile phone subscriptions per 100 inhabitants. The reasons for this high penetration are simple. First and foremost, mobile phones enable a large proportion of the population to communicate across long distances. They offer much better access and are more affordable than landline telephony. Furthermore, long commutes that are typical for most Kenyan workers create a natural demand to stay in touch with family and friends. In sum, mobile phones have thus become a technology that people always carry with them and trust.

Trust in the Technology is One Thing, Trust in the Service Another

The fact that Safaricom is Kenya's largest mobile service operator with a market share of almost 64 % (CCK 2012, measured by

the number of subscriptions in September 2012) significantly supported the success of M-Pesa. Safaricom not only benefits from a good reputation as a trustworthy and reliable operator, but it also has a strong corporate brand associated with progress and a 'modern Kenya'. The company's marketing has been able to communicate and manifest the image of the 'modern Kenyan', who is independent, self-reliant and at ease with typical daily tasks such as paying bills.

Furthermore, the M-Pesa service adapts to the living conditions of the local people. To sign up, people are only asked to present their ID – other documents such as proving creditworthiness are not needed. There is no registration fee, there are no monthly charges and, most importantly, there is no minimum sum that has to be deposited. The account balance can be zero and the service is still at the customer's disposal. Last but not least M-Pesa enables people to safely store money which they previously had to carry in cash. The danger of losing money by being mugged – a real and valid concern for many people – does not exist anymore.

Transferring Money, Transforming Behaviour?

Although it was launched as a mere money transfer and payment system for those outside the formal banking system, M-Pesa to some degree is perceived as a provisional bank account. Evidence suggests that after 'cash-ins', many customers do not touch their e-money for comparatively long periods of time, which could be interpreted as them actually saving the money (despite the fact that no interest can be earned). When asked why money was stored, customers explained that while travelling they preferred to store their money in their M-Pesa account for safety reasons. Both of the above observations indicate a shift in behavioural patterns towards future planning and responsibility when dealing with money.

M-Pesa stands out from other m-banking projects for several reasons: it is long-lasting and sustainable; it has a huge impact on people's daily lives; it has an educational impact and triggers changes in behaviour; and it helps 'unbanked' people to become familiar with banking mechanisms, thus to a certain extent enables them to participate in society. M-Pesa's potential to transform is still growing as Safaricom recently launched a follow-up product in cooperation with Vodafone and the Commercial Bank of Africa (CBA): M-Shwari, an interest-bearing savings account offered through M-Pesa. Customers can register for the new service via their Safaricom account and deposit their savings, however modest they may be, in the new CBA-based M-Shwari account. They can also apply for mini loans, depending on their M-Pesa transactions and savings history, with eligibility determined by CBA. The loan is sent to them as e-money via their M-Pesa account. Both the possibility to earn interest and to get a loan can help people who never had bank accounts prior to the advent of M-Pesa to become part of the formal economy. Michael Joseph, Director for M-Pesa within Vodafone Group, says:

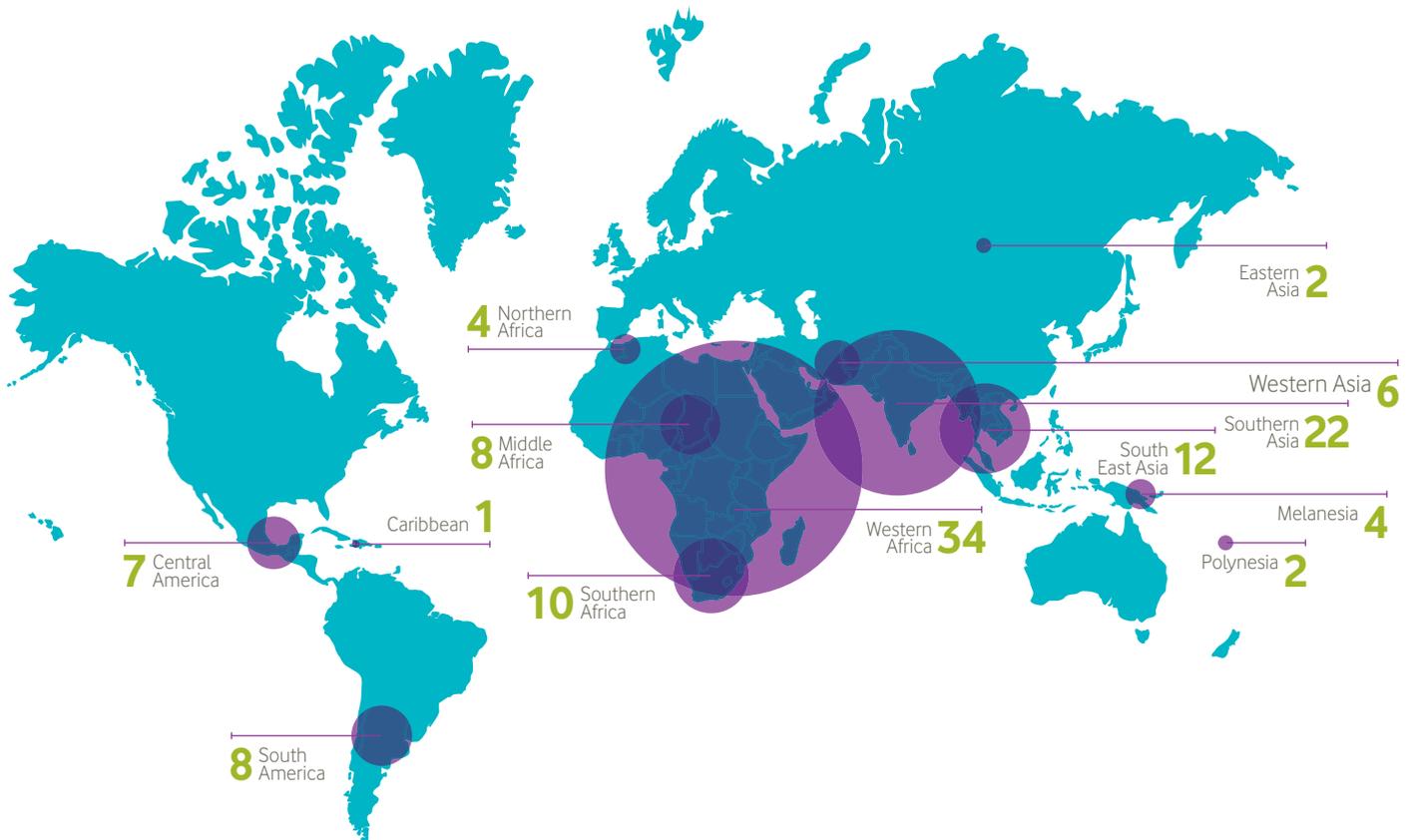
M-Shwari is a transformational service: saving is no longer the privilege of an elite; all Kenyans can now save, even the smallest amounts and at their own pace. M-Shwari creates a safe environment for customers to borrow small amounts and links the amounts of credit available to the ability to save. Through their M-Shwari savings account, M-Pesa customers are empowered to manage their financial lives. (Vodafone 2012)

However, M-Pesa is not the only mobile payment system based on the infrastructure provided by mobile phones. GSMA (2013) currently lists 156 live deployment projects of mobile money

solutions around the world. There are 110 more planned for the near future. From the map, it's obvious that the vast majority of these projects are deployed in developing countries, where they often introduce a rudimentary banking system for those who previously had no access to a similar institution. In developed countries, well-functioning banking systems exist with credit and debit cards being a reliable, secure and accepted mobile payment system. As consumer habits and strong competition from banks are difficult to overcome, mobile phone payment seems less likely to achieve a status similar to developing countries in the developed world within the near future.

NUMBER OF LIVE AND PLANNED MOBILE MONEY SERVICES FOR THE UNBANKED

Regions



Source: Mobile World Live



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Kenya: 'Silicon Savannah' in the Making?

Kenya has emerged as a leader in information and communication technologies (ICTs) in Sub-Saharan Africa and the country is already being touted as the next 'Silicon Savannah'. In addition to large international firms such as Nokia and Google, which are setting up offices in Nairobi, local start-ups have also been expanding rapidly, seeking to offer services to Kenyan customers through mobile phones. The government has been actively supporting the sector as one of the key drivers of economic growth in the future. But underlying Kenya's success are also other factors, in particular those that have been driving the emergence of the local technology scene.

Kenyan technology start-ups have greatly benefited from the growth of the local innovation environment.

Kenyan technology start-ups have greatly benefited from the growth of the local innovation environment over the past three to four years. Several innovation hubs have been established, led by the iHub and followed by others, such as the m:lab, the Nailab and the 88mph Garage. These innovation spaces were initiated by visionary entrepreneurs and technology developers with support from foreign investors or donors. They offer a space and infrastructure for developers, mentorship from more experienced entrepreneurs, and opportunities to interact with investors, fellow developers and potential business partners. They have also helped to give Kenya's technology scene visibility and provide a contact point for foreign visitors.

Access to funding for local start-ups has also been improving. Deloitte's (2012) East Africa Private Equity Confidence

Survey Kenya found that the country has been attracting investor attention 'as a hub for ICT innovation'. Much of the interest has come from non-Kenyan investors and in particular so-called 'angel investors' who are willing to support new ideas and talent. The Savannah Fund, for instance, was launched in mid-2012 as a seed capital fund specialising in medium-sized investments in early-stage technology start-ups in sub-Saharan Africa. Seed funding for Kenyan entrepreneurs is also available through numerous competitions, such as Pivot East, IPO48, Apps4Africa, Google Apps Developer Challenge and the Orange African Social Venture Prize.

In addition, Kenya's ICT sector can draw on a growing pool of human resources and a young generation that is increasingly willing to take the risk of setting up their own technology companies. Training opportunities are expanding, notably through eMobilis, the first Mobile Technology Training Academy in Sub-Saharan Africa. The academy was established in 2008 and teaches both IT and business skills to give young people the skills and confidence to start their own company. The graduates are highly motivated by seeing other technology companies succeed, such as Facebook and Instagram internationally and local start-ups such as Ushahidi, Kopo Kopo or M-Farm.

The customer base for mobile phone-enabled services is growing rapidly.

The ICT sector has also benefited from the success of the mobile banking service M-Pesa, one of the most successful m-payment services in the developing world (as discussed earlier in this chapter). Through its widespread adoption, M-Pesa has helped to prepare the ground for other mobile

phone-enabled services in Kenya by familiarising many Kenyans with the use of their mobile phone for non-call-related services. M-Pesa (and other m-payment services) also provides supporting services for other companies offering m-services that require monetary transactions. Moreover, the agent network can be used to market other technologies, such as the first Intel-powered smartphone, which is being sold exclusively through Safaricom to take advantage of the widely available and highly frequented Safaricom outlets. The customer base for mobile phone-enabled services is growing rapidly, not least driven by Kenya's young and increasingly educated population. The youth are tech-savvy and interested, exemplified by the fact that Kenyans are the second-most prolific tweeters in Africa after South Africa. As the Kenya Technology, Innovation & Startup Report 2012 (Afrinnovator 2012) notes, 'never before has the digital consciousness of the Kenyan people been as alive as it is today'. These customers can be reached through an extensive and increasingly fast mobile network. Access to mobile phones in Kenya is already relatively high by regional standards and continues to improve. The mobile network covers more than 85 % of the population thanks to a growing network of fibre-optic cables. 3G networks are available (though do not always perform well) and plans to roll out LTE are also in place.

However, Kenya's ICT sector is not without its challenges. Many start-ups struggle to move from initial idea to scale. Access to mid-level finance that would allow them to expand remains a problem. Investors are still not sufficiently aware of investment opportunities or lack the information to weed out the promising from the bad start-ups. Kenyan investors have so far not shown much interest in local tech start-ups, preferring safer and often bigger investments that bring higher returns.

In addition, many local start-ups are still learning to understand and respond to their customers' needs. At times developers appear too focused on building the next big thing or pitching their idea at one of the numerous competitions. Much hope is pinned on earning big money by developing apps and selling them via the app stores. As a result,

m-services risk turning into technology solutions, rather than solutions that address a particular demand. Moreover, while the IT infrastructure is fairly advanced by regional standards, it continues to face problems. Access to the mobile network and internet has at times been disrupted by damage to the sea cables and power cuts continue even in Nairobi. In rural areas, access to smartphones, the internet and electricity remain very low, thus limiting the services that can be offered to rural customers.

Kenya is on the right track to firmly establishing itself as the main ICT hub of East Africa and one of the leading ICT centres on the continent.

However, it is also important to stress that it is still early days for Kenya's technology scene. Silicon Valley was not built in a day either. Start-ups need time to grow into full-scale businesses and investors need time to build sufficient trust in the viability of the sector. But Kenya is on the right track to firmly establishing itself as the main ICT hub of East Africa and one of the leading ICT centres on the continent.

Information is Everything

Ensuring the good health of citizens is clearly one of the most important and also one of the most expensive tasks for any country. In the OECD, health expenditure has continuously increased over the last 50 years, tending to grow faster than GDP. In 1960, health expenditure accounted for less than 4 % of GDP on average across OECD countries. This figure increased to almost 10 % in 2009. Among the OECD countries, health expenditure as a percentage of GDP is highest in the United States (more than 17 %) followed by the Netherlands (12 %) and France (11.8 %) (OECD 2011).

The bulk of these costs originates from treatments for the final stages of severe diseases that often could be prevented had the illness been spotted earlier. Logically, the best way to reduce costs for the health system is to keep people healthy rather than treating them in ever more complex ways, ultimately following the theory of prevention being better than cure. This is where innovative solutions that build on mobile phone infrastructure are likely to make the biggest impact as they can gather and spread relevant information.

The challenges health systems face vary significantly between developed and developing countries. In developed countries, health systems have to find ways to effectively ensure healthy and comfortable living for ageing societies. Gathering information on the well-being of patients in a non-intrusive way is essential to tackling this challenge. Machine-to-Machine (M2M) communication can provide such seamless health data that can enable more attentive treatment. In developing countries, health systems are often under-resourced or non-existent, especially in rural areas.

As with the banking example above, we find that in developed countries generally well-functioning institutions exist that are able to inform, support and treat people irrespective of where they live and how well-off they are. In developing countries often a reliable and trustworthy health system is missing in rural areas. Thus, it is likely that people turn to traditional healers or rely on word-of-mouth information that is often shaped by local myths and social norms. Although steps have been taken to improve this situation and integrate traditional healers into the health system, their qualifications and treatments are considered suspicious at best by most qualified medics (Ndhlalambi 2009). Spreading trustworthy information and enabling a rapport between people and qualified medics is necessary for the prevention and timely treatment of epidemics as well as minor diseases. The mobile offers a direct, intimate and cheap way to spread information and establish a rapport.

The following sections introduce two innovations in mHealth. The first focusses on M2M communication in developed countries and its potential impact. The second describes a successful

project in South Africa that aims to tackle HIV and TB by providing information and guidance.

Machine-to-Machine Communication in Healthcare

M2M communication, which utilises body sensors, can deliver seamless data regarding individuals' well-being. Pooling and analysing these data can lead to a much improved understanding of diseases. Consequently, it is likely that new treatments can be developed and doctors can respond more quickly to patients' needs (Chen 2012). M2M communication is particularly useful when it comes to Ambient Assisted Living (AAL) for the elderly. Small inconspicuous and easy to use devices ensure tele-monitoring and significantly improve peace of mind and therefore quality of life as people get older.

In addition to body sensors, M2M communication offers advantages such as continuously monitoring the state of delicate healthcare items such as blood bags or medicines. Physical data such as humidity, temperature, pressure or radiation can be measured during transit and logged on a device that accompanies the item. When the relevant measurements get close to their pre-set limits, an alarm can be generated, for instance, when a blood bag gets too warm, an alarm is set off. As a result, wastage and costs can be reduced and quality within the health system can be ensured (Jain 2012).

While these data are likely to have a positive impact on healthcare, M2M communication faces significant challenges in terms of infrastructure requirements. First, devices need to be developed and accepted by patients. Second, it is likely that a new wireless spectrum will have to be allocated for these applications. Although minimal data are transferred by a single device, the potential number of devices and the continuity of the data stream are likely to be too much to handle within the existing infrastructure (Chen 2012).

Project Masiluleke

Launched by a consortium of partners (among others MTN and Nokia Siemens Networks), Project Masiluleke builds on the mobile phone infrastructure to raise awareness of HIV and TB among South Africans. It actively encourages people to get tested for these diseases and also supports individuals who have contracted either disease with message and call-centre services. HIV is still heavily stigmatised in South Africa. Thus, the immediate and intimate contact a mobile phone offers seems to be better suited to the issue than public campaigns, which have generally failed to improve conditions in the area.

Taking advantage of the high penetration rate of mobile phones in South Africa, millions of text messages were sent to South Africans. The 'Please Call Me' messages encouraged people to contact a network of HIV call centres. If required, they were given precise and above all trustworthy healthcare information, for example, how to deal with their infection or protect themselves from contracting HIV. If testing or treatment were necessary, they were referred to the nearest health centre.

Being able to contact a large proportion of the population direct-

ly helped the project's success. Calls to call centres increased by more than 300 % and about 1.2 million calls could be directly linked to the 'Please Call Me' messages. In particular, messages in the local Zulu language performed well. Having understood the relevance of intimacy when dealing with sensitive issues like HIV, the project later introduced HIV testing kits for home use supported by mobile phone counselling (Vital Wave Consulting 2009).

What's the Next Big Thing? And Where Will It Come From?

Thus far, this chapter has highlighted the role that mobile phones play in innovations. They are the only set-up that allows immediate and intimate contact with almost anyone in developed as well as developing countries. Standards built on top of this infrastructure can further enforce the innovative capacity of the mobile environment as Ian Graham's contribution illustrated. However, an important distinction between developed and developing countries emerges from the insights gathered here. While in developed countries existing institutions like the health system or energy supply become more and more mobile, for instance by utilising M2M communication, in developing countries innovations building on the mobile phone infrastructure have introduced institutions like banking or trustworthy health information for the first time.

This leads us to the question, what is the next big thing and where will it come from? The race between developed and developing countries seems to be more open than ever before. Obviously developed countries are still in the lead when it comes to R&D capacity and infrastructure. However, the R&D capacity in developing countries is steadily improving and the role that mobile phones play in people's lives makes it more likely that they will come up with innovative solutions. It therefore seems plausible that perhaps the next big thing in mobile innovation will originate from someone other than the usual suspects ...

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IF THE NUMBER OF **MOBILE PHONE SUBSCRIPTIONS** PER 100 INHABITANTS RISES FROM

20 TO 60

THE AVERAGE **VOICE AND ACCOUNTABILITY INDEX** OF THE COUNTRIES SAMPLED INCREASES



04 | Social Development

New Connections, New Opportunities.

Qualitative and anecdotal evidence suggests that mobile phones have made an impact on social development. We investigate this relationship using econometric analysis based on a broad sample of countries and years for three major building blocks of social development: (1) voice and accountability, (2) gender inequality and (3) education. We find statistically significant effects in line with the expectations drawn from the literature reviewed for the other chapters of this study. All three models indicate a stronger effect of mobile phones on social development in developing countries compared to developed nations.

So far, this study has generally presented qualitative and sometimes anecdotal evidence on the impact that mobile technologies have had on our lives. While the insights gathered from the literature have been able to shed light on how mobile technologies have altered our intimate sphere, our idea and the impact of networks as well as the innovation environment, only econometric analyses on the macro-level are able to uncover general linkages between mobile phone adoption and significant developments. This chapter sets out to investigate the linkage between mobile phone adoption and social development, while the following chapter focusses on mobile phone adoption's relationship to economic development.

Social development is a very broad concept. We approach its relationship with mobile phone adoption referring to three specific areas of social development: (1) voice and accountability, (2) gender inequality and (3) education. For all three areas of social development, we find a positive effect of mobile phone adoption. More mobile phone subscriptions per 100 inhabitants correlate with better political participation, more gender equality and higher education levels among the population. The effects are particularly pronounced in developing countries where there is also most potential for positive change in the three areas we investigated.

The chapter briefly discusses the different potential ways in which ICT in general and mobile phones in particular are likely to influence social development. It proceeds along the three areas of social development selected for investigation. First, voice and accountability is discussed mainly in light of the insights gained

in Chapter 2 "Networks" of this study. Gender inequality and education follow drawing from the insights gathered in the chapters on Intimacy and Innovation, but also incorporating specific literature relating to the issues at hand.

The Impact of ICT and Mobile Phones on Social Development

ICT for development (ICT4D) and mobile communication technology for development (M4D) are well established in the social development discourse. However, there has been a shift from a vertical understanding of the role of communication in social development to a horizontal one.

Early approaches to ICT4D and M4D viewed communication primarily as a way to inform people in developing countries, thus bridging knowledge gaps and initiating modernisation. In contrast to this deterministic view of seeing technology as a means to the end of distributing information leading to modernisation, modern approaches emphasise the capacity of actors to develop their own discourses, create, share and negotiate meaning. This approach sees communication as a way to enable people to participate in dialogic processes that emphasise the realisation of human rights (Obregon 2012). Mobile phones as personal devices and enabling direct contact to others support this perspective, especially when they enable people to participate in social networks.

Access to networks and the ability to communicate, facilitated in particular by mobile technologies, have been shown to have five broad types of impact on social development (Yamamichi 2011).

ICT and mobile phones in particular enable **faster and easier information delivery** that is cheap and effective. In terms of social development for instance, relevant health information can be delivered to people in developing countries as we have seen in the case of Project Masiluleke (see Chapter 3 “Innovation”), which provides free and trustworthy HIV and TB advice in South Africa. More importantly within the view of the horizontal communication for development perspective, **information can be easily exchanged via mobile phones and networks can be created.** People can link locally as well as globally to pursue their interests. Such networks can have an influence on people’s empowerment. This has been the case in the movements to overthrow regimes in the Philippines as well as more recently in North Africa and the Middle East (see Chapter 2 “Networks”).

The infrastructure of mobile phones, in particular in developing countries, can help to create a more **transparent and effective public service.** Such improvements can range from simple bulk SMS/text information on governmental issues to the delivery of public services to citizens in rural and remote areas.

More fundamentally, the three effects introduced above can significantly **transform people’s lives** and **lead to decentralisation and empowerment.** With the ability to access and exchange information, people can live, learn and conduct business in different ways. This has the most pronounced effect on people at the Bottom of the Pyramid (BoP), who prior to owning a mobile phone did not have to ability to engage in communication much unless they were willing and able to afford to travel. This may allow them to break the vicious circle of poverty and segregation. Also, mobile technologies defer decision-making processes from centralised institutions to a more local level, thus empowering people and giving them confidence in their own abilities.

However, modern communication technologies like mobile phones and social network sites (SNS) present a double-edged sword. On the one hand, they can be an enabler of self-organisation and self-help processes when started by or involving socially excluded people, transforming weak-tie relationships into effective collective structures of engagement and participation. On the other hand, while there is ample support in the literature for positive effects of communication on development, these positive effects mean that those without access to improved communication are likely to suffer more. This type of exclusion most affects people who are already vulnerable due to various socio-economic reasons (Verdegem 2011).

So far, evidence for mobile phone adoption’s impact on social development is limited to qualitative enquiry. We have for the first time tested three models that provide tentative evidence for the relationship between mobile phone adoption and three central concepts of social development: (1) voice and accountability, (2) gender inequality and (3) education. The following sections elaborate on the econometric models and interpret the results in light of the insights gathered throughout this study as well as in specific literature.

Voice and Accountability

The ‘Voice and Accountability’ measure published by the World Bank can be understood as a surrogate measure for democratic structures and values. As Chapter 2 “Networks” illustrates, connectedness via digital and in particular mobile technologies has recently contributed to the democratisation processes. Our model investigates whether the evidence found in specific countries, such as Egypt or Tunisia, for the role mobile phones play in the democratisation process is generalisable across a wider range of countries and years.

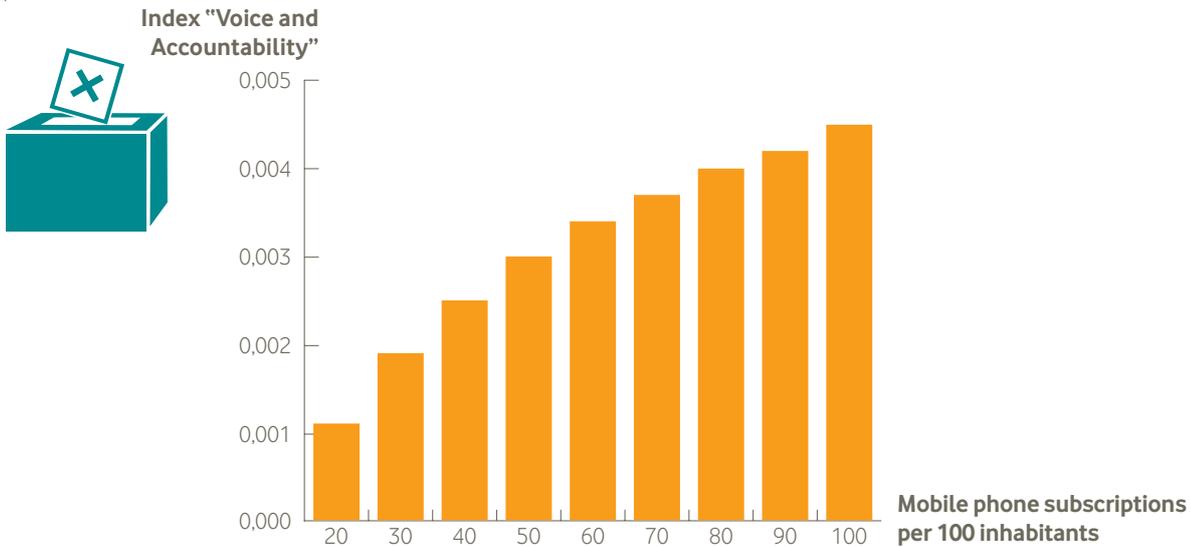
We estimate our model based on data drawn from 202 countries and in varying years between 1998 and 2011. On average, we have data for 12 years per country. The total sample size is 2,429. This enables us to observe the general relationship between mobile phone adoption and democratisation. As many countries featured in the dataset already have long-established and strong democracies, any effect to be found across all countries is likely to be relatively small.

The effect we find in our model has a nonlinear (logarithmic) form. Up to a threshold of about 50 to 70 subscriptions per 100 people, voice and accountability rises with the number of subscriptions. Beyond this threshold, the effect is not identifiable. Consequently, the initial ability to communicate via mobile phones is likely to have an impact on voice and accountability, such as democratisation, while further mobile penetration has little or no effect.

This suggests a clear interpretation: mobile communication correlates with voice and accountability in developing countries where there is still room for democratic structures and values to be established. In developed countries, mobile communication might still have an effect, but not one that is strong enough to be visible in this econometric analysis. For example, in Sub-Saharan Africa the effect of mobile subscriptions on voice and accountability is substantially larger than on average, whereas this is not the case in the EU-27 countries.

Our model investigates the relationship between voice and accountability and mobile phone adoption. Voice and accountability is measured by the World Bank using an index that ranges between -2.5 and +2.5. In practice, however, the countries we have in our dataset range between -2.2 and +1.8 on this index. Mobile phone adoption is approximated by the number of mobile phone subscriptions per 100 inhabitants as provided by the International Telecommunication Union (ITU).

The analysis has some limitations that have to be kept in mind. First, while the effect of mobile subscriptions on voice and accountability is statistically significant ($p < 0.001$), it is not particularly strong. The estimated coefficient has a value of 0.021, which means that for a one per cent increase in the number of subscriptions, ‘Voice and Accountability’ rises one-hundredth of that value. However, considering the number of countries and the time frame of our dataset, our results provide tentative evidence that there is an underlying relationship between the variables. Conversely, with mobile phones fulfilling various



Voice and Accountability: The index is part of the "Worldwide Governance Indicators". It captures perceptions of the extent to which a country's citizens are able to participate in selecting

their government, as well as freedom of expression, freedom of association, and a free media.

Source: IW Consult

functions that are likely to be captured in other variables such as internet use, it is likely that our model underestimates the value of mobile phones. This seems particularly relevant in developing countries where mobile phones are often the main access point to the internet and SNS.

Furthermore, inferring causality from econometric data is never straightforward. Thus, we took several steps to approximate causality from mobile phone adoption to democratisation processes. First, we introduced specific country effects in our model that impede an over- or underestimate the effect of mobile phones due to their state of development. Second, we controlled for annual volatility of the countries in our model. Finally, and most important for approximating causality, we estimated a lagged effect: in our model we relate voice and accountability to the mobile phone adoption rate in the previous year. By doing so, we account for the fact that communication and resulting self-organisation is a process of agency and empowerment that takes some time to evolve.

In summary, our results support the notion that mobile communication aids the development of democratic structures and values.

Gender Inequality

Women and girls are often the most vulnerable members of communities in developing countries. Their access to the outer world is often very limited and they have to cope with numerous hurdles. The most important issues most often stretch only to the immediate survival of their families. Health, personal safety and food are the most pressing concerns. In addition, women

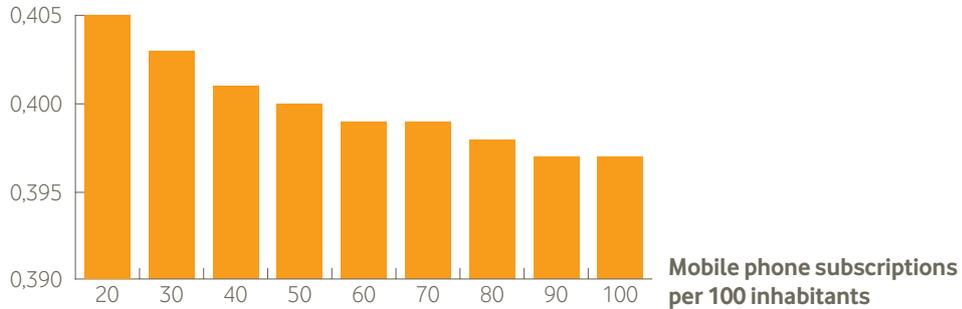
in particular face the challenge of simultaneously managing different roles such as wife, mother and wage earner. In doing so, at least one of their roles is likely to collide with traditional values of the community or their husbands in various ways.

Mobile phones can help with these issues. First and foremost, they can help with the daily lives of women in developing countries. A survey supported by Australian AID and USAID in 2011 (GSMA 2012) highlights the five top benefits of mobile phones for BoP women in four developing countries. Among these five, help in emergencies, reduction of travel costs and finding new job opportunities feature prominently. Chapter 1 "Intimacy" has illustrated a second important function of the mobile phone as regards the empowerment of women. It was highlighted that mobiles enable women to take and successfully manage various roles, in particular taking the (often) new role as wage earner as they are able to take care of their families and especially their children via the mobile phone. This is important as it gives women the opportunity to earn their own income and participate in social interaction above and beyond their household and immediate shopping needs. In addition, mobile phones can empower women with access to trustworthy and quick health information about themselves and/or family who are dependent on them (see Chapter 3 "Innovation" for an example of how health information is spread via mobile phones).

The most important benefit of owning a mobile phone is being able to connect with friends and family. This is also likely to be the most important function of mobile phones when it comes to empowering women. Mobile phones and the access they enable



Index "Gender Inequality"



Gender Inequality Index: The Index reflects women's disadvantage in three dimensions – reproductive health, empowerment and the labor market. The index shows the loss in human development due to inequality between female and male achieve-

ments in these dimensions. It ranges from 0, which indicates that women and men fare equally, to 1, which indicates that women fare as poorly as possible in all measured dimensions.

Source: IW Consult

to social networks have empowered adolescent girl in various countries. With access to communication platforms, they are able to exchange information and participate in the public sphere (Bachan & Raftree 2011 cf. Obregon 2012). Without communication these girls and women would be cut off from public discourse and less able to form ideas about the world outside their immediate livelihoods. Further evidence is provided by Horst and Miller (2006), whose results demonstrate how mobile phones support social networks that help poor women in Jamaica to develop coping strategies.

The model we estimate tests whether these important effects on the individual level can be verified in a large set of countries and across several years. Our dataset comprises 148 countries and the years 1995, 2000, 2005 and 2011. In total, our estimation is based on a sample size of 457 observations. To identify the specific effect of mobile phones, we took the same precautions as in the model reported in the previous section.

The econometric analysis finds a negative relationship between mobile phone adoption and gender inequality i.e. with rising mobile phone adoption, gender inequality decreases. As with democratisation before, we find a logarithmic relationship of the two variables. This indicates that again the most pronounced effects are visible in countries where mobile phones represent the first and more often than not only communication access for women. The effect we find is relatively small albeit statistically significant. This is due to the fact that many other variables are likely to influence gender inequality more strongly than mobile phone adoption e.g. legislation or culture. However, it may also be the case that our model underestimates the effect mobile phones

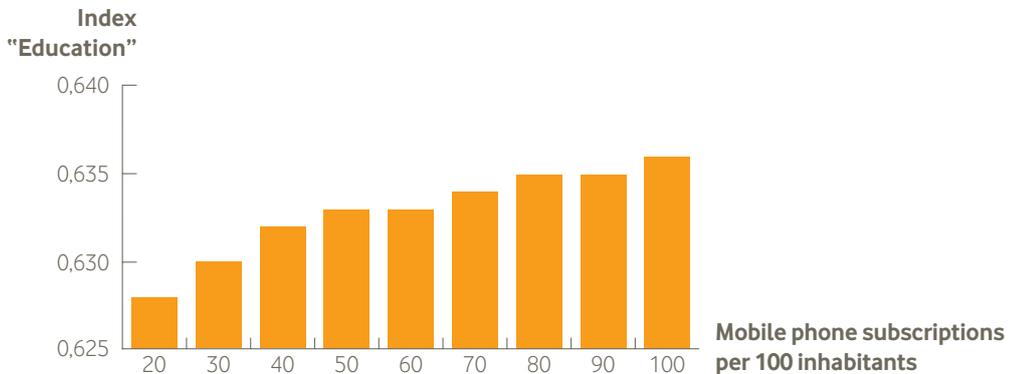
have directly on the livelihoods of women in developing countries as it is most often the (male) head of the family who gets ownership and access to a mobile phone first. Even the sons or brothers of a woman in the household are likely to get a mobile phone before the women in the household get access to it. When they do, the impact of having their own mobile phone is likely to be larger than what appears in our estimate.

Education

Information, knowledge and education can be considered core building blocks of social empowerment. In developing countries in particular, access to education is limited and the effect that mobile phones have on education is likely to be twofold.

On the one hand, mobile phone adoption enables direct access to education. Content and exercises can be delivered via SMS/texts or apps to the recipient, who may otherwise not be able to access any education due to the distance to the nearest institution. Distance learning can be helpful in the context of schooling children and adolescents, but also for supporting learning, e.g. farming among adults. For instance, SMS/texts and mobile phones were used in Manila to employ non-formal education to enhance the delivery of water, sanitation and hygiene information. The project significantly enhanced the learning experience of participants and led to improvements in the livelihoods of people targeted (Ramos 2006).

On the other hand, mobile phones' various other benefits free up time and resources that can be used by people for educating themselves and/or their children. The evidence gathered in this study highlights that mobile phones help to coordinate our lives,



Education Index: The Index is part of the Human Development Index. The education component is measured by mean of years of schooling for adults aged 25 years and expected years of schooling for children of school entering age. Mean years of

schooling is estimated based on educational attainment data from censuses and surveys. Expected years of schooling estimates are based on enrolment by age at all levels of education and population of official school age for each level of education.

Source: IW Consult

improve our interaction in networks and enable new services that potentially facilitate quicker and better information access or service provision e.g. in the case of M-Pesa (see Chapter 3 "Innovation"). All this taken together is likely to change people's livelihoods, especially in developing countries where we have found the most pronounced effects relating to mobile phone adoption. These changes may encourage and enable people to fulfil (at least some of) their aspirations, the most prominent often being a better education and life for their children (GSMA 2012).

The model we estimated as regards the education component of social development addresses this second effect of mobile phone adoption. It relates the number of mobile phone subscriptions per 100 inhabitants to the education index used by the United Nations Development Programme as part of the Human Development Index. In short, the index measures the mean years of education individuals have received or are likely to receive in a particular country and year. Our dataset includes 188 countries and 11 years between 1985 and 2011 (90 per cent of the observations are from 2000 or later). On average, we have 8.2 observations per country. The total sample size is 1,542 observations. Statistical methods and limitations are similar to the other models reported here.

As was the case with voice and accountability, the econometric analysis shows that there is a positive logarithmic relationship between education and mobile phone subscriptions. As outlined above, the effect of mobile adoption on education is likely to be an indirect one. Therefore, it is less surprising that the relationship we find is marginal though statistically significant. Similar to the

other indicators discussed above, we find a logarithmic relationship indicating a stronger impact of mobile phone adoption on education in developing countries than in developed ones.

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BETWEEN 2010 AND 2012, **THE INCREASE
IN MOBILE PHONE SUBSCRIPTIONS**
ACCOUNTED FOR

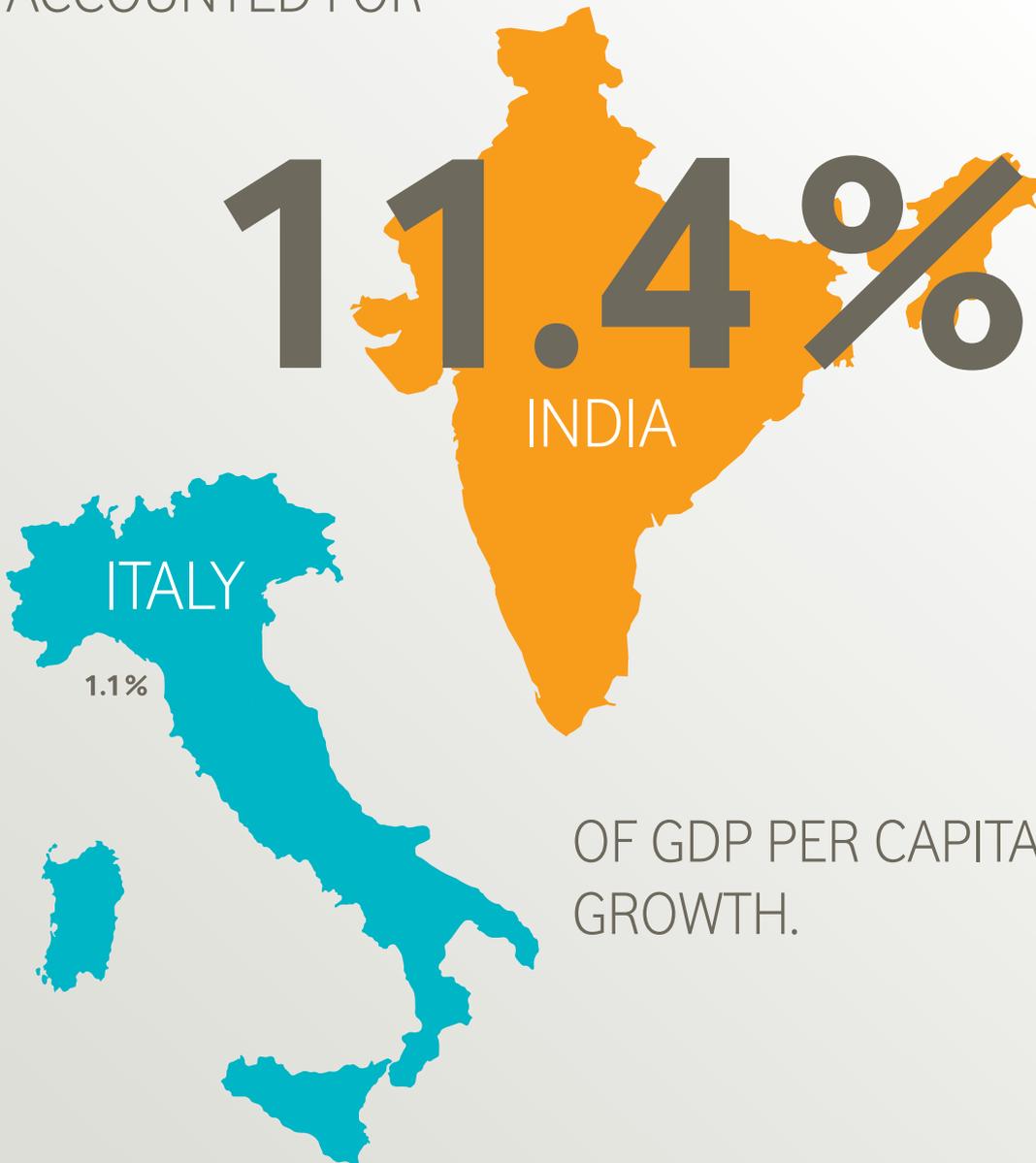
11.4%

INDIA

ITALY

1.1%

OF GDP PER CAPITA
GROWTH.



05 | Economic Development

Mobile Technology Powers Growth.

The contribution of mobile technologies to economic development has been shown in other studies before. We attempt to estimate the contribution of mobile phone adoption to economic growth for the years 2010 to 2020. For this period, the results indicate a positive contribution for all ten countries in the study. Mobile phones enable new services and applications often providing opportunities to generate income. Furthermore, the access to information and increased communication facilitate coordination resulting in productivity gains. Finally, mobile phones enable immediate response to crisis and shocks that without them may lead to destruction of crops or machinery.

Various studies exist regarding the economic impact of Information and Communication Technology (ICT) and mobile ICT in particular. The vast majority of these studies shed light on individual aspects of the economic effects such as access to information or improved communication. Two major studies (Röller & Waverman 2001; Waverman et al. 2005) exist that aim at a more comprehensive appreciation of telecommunication infrastructure's economic impact in a cross-country comparison as well as on mobile phone penetration in particular. They find a positive economic impact of 1.5 % and 0.6 % on GDP growth for a 10 % improvement of telecommunication infrastructure and a 10 % mobile phone penetration growth respectively. The model we present as part of this chapter has a similar objective. We investigate the relationship between growth in mobile phone adoption and GDP growth across ten countries. For the contribution of mobile phone adoption growth to GDP growth over the period from 2010 to 2012, our estimates range from 1.1 % (Italy) to 19.6 % (Egypt). All estimated growth contributions increase continuously from 2010 to 2020.

The chapter first discusses how mobile phones can affect economic development in general. Second, adoption rates in the ten selected countries are discussed in some depth. Third, the chapter describes other major influencing factors that are likely to mediate the economic impact of mobile phones. Finally, the econometric model is described and our results are depicted for each of the ten selected countries.

Economic Effects of the Mobile Phone

Mobile phones fulfil numerous functions and their economic effects differ between developed and developing countries. In developed countries, they refer mainly to the development of new applications based on the mobile infrastructure, such as local services and productivity gains in firms as employees are able to carry out tasks while out of office. In developing countries, the economic impact is more fundamental: mobile phones are often the first and only communication infrastructure for the greatest part of the population. As such, first and foremost they enable communication, but they also bring new ways of accessing information, coordinating supply chains and facilitating the delivery of services that used to be non-existent for most people such as mobile payment systems (substitute for bank accounts) or mobile health applications. In the following section, we describe the major types of mobile phones' economic impact in more depth. **New services and applications** for mobile phones have surged since the introduction of the iPhone in 2007. Other companies have entered the smartphone market, often with their own operating systems and application store. The latest offering is Firefox OS, which is due to run on mobile phones from later this year. Developers around the world have jumped on the mobile bandwagon and have created more than 1 billion apps. In 2010, Sharma predicted that by 2012 the worldwide revenue from these apps would be US\$17.5 billion. Most of this revenue refers to the developed world with North America accounting for

more than 50 % of it. Besides the direct revenue from paid apps, revenue is also generated through apps, for example for service provision or in retail. It is difficult, however, to estimate the actual impact of these as a large proportion of revenue generated in these channels only substitutes other revenues.

On another level of technical sophistication, **opportunities to generate income** also emerge in developing countries. They stretch more obviously into the physical world. Due to a lack of infrastructure, for instance, there is a growing market for mobile phone charging services in many developing countries. Also networks of prepaid card distributors, repair services and accessories are valid entrepreneur opportunities. Furthermore, other services have been developed that build on the mobile phone infrastructure such as private transport or information services. Some of these have resulted in significant shifts for people moving from jobs in the informal to the formal economy (CCK 2008).

Productivity gains can be achieved in companies that provide their employees with mobile devices and suitable apps. In a survey conducted by Forrester (2012), 70 % of firms stated that productivity had grown as a result of mobile working. Also of note, firms reported increased employee responsiveness and decision-making, improved customer satisfaction and increased sales revenue. Productivity gains in developing economies are mainly linked to improved access to information.

Access to information is clearly the most relevant precursor for economic impact in developing countries. For instance, it enables farmers and fishermen to make better decisions about where to plant crops or where to fish. Such information can lead to increases in daily catches by up to five to ten times (Gandhi et al. 2009). Furthermore, they can achieve much better prices for their goods as they get quick information about prices and supply in different markets within their reach. As a result, they can circumvent often abusive intermediaries and sell directly to their customers improving both their revenues and prices for customers.

Increased communication that facilitates coordination across supply chains but also within circles of friends and family is an enormous social benefit, which also has direct economic implications. With better coordination, interruptions in production and out-of-stock items are seriously reduced. Especially for small-scale companies in developing countries, such improvement can lead to increased profits and significant time savings (Samuel et al. 2005).

Both better access to information and increased communication play a role in **response to shocks**. Such shocks can be diseases, natural disasters or even conflicts that affect many people in developing countries regularly. Access to information, for instance, via a camera phone that can send a picture of a new plant disease can save the crop that supports a household or a whole village. Before the advent of mobile technologies, reliable and quick information on how to fight unknown plant diseases was at best hard to get and was often non-existent. Better communication within a social network can significantly enhance social

learning regarding the best ways to plant, irrigate or fertilise (Aker & Mbiti 2010).

Delivery of previously non-existent services can happen through the mobile phone infrastructure. Examples for services that can be based on development initiatives, private business models (e.g. telecom operators) or innovations at the grassroots level are numerous. The most prominent application by far is mobile payments, which for many people has become the first method of being able to transfer and save money without having to travel. Other services include mobile health and systems to support the validity of elections (Aker & Mbiti 2010).

Adoption Around the World

Adoption of mobile phones has surged around the world over the past 10 to 15 years. In 2011, the International Telecommunications Union (ITU) noted 5.9 billion mobile phone subscriptions worldwide. Penetration in developed and developing countries was at 87 % and 79 % respectively (ITU 2011).

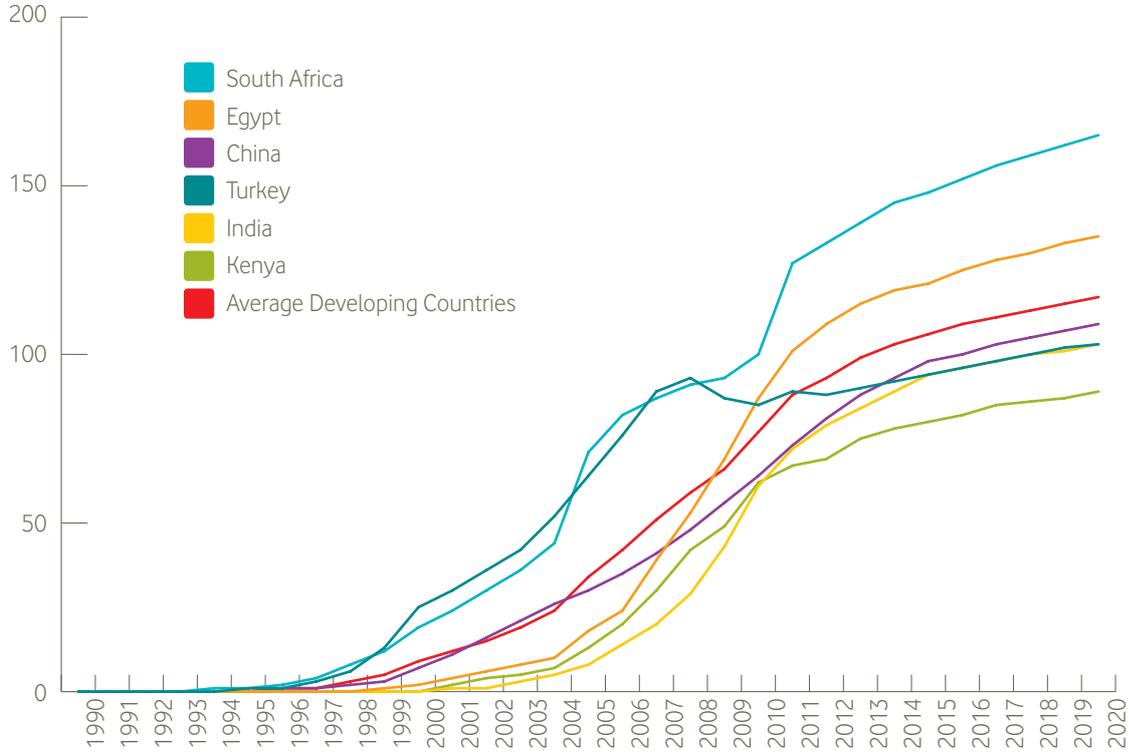
In 2011 alone, 660 million new mobile phone subscriptions were noted (ITU 2012). Developing countries accounted for 80 % of this growth. This figure indicates the major differences in adoption between developed and developing countries. While developed countries may be labelled 'early adopters' of mobile phones, mainly due to better infrastructure and prosperity, developing countries only started to adopt mobile phones around the early 2000s, but have outpaced the 'early adopters' in terms of adoption growth rates.

This general evidence is also reflected in the ten countries selected for the present study. Back in 1990, only the UK had notable mobile subscriptions at 2 per 100 inhabitants. In the mid-1990s, Germany, Italy and Spain were catching up with the UK at subscription rates of around 15 to 20 per 100 inhabitants. At this time, South Africa and Turkey saw the start of uptake of mobile communication with around 1 to 3 subscriptions per 100 inhabitants. In other countries (India, China, Kenya, Egypt), subscriptions did not start until around the year 2000. By then, there were 74 mobile phone subscriptions per 100 inhabitants in the UK. Since 2000, a lot has changed. Growth rates of mobile phone subscriptions have soared in developing countries. For instance, Egypt has increased its number of mobile subscriptions from 1,359,900 in 2000 to 83,425,145 in 2011. That translates into an increase of almost 5,000 % in subscriptions per 100 inhabitants. Other developing countries in the set show similar or even more staggering growth rates for subscriptions per 100 inhabitants over the same period (India plus 21,000 %; Kenya plus 16,500 %; China plus 1,000 %). Growth rates in the UK, Germany, Italy and Spain have been much slower recently.

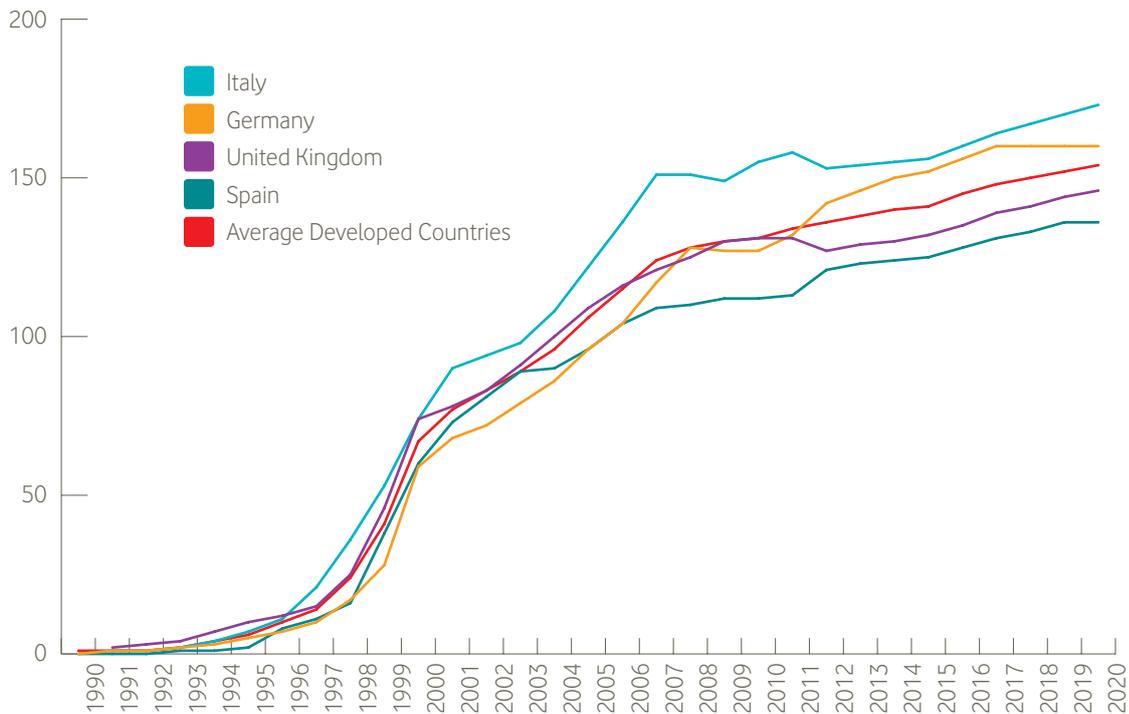
In the future, the experts we surveyed from within Vodafone expect further growth in all countries selected for the current analysis. The UK is the exception in this set of countries, as the experts predict that subscription rates will decrease over the next two years, before picking up again. According to the experts,

MOBILE CELLULAR SUBSCRIPTIONS PER 100 INHABITANTS

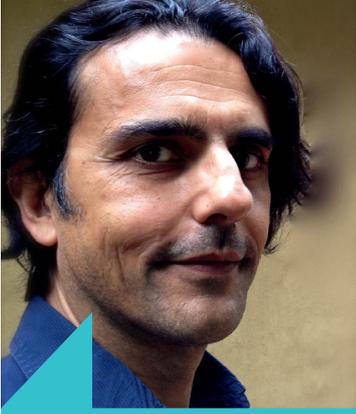
Developing Countries



Developed Countries



Source: ITU (2012) and expert survey



Indra de Lanerolle

Visiting Research Associate, University of Witwatersrand, Johannesburg, South Africa. Lead Researcher, South African Network Society Survey, www.networksociety.co.za.

South Africa – the Growth of the Byte-sized Internet

Our research indicates that one in three South African adults – 12 million people – is now an internet user, more than double the number four years ago (De Lanerolle 2012). Most of these users are accessing the internet on mobile phones, though not necessarily exclusively. Discussion of the importance of mobile networks in meeting ICT needs in Africa usually focuses on access. African fixed-line penetration has remained below 2 % throughout the last few decades while mobile penetration has grown to over 50 % (World Bank Database 2012) so it is undoubtedly true that mobile networks are now crucial for the delivery of internet and data services. Why have mobile services succeeded where fixed-line services have failed? Geography – widely dispersed populations combined with challenging topography – and poor-performing state-owned monopolies are factors that have been recognised as contributing to the poor performance of fixed-line networks in Africa. Technical innovation in mobile – early use of digital technologies – and effective distribution networks have also been suggested as enabling mobile growth. But business models and product packaging may be just as important.

The 'Sachet Revolution'

Prepaid services for mobiles were introduced in South Africa in 1999/2000 when the number of users was around one-tenth of what it is today (Esselaar et al. 2010). This brought the 'single-serve revolution' (Pralahad 2010: 41) that had been proven in the FMCG (fast-moving consumer goods) market in India and Africa to the telecommunications market. Today, South African users can purchase a SIM card for R1 (\$0.12c) and buy prepaid call vouchers in denominations as low as R2 (\$0.25c). As long as a mobile SIM card remains active, there is no charge to remain on the network. In comparison, a fixed-line installation costs over R550 (\$70) and there is a monthly 'line rental' charge of R148 (\$20). So while per minute call costs remain cheaper

on fixed-line networks, the price structure of fixed-line services make them unaffordable to consumers at the Bottom of the Pyramid (BoP) in South Africa and elsewhere on the continent. In addition, fixed-line connections usually require contracts and bank accounts. So for many at the BoP who live outside the formal economy, these services are effectively unavailable at any price.

The Constraints of Sachet Economics

Looked at from this point of view, the mobile revolution in Africa is really the prepaid revolution: it is less about changes in network technologies and more about marketing and business model approaches. This revolution has had the effect of greatly increasing access, but the model has its limits. The internet services that consumers in developed markets are now getting used to are being built on an assumption of always-on as-much-as-you-can-eat connectivity. This kind of connectivity is unaffordable if you are purchasing in sachets – 1GB of data currently costs from R279 (\$35) to R900 (\$113) for a prepaid customer buying data on South Africa's largest network, depending on the size of 'sachet' you buy. For that kind of money, a South African consumer in the formal economy who is able to sign a long-term contract can get a 4 Mbps uncapped fixed-line service. Our research indicates that only a small minority of internet users in South Africa are able to use it in the way that consumers in the developed world can. Most use mobile internet services in small quantities and also rely on shared access at workplaces, education institutions, libraries and internet cafes, many of which are free. So in my view, unless innovations in the sachet model are made, while rich countries (and rich consumers) gorge at their mobile internet buffets, the number of users in South Africa will continue to grow but most of them will be limited to a 'byte-sized' internet menu.

all countries except Kenya are likely to reach more than 100 subscriptions per 100 inhabitants around 2017/2018. In general, however, growth is likely to slow down everywhere as markets become saturated.

Factors that Influence Adoption

Availability, i.e. mobile coverage and affordability, critically shape adoption in all markets. These two factors can explain the major differences in adoption depicted on page 47. While in developed countries there was a quick roll-out of mobile infrastructure, this had to be developed and is still lacking in developing countries. Of course, mobile handsets have been more affordable in the developed world, but more importantly competition and regulation have brought down call and data charges. With the switch from state-owned monopoly telecommunication operators to private ones and market competition in developing countries as witnessed over recent years, similar changes are about to take place in these countries too.

Our Model

The regression model we have computed for the present study focuses on the relationship between growth rates in mobile phone subscriptions per 100 inhabitants and the growth of GDP per capita. We account for several other factors that are likely to influence adoption of mobile phones as well as the general business environment. To estimate the effects for the ten selected countries, we have built our model on annual data (2000 to 2010) for over 50 countries. For the forecasts published in this chapter, we referred to experts' projections of the variables we used. The dependent variable in the model is GDP per capita growth. The key independent variable is growth of mobile phone subscriptions. Other variables were used to account for the general business environment including a time trend. A full list and description of the variables can be found in the Methods at the end of this study. The results of our calculations are depicted for each of the ten countries on the following pages.

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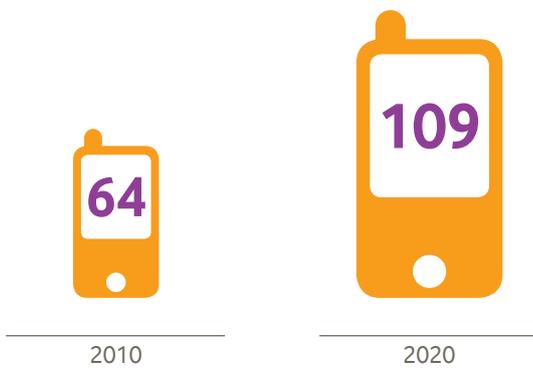
China

China's telecommunication market shows very different tracks of development. While the market for mobile phones is growing rapidly a significant decline in the number of subscribers of fixed voice services can be seen. Overall, China's broadband infrastructure compared to other developing countries is very advanced with 150 million fixed broadband connections of which 74 % are DSL connections. Furthermore the number of broadband connections is very likely to increase in the future due to lower prices (Chen et al. 2012).



Area: 580,367 km²
Population: 38.6 Mio.
Population Density: 67/km²
GDP per capita: 808 US \$

MOBILE PHONE SUBSCRIPTIONS



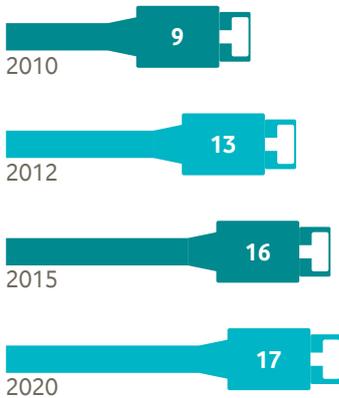
In 2010, mobile phone adoption in China was similar to India. However, China started much earlier. As early as 2000, seven per cent of the population had a mobile phone subscription. In 2005, this figure had increased to 30 %. At the same time, only 8 out of 100 Indians used mobile phones. Since then growth rates in China have slowed down significantly. The experts in our survey expect China's mobile phone market to grow similarly to that in India reaching 109 mobile phone subscriptions per 100 inhabitants in 2020.

Subscriptions per 100 inhabitants includes pre- and postpaid subscriptions

Source: ITU (2012) and expert survey

ECONOMIC IMPACT OF MOBILE TECHNOLOGIES IN CHINA

FIXED BROADBAND INTERNET (per 100 inhabitants)



China's fixed broadband infrastructure, in particular in the large cities, is much better than India's. The state supports infrastructure deployment and uptake among the population. Consequently, the experts in our survey expect subscriptions to almost double from 2010 to 2020 with predictions that in 2020, there will be 17 subscriptions per 100 inhabitants.

Source: ITU (2012) and expert survey

SHARE OF GROWTH IN MOBILE PHONE SUBSCRIPTIONS IN GDP GROWTH PER CAPITA (2010 to 2012)

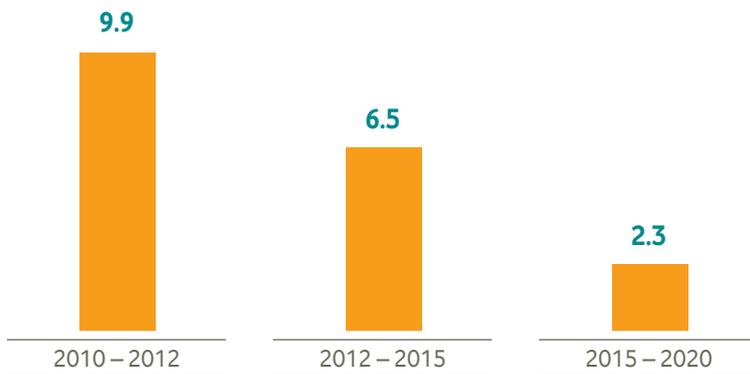
9.9%

of **GDP growth** in China between 2010 and 2012 were due to the increase in mobile phone subscriptions.



Source: IW Consult (2013)

MOBILE SUBSCRIPTIONS' CONTRIBUTION TO GDP PER CAPITA GROWTH OVER TIME



Source: IW Consult (2013)



According to our estimates, the growth in mobile phone subscriptions from 2010 to 2012 in China will contribute 10% of the projected per capita GDP growth during that time period. Accumulated from 2010 to 2020, this translates into US\$131 of additional GDP linked to the growth of mobile technology adoption for every person in China. The contribution of mobile phones will continue to be strong in China as the experts in our survey expect a continuously high growth rate of mobile phone adoption.



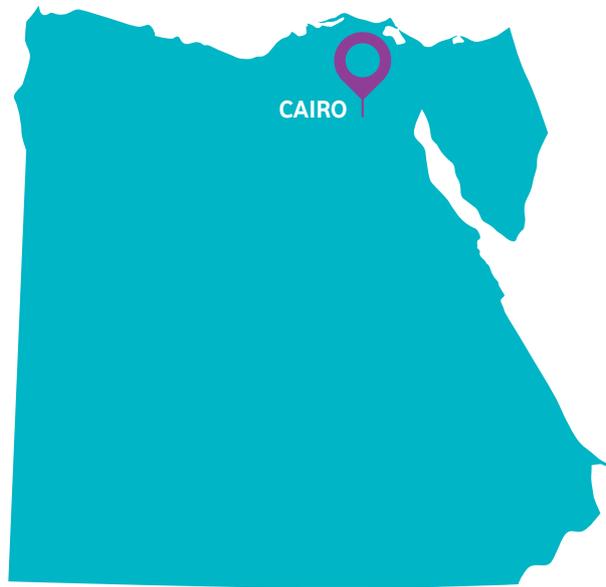
The increase in mobile phone subscriptions in **China** accounts for

131 US \$

of the projected GDP per capita growth **between 2010 and 2020.**

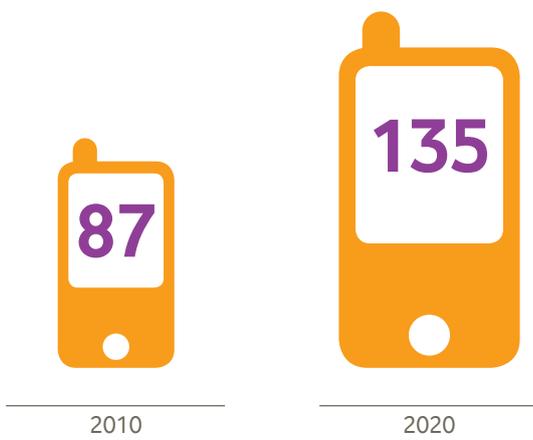
Egypt

Telecommunication played a very important role during the political changes in Egypt in 2011, especially with communication via mobile devices. In the future competition in the market for mobile services is likely to increase due to the entrance of a fourth major competitor. Despite Egypt's political problems the number of mobile users and the change in revenue generation is likely to continue. In 2011, data revenue already accounted for 15 % of all mobile revenues (Roseboro & De Villiers 2012).



Area: 1,001,449 km²
Population: 80.5 Mio.
Population Density: 80/km²
GDP per capita: 2,781 US \$

MOBILE PHONE SUBSCRIPTIONS



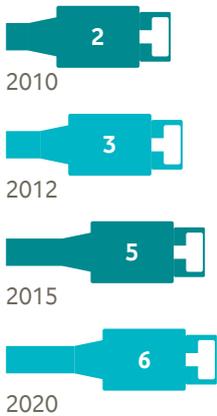
Egypt's adoption of mobile phones started somewhat earlier than that of other African countries. In 2001, when the first mobile phones made their way into Kenya, 4 out of 100 inhabitants in Egypt already had a mobile phone subscription. From 2001 to 2010, penetration increased by 83 percentage points. The experts in our survey expect this figure to grow to 135 phones per 100 inhabitants by 2020. This is much higher than what they expect for Kenya.

Subscriptions per 100 inhabitants includes pre- and postpaid subscriptions

Source: ITU (2012) and expert survey

ECONOMIC IMPACT OF MOBILE TECHNOLOGIES IN EGYPT

FIXED BROADBAND INTERNET (per 100 inhabitants)



Although the experts in our survey expect fixed broadband penetration to triple from 2010 to 2020, fixed broadband connectivity is going to remain a fringe player in Egypt. Similar to other African countries, it is likely that the mobile phone and other mobile devices will become the most important way for people to connect to the internet in the foreseeable future.

Source: ITU (2012) and expert survey

SHARE OF GROWTH IN MOBILE PHONE SUBSCRIPTIONS IN GDP GROWTH PER CAPITA (2010 to 2012)

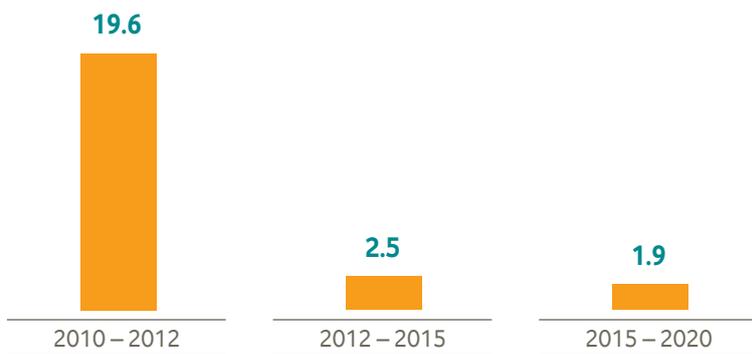
19.6%

of GDP growth in Egypt between 2010 and 2012 were due to the increase in mobile phone subscriptions.



Source: IW Consult (2013)

MOBILE SUBSCRIPTIONS' CONTRIBUTION TO GDP PER CAPITA GROWTH OVER TIME



Source: IW Consult (2013)

According to our estimates, the growth in mobile phone subscriptions from 2010 to 2012 in Egypt will contribute almost 20 % of the projected per capita GDP growth during that time period. Accumulated from 2010 to 2020, this translates into US\$85 of additional GDP linked to the growth of mobile technology adoption for every Egyptian. This is the highest estimate in our set of countries. The strong impact of mobile phones is linked to the high growth projected by the experts in our survey. However, contribution to growth in Egypt according to our model is likely to have been even larger in the recent past, when Egypt's mobile phone penetration increased rapidly.



The increase in mobile phone subscriptions in **Egypt** accounts for

85 US \$

of the projected GDP per capita growth between 2010 and 2020.

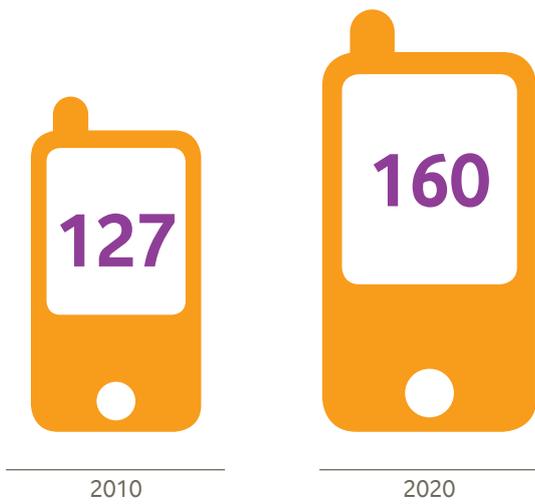
Germany

Germany's mobile telecom market has been in a marginal decline over the past two years. Operators' revenues still stem predominantly from fixed line subscriptions. In 2011, 65 % of all outgoing calls were generated from landline networks. While the fixed services have been in a long-term recession, the German mobile voice and text communication shows one of the lowest levels in Western Europe (Buckland & Tee 2011).



Area: 357,121 km²
Population: 82.0 Mio.
Population Density: 230/km²
GDP per capita: 44,060 US \$

MOBILE PHONE SUBSCRIPTIONS



Germany, like other developed countries, has more mobile phone subscriptions than inhabitants. The experts in our sample believe that this figure will grow until 2020, although at a slower pace than before. The strongest growth is likely to come from additional smartphones, which enable various internet-based applications. In 2012, 23 million smartphones were sold in Germany. This is an increase of 43 % from the previous year (BITKOM 2012).

Subscriptions per 100 inhabitants includes pre- and postpaid subscriptions

Source: ITU (2012) and expert survey

ECONOMIC IMPACT OF MOBILE TECHNOLOGIES IN GERMANY

FIXED BROADBAND INTERNET (per 100 inhabitants)



Fixed broadband penetration in Germany is higher than in the other countries in the sample. This is due to Germany having a generally good infrastructure, strong competition and low prices for services. Nonetheless, there are marked differences in Germany between urban and rural areas in terms of broadband internet coverage and connectivity. Often infrastructure costs for fast Next Generation Access (NGA) are prohibitive in rural areas. With the growing trend towards mobile broadband in Germany – LTE started in 2010 – the experts believe there is relatively little growth potential for more fixed broadband subscriptions.

Source: ITU (2012) and expert survey

SHARE OF GROWTH IN MOBILE PHONE SUBSCRIPTIONS IN GDP GROWTH PER CAPITA (2010 to 2012)

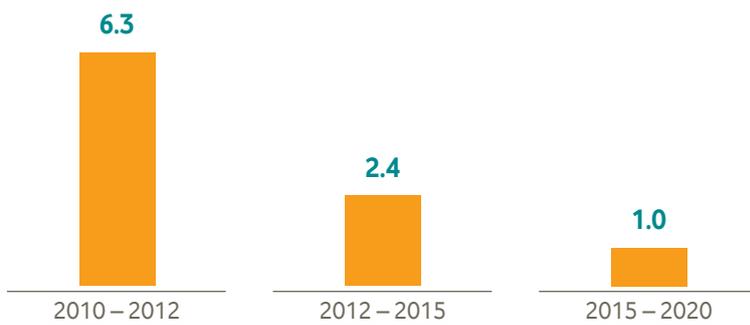
6.3%

of GDP growth in Germany between 2010 and 2012 were due to the increase in mobile phone subscriptions.



Source: IW Consult (2013)

MOBILE SUBSCRIPTIONS' CONTRIBUTION TO GDP PER CAPITA GROWTH OVER TIME



Source: IW Consult (2013)

According to our estimates, the growth in mobile phone subscriptions from 2010 to 2012 in Germany will contribute 6.3% of the projected per capita GDP growth during that time period. Accumulated from 2010 to 2020, this translates into US\$742 of additional GDP linked to the growth of mobile technology adoption for every German. This is a relatively high contribution compared to other developed countries.

The increase in mobile phone subscriptions in **Germany** accounts for

742 US \$

of the projected GDP per capita growth **between 2010 and 2020.**



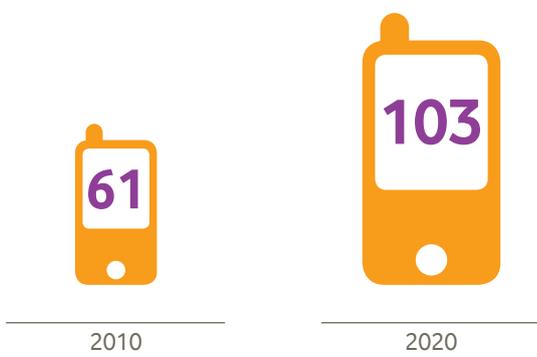
India

In 2011 fixed broadband connections in India grew by 21 %. However, as of December 2011 only 6 % of all households had a fixed broadband connection. As in other developing countries, there is a trend that the lack of fixed broadband connections is compensated by an increasing number of mobile broadband connections. This trend can also be seen in the increasing revenue from non-voice services, which in 2011 accounted for 17 % of all revenues (Kaushal 2012).



Area: 3,287,590 km²
Population: 1,210.2 Mio.
Population Density: 365/km²
GDP per capita: 1,489 US \$

MOBILE PHONE SUBSCRIPTIONS



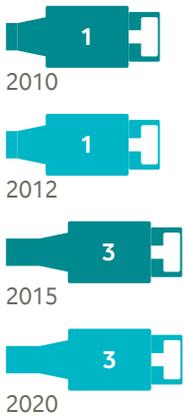
Mobile phone adoption has gained significant pace in India since 2005. In 2010, there were 61 mobile phone subscriptions per 100 inhabitants. The experts surveyed for this study estimate that this figure will grow to more than 100 mobile phone subscriptions in 2020. Mobile phone adoption is particularly widespread in urban areas and with increasing urbanisation the trend towards mobile communication is likely to continue.

Subscriptions per 100 inhabitants includes pre- and postpaid subscriptions

Source: ITU (2012) and expert survey

ECONOMIC IMPACT OF MOBILE TECHNOLOGIES IN INDIA

FIXED BROADBAND INTERNET (per 100 inhabitants)



Similar to other developing countries, India does not have a good fixed broadband infrastructure. Consequently, uptake is low. In 2010, there was only one fixed broadband subscription per 100 inhabitants. With prohibitive costs for further deployment, it is unlikely that this situation will change significantly in the foreseeable future. Mobile devices will be the major gateway for Indians to access the internet. This is also reflected in the fact that in 2012, for the first time, there was more mobile-related internet traffic than traffic originating from desktop computers.

Source: ITU (2012) and expert survey

SHARE OF GROWTH IN MOBILE PHONE SUBSCRIPTIONS IN GDP GROWTH PER CAPITA (2010 to 2012)

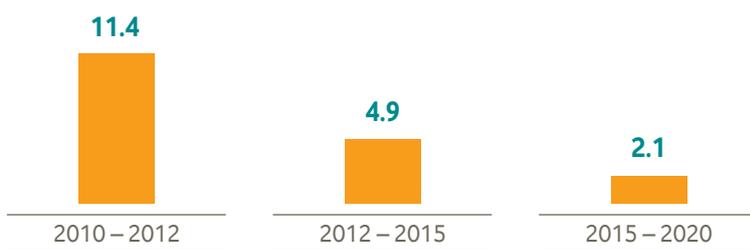
11.4%

of GDP growth in India between 2010 and 2012 were due to the increase in mobile phone subscriptions.



Source: IW Consult (2013)

MOBILE SUBSCRIPTIONS' CONTRIBUTION TO GDP PER CAPITA GROWTH OVER TIME



Source: IW Consult (2013)

According to our estimates, the growth in mobile phone subscriptions from 2010 to 2012 in India will contribute 11.4% of the projected per capita GDP growth during that time period. Accumulated from 2010 to 2020, this translates into US\$51 of additional GDP linked to the growth of mobile technology adoption for every Indian. As with other developing countries, India has had enormous growth rates in mobile phone adoption over recent years. It is likely that the contribution of mobile adoption to GDP per capita growth will be below the levels it reached prior to 2010. However, it still remains a significant factor for GDP growth in India.



The increase in mobile phone subscriptions in **India** accounts for

51 US \$

of the projected GDP per capita growth **between 2010 and 2020.**

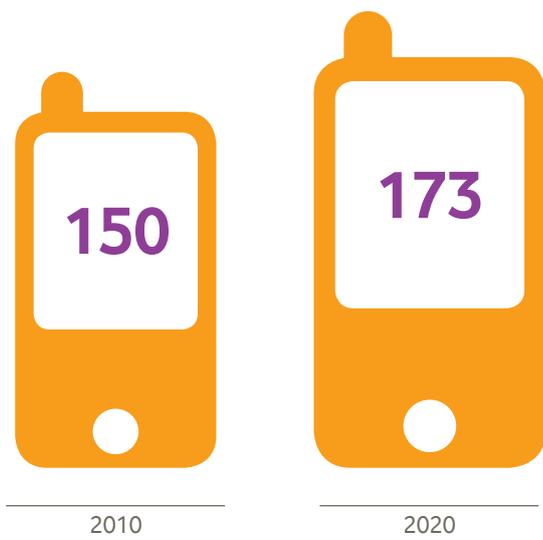
Italy

The Italian telecom market is the fourth biggest in Western Europe. Income obtained from mobile services stood at EUR 20.9 billion in 2010, representing a 55 % share of the entire Italian telecom revenue. Being an exception in Western Europe, pre-paid usage dominates the mobile market (79 %). Moreover, due to EU mandates within the telecom market, the revenue generated by calls has declined. Simultaneously, usage of data services such as SMS and MMS texts have increased (Bennici 2012).



Area: 301,338 km²
Population: 60.6 Mio.
Population Density: 201/km²
GDP per capita: 36,103 US \$

MOBILE PHONE SUBSCRIPTIONS



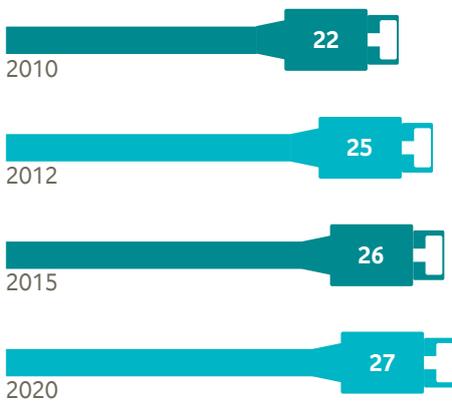
Italy has one of the highest mobile phone penetrations worldwide: for every citizen, 1.5 subscriptions exist. The surveyed experts project a further growth to 173 subscriptions per 100 inhabitants in 2020. Mobile phones are very important in Italy. According to Google (2012), 31 % of Italians would rather give up their TV than their smartphone.

Subscriptions per 100 inhabitants includes pre- and postpaid subscriptions

Source: ITU (2012) and expert survey

ECONOMIC IMPACT OF MOBILE TECHNOLOGIES IN ITALY

FIXED BROADBAND INTERNET (per 100 inhabitants)



Italy's fixed broadband penetration is similar to that in Spain. In 2010, there were 22 subscriptions per 100 inhabitants. The surveyed experts estimate that this figure will have risen to 25 in 2012 and think it will continue to increase slowly to 27/100 in 2020. Deployment of fixed broadband in Italy still relies on relatively old technology. Italy is set to achieve the minimum requirements of the Digital Agenda in 2013; however, fast access (30 Mbit/s and more) is being deployed slowly. With little coverage, interest and take-up remains low.

Source: ITU (2012) and expert survey

SHARE OF GROWTH IN MOBILE PHONE SUBSCRIPTIONS IN GDP GROWTH PER CAPITA (2010 to 2012)

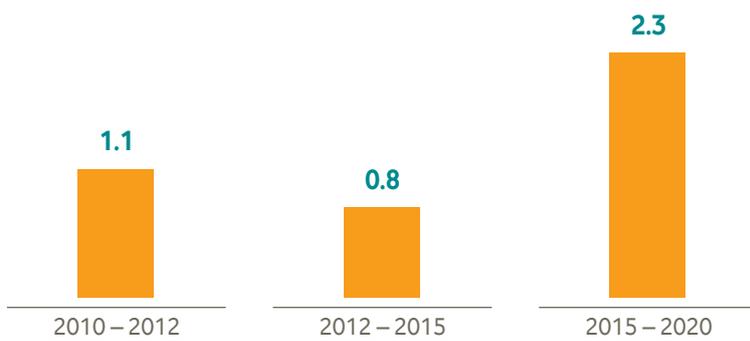
1.1%

of GDP growth in Italy between 2010 and 2012 were due to the increase in mobile phone subscriptions.



Source: IW Consult (2013)

MOBILE SUBSCRIPTIONS' CONTRIBUTION TO GDP PER CAPITA GROWTH OVER TIME



Source: IW Consult (2013)

According to our estimates, the growth in mobile phone subscriptions from 2010 to 2012 in Italy will contribute 1.1% of the projected per capita GDP growth during that time period. Accumulated from 2010 to 2020, this translates into US\$ 455 of additional GDP linked to the growth of mobile technology adoption for every Italian. This is the lowest contribution among the European countries in the sample for the current study.

The increase in mobile phone subscriptions in **Italy** accounts for

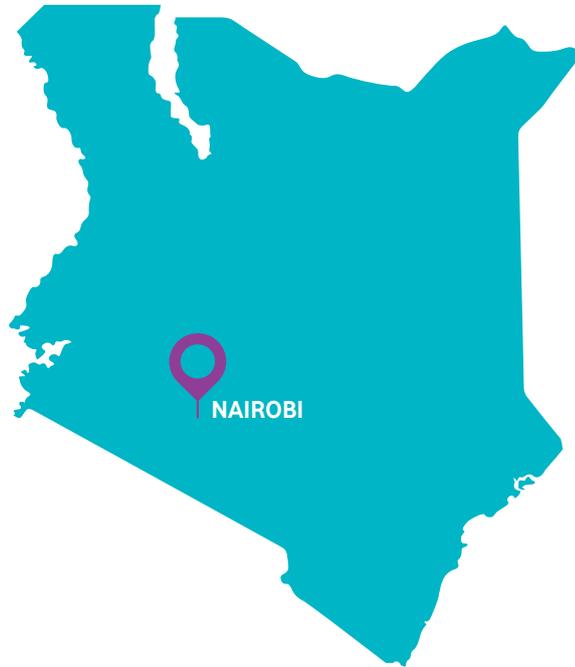
455 US \$

of the projected GDP per capita growth **between 2010 and 2020**.



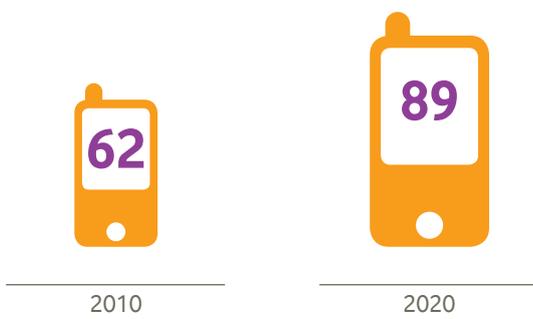
Kenya

Only 24 % of Kenya's population live in urban areas so telecommunication is very important to connect the rural with the more urban areas. Nevertheless Kenya's telecommunication market is still developing. Although 33 % of all mobile revenues were generated by the usage of mobile data, 99 % of all mobile subscribers still use pre-paid mobile phones. Therefore Kenya's telecommunication market leaves potential for development in terms of mobile broadband connection (Roseboro 2013).



Area: 580,367 km²
Population: 38.6 Mio.
Population Density: 67/km²
GDP per capita: 808 US \$

MOBILE PHONE SUBSCRIPTIONS



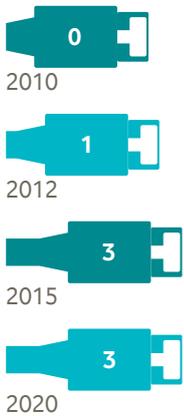
Kenya is one of the most prominent examples of the success and impact of mobile phones in developing countries. In recent years, it has seen impressive growth rates – from just over 125,000 mobile phone subscriptions in 2000 to almost 25 million in 2010. The latter figure translates into a penetration of 62 subscriptions per 100 inhabitants. The surveyed experts believe that this rapid growth is likely to come to an end soon with decreasing growth rates after 2016 leading to 89 mobile phone subscriptions in 2020.

Subscriptions per 100 inhabitants includes pre- and postpaid subscriptions

Source: ITU (2012) and expert survey

ECONOMIC IMPACT OF MOBILE TECHNOLOGIES IN KENYA

FIXED BROADBAND INTERNET (per 100 inhabitants)



Fixed broadband infrastructure is practically non-existent in Kenya apart from large cities such as the capital Nairobi. Furthermore, many people can either not afford a fixed broadband subscription or live outside the formal system and are thus cut-off from the contracts necessary to subscribe to a fixed broadband service. Consequently, few Kenyans have fixed broadband subscriptions. This figure is unlikely to increase over the next five to eight years. Mobile phones are commonly the first and only communication technology for local inhabitants, also enabling internet access for many Kenyans.

Source: ITU (2012) and expert survey

SHARE OF GROWTH IN MOBILE PHONE SUBSCRIPTIONS IN GDP GROWTH PER CAPITA (2010 to 2012)

1.5% of GDP growth in Kenya between 2010 and 2012 were due to the increase in mobile phone subscriptions.



Source: IW Consult (2013)

MOBILE SUBSCRIPTIONS' CONTRIBUTION TO GDP PER CAPITA GROWTH OVER TIME



Source: IW Consult (2013)

According to our estimates, the growth in mobile phone subscriptions from 2010 to 2012 in Kenya will contribute 1.5% of the projected per capita GDP growth during that time period. Accumulated from 2010 to 2020, this translates into US\$28 of additional GDP linked to the growth of mobile technology adoption for every Kenyan. As mobile subscription growth rates were projected by the surveyed experts to slow down, this figure is much smaller than might be expected when looking at the decade from 2000 to 2010. During that time (2000 – 2010), we would estimate a much higher growth contribution of mobile phone penetration.



The increase in mobile phone subscriptions in Kenya accounts for

28 US \$

of the projected GDP per capita growth between 2010 and 2020.

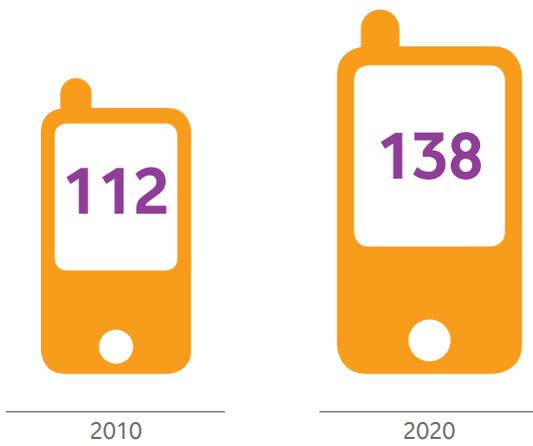
Spain

Spain has experienced one of the hardest recessions in Europe in the last few years. As a result, the telecom market revenue has decreased due to a cut in consumer spending and increasing price sensitivity. The mobile market still holds its dominant position; however, due to lower prices, subscribers have switched to low-cost operators and landline services. Growing competition coupled with the recession led to a loss of mobile revenue, which decreased from EUR 15.5 billion to EUR 14.0 billion between 2008 and 2011 (Caria 2012).



Area: 504,645 km²
Population: 47.2 Mio.
Population Density: 94/km²
GDP per capita: 31,943 US \$

MOBILE PHONE SUBSCRIPTIONS



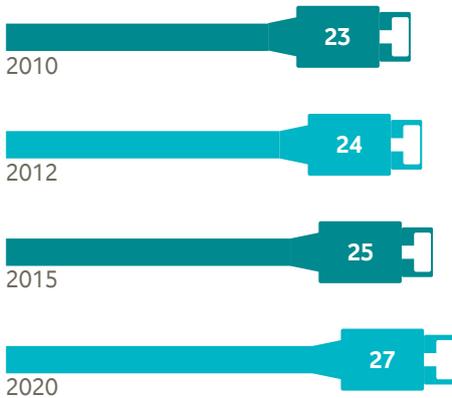
The data for Spain show the lowest penetration of the European countries in the sample in 2010. Experts in our survey also do not envisage much further growth potential. For 2020, they estimate penetration will increase to 138 subscriptions per 100 inhabitants. Italy surpassed this level in 2006. Interestingly, as a percentage of mobile users, mobile commerce is developing more strongly in Spain than in other European countries. According to DIBS (2012) more than a quarter of consumers with mobile devices have used them to make online purchases. In other countries, this figure is much lower e.g. Germany 14 % or the UK 19 %.

Subscriptions per 100 inhabitants includes pre- and postpaid subscriptions

Source: ITU (2012) and expert survey

ECONOMIC IMPACT OF MOBILE TECHNOLOGIES IN SPAIN

FIXED BROADBAND INTERNET (per 100 inhabitants)



The penetration of fixed broadband in Spain is similar to the figures in Italy. In 2010, there were 23 subscriptions per 100 inhabitants. Figures are expected to increase slowly, reaching 27 subscriptions per 100 inhabitants in 2020. The deployment of broadband infrastructure is at a critical stage due to the economic crisis and uncertainty in the demand side, which can lead to operators focusing uniquely in areas with high investment return and limiting their investment elsewhere. Despite these concerns, investment in high-speed networks continues.

Source: ITU (2012) and expert survey

SHARE OF GROWTH IN MOBILE PHONE SUBSCRIPTIONS IN GDP GROWTH PER CAPITA (2010 to 2012)

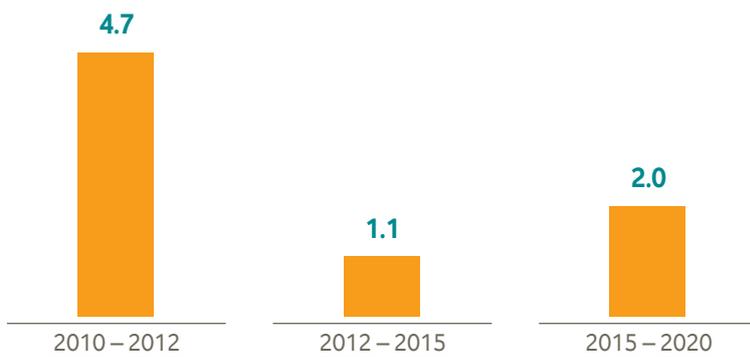
4.7%

of **GDP growth** in Spain between 2010 and 2012 were due to the increase in mobile phone subscriptions.



Source: IW Consult (2013)

MOBILE SUBSCRIPTIONS' CONTRIBUTION TO GDP PER CAPITA GROWTH OVER TIME



Source: IW Consult (2013)

According to our estimates, the growth in mobile phone subscriptions from 2010 to 2012 in Spain will contribute 4.7% of the projected per capita GDP growth during that time period. Accumulated from 2010 to 2020, this translates into US\$ 514 of additional GDP linked to the growth of mobile technology adoption for every person in Spain. With the economic crisis looming over Spain, these results have to be interpreted with care.



The increase in mobile phone subscriptions in **Spain** accounts for

514 US \$

of the projected GDP per capita growth **between 2010 and 2020**.

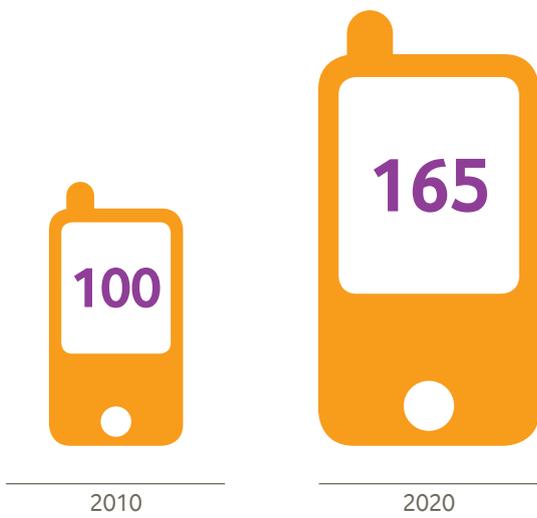
South Africa

Although South Africa's mobile market is one of the most developed in Africa, there are some drawbacks. Broadband penetration is still very low due to its high costs and the bad infrastructure. In 2010 less than 2% of the population used a DSL connection. Instead many people used and continue to use mobile broadband. The dominance of mobile broadband will grow in the future due to high investments in network infrastructure (Roseboro & Sagalbayaeva 2011).



Area: 1,219,912 km²
Population: 51.8 Mio.
Population Density: 41/km²
GDP per capita: 8,070 US \$

MOBILE PHONE SUBSCRIPTIONS



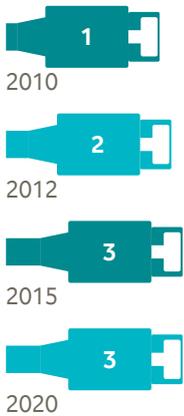
South Africa is probably the African country whose mobile phone adoption is the one most similar to figures in Europe. As early as 2000, 19% of South Africans had a mobile phone subscription. In 2010, statistically every South African had a mobile phone subscription. The experts surveyed for this study estimate that this figure will grow to 165 in 2020, which is by far the highest figure for the African countries in our sample. Unlike many other markets, South Africans like Blackberry handsets as they enable Blackberry Messages (BBM), which are free of charge.

Subscriptions per 100 inhabitants includes pre- and postpaid subscriptions

Source: ITU (2012) and expert survey

ECONOMIC IMPACT OF MOBILE TECHNOLOGIES IN SOUTH AFRICA

FIXED BROADBAND INTERNET (per 100 inhabitants)



Fixed broadband penetration is meagre in South Africa. In this respect South Africa is closer to the figures of other African countries rather than European nations. Access to fast broadband is really only available in the large cities. Consequently, mobile devices will play a key role in enabling South Africans to access the web in the foreseeable future. In 2010, only 1 in 100 inhabitants had a fixed broadband subscription.

Source: ITU (2012) and expert survey

SHARE OF GROWTH IN MOBILE PHONE SUBSCRIPTIONS IN GDP GROWTH PER CAPITA (2010 to 2012)

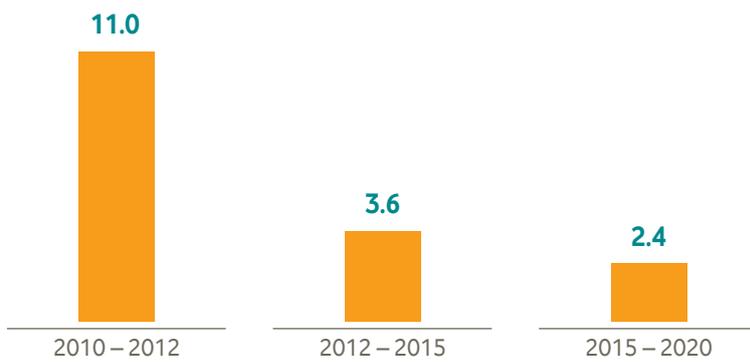
11.0%

of GDP growth in South Africa between 2010 and 2012 were due to the increase in mobile phone subscriptions.



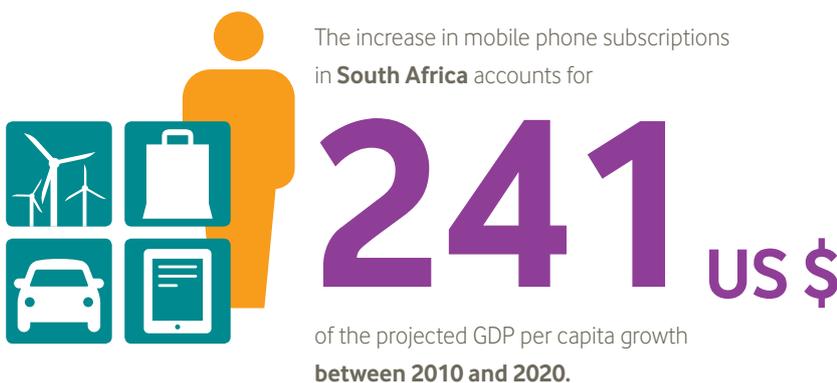
Source: IW Consult (2013)

MOBILE SUBSCRIPTIONS' CONTRIBUTION TO GDP PER CAPITA GROWTH OVER TIME



Source: IW Consult (2013)

According to our estimates, the growth in mobile phone subscriptions from 2010 to 2012 in South Africa will contribute 11 % of the projected per capita GDP growth during that time period. Accumulated from 2010 to 2020, this translates into US\$ 241 of additional GDP linked to the growth of mobile technology adoption for every South African. This figure is relatively much larger than in European countries as experts predict stronger growth in the adoption of mobile technologies in our sample in South Africa than in European countries.



Turkey

While landline service penetration shows levels amongst the highest in Central and Eastern Europe, mobile service penetration is relatively low compared to its neighbours. However, with the introduction of the 3G networks in 2009, mobile broadband and smartphones are rapidly conquering and replacing the fixed-line voice market. Moreover, the launch of 3G resulted in an increased and still growing usage of non-voice services (Scott & Martin 2011).



Area: 814,578 km²

Population: 74.7 Mio.

Population Density: 91/km²

GDP per capita: 10,524 US \$

MOBILE PHONE SUBSCRIPTIONS



2010

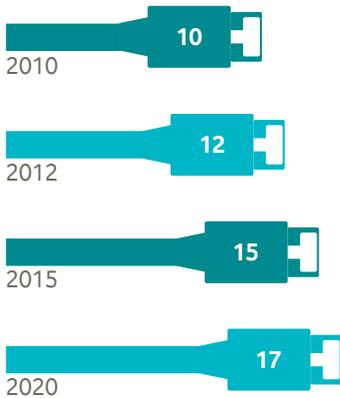


2020

Turkey is characterised by huge differences between urban and rural areas. While the large cities like Istanbul barely differ from any other capital city in the Western world, rural areas suffer from poor infrastructure and are close to what one would find in other developing countries in our sample. In 2010, mobile phone penetration was at 85 subscriptions per 100 inhabitants. The surveyed experts believe that it will increase to 103 in 2020, which seems a conservative estimate given the role that mobile phones already play in Turkish cities.

ECONOMIC IMPACT OF MOBILE TECHNOLOGIES IN TURKEY

FIXED BROADBAND INTERNET (per 100 inhabitants)



Fixed broadband penetration in Turkey is relatively low compared to its European neighbours. Only 10 subscriptions existed per 100 inhabitants in 2010. The surveyed experts believe that this figure will almost double by 2020. However, increasing smartphone penetration – in Turkey there are 4.8 million smartphone users (Turkcell 2012) – and increasing use of mobile internet applications raises doubt about who is going to take responsibility for the necessary investments for further deployment of fixed broadband infrastructure.

Source: ITU (2012) and expert survey

SHARE OF GROWTH IN MOBILE PHONE SUBSCRIPTIONS IN GDP GROWTH PER CAPITA (2010 to 2012)

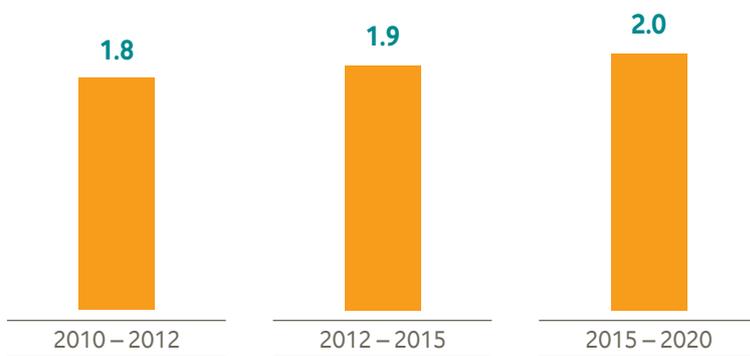
1.8%

of GDP growth in Turkey between 2010 and 2012 were due to the increase in mobile phone subscriptions.



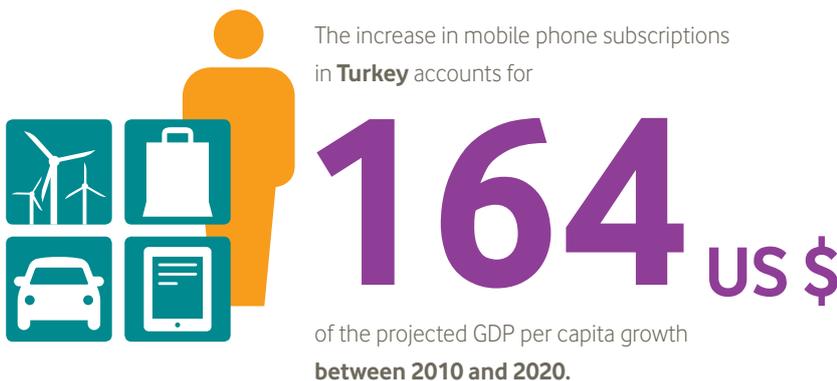
Source: IW Consult (2013)

MOBILE SUBSCRIPTIONS' CONTRIBUTION TO GDP PER CAPITA GROWTH OVER TIME



Source: IW Consult (2013)

According to our estimates, the growth in mobile phone subscriptions from 2010 to 2012 in Turkey will contribute 1.8% of the projected per capita GDP growth during that time period. Accumulated from 2010 to 2020, this translates into US\$164 of additional GDP linked to the growth of mobile technology adoption for every Turk. Although this figure may seem small in absolute terms, in relative terms the gains from the spread of mobile technologies estimated for Turkey are higher than those for Spain. However, as experts expect growth rates in mobile phone adoption to be relatively small compared to developing countries in our sample, their effect in Turkey is likely to be less pronounced.



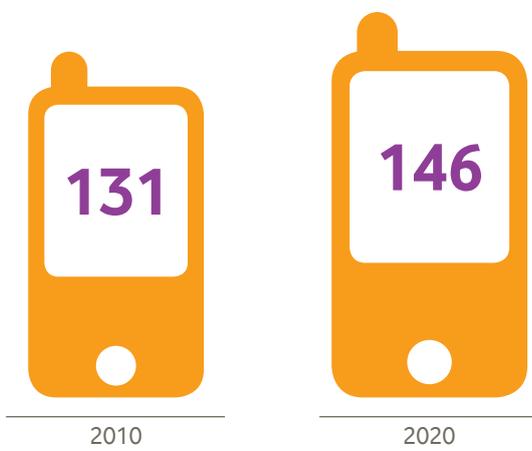
United Kingdom

A particular element of the telecom market in the UK is the absence of an intersection of the mobile and landline services. Overall, the focus is on the mobile market, which has experienced a shift from pre-paid to post-paid contracts. Stricter telecom regulations have led to a decrease in the average revenue per user, obliging UK's operators to implement new measures targeted at consumers with lower incomes. Their aim is to increase the market share (Hare 2012).



Area: 224,820 km²
Population: 63.2 Mio.
Population Density: 258/km²
GDP per capita: 39,038 US \$

MOBILE PHONE SUBSCRIPTIONS



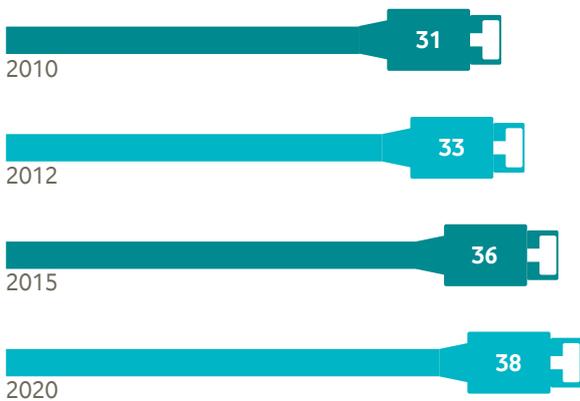
Similar to other developed countries, in the UK there are more mobile phone subscriptions than inhabitants. The experts' forecast sees penetration increase to 146 subscriptions per 100 inhabitants in 2020. While the UK was the earliest adopter of mobile phones among the countries in our sample, its growth prospects are somewhat lower than those of other countries like Germany or Italy. However, the UK is currently leading in the adoption of smartphones. In 2011, 51.3 % of the mobile phone market in the UK used smartphones (ComScore 2012).

Subscriptions per 100 inhabitants includes pre- and postpaid subscriptions

Source: ITU (2012) and expert survey

ECONOMIC IMPACT OF MOBILE TECHNOLOGIES IN THE UNITED KINGDOM

FIXED BROADBAND INTERNET (per 100 inhabitants)



Fixed broadband penetration in the UK is similar to the figures for Germany. In 2010, 31 % of the population had subscribed to a fixed broadband line. By 2015, this figure is expected to have increased by five percentage points. Growth is, however, expected to slow down between 2015 and 2020. The UK has just proposed a new policy vision for broadband deployment, framing it as one of the key assets for economic success instead of a policy driven by target figures given by the Digital Agenda. Consequently, if Next Generation Access (NGA) is deployed throughout the UK, the estimates here may be somewhat pessimistic.

Source: ITU (2012) and expert survey

SHARE OF GROWTH IN MOBILE PHONE SUBSCRIPTIONS IN GDP GROWTH PER CAPITA (2010 to 2012)

-2%

of **GDP change** in the UK between 2010 and 2012 were due to the decrease in mobile phone subscriptions.



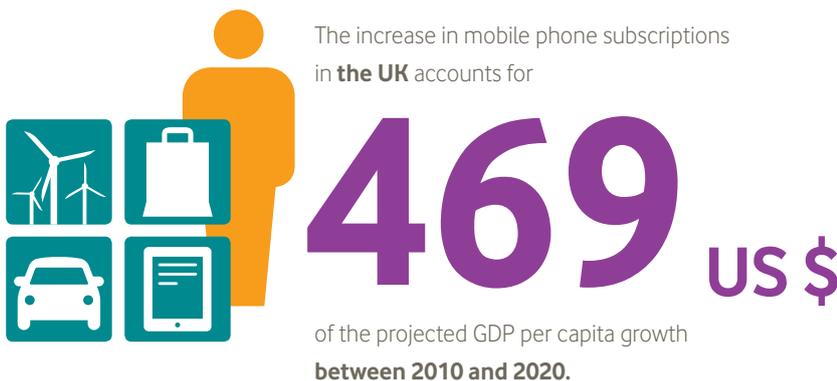
Source: IW Consult (2013)

MOBILE SUBSCRIPTIONS' CONTRIBUTION TO GDP PER CAPITA GROWTH OVER TIME.



Source: IW Consult (2013)

According to our estimates, the growth in mobile phone subscriptions from 2010 to 2012 in the UK will contribute -2 % of the projected per capita GDP growth during that time period. Accumulated from 2010 to 2020, this translates into US\$469 of additional GDP linked to the growth of mobile technology adoption for every person in the United Kingdom. This relatively low figure stems from the experts' forecast, which predicts a decline in mobile subscriptions over the next few years and after that only slow growth. Also, high penetration and considerable growth in fixed broadband reduces the estimated effect of mobile phones in the UK. However, considering the high penetration of smartphones and the user habits of surfing "on the go" more than ever before, the effect of mobile phones in the case of the UK is likely to be underestimated in our model.



Methods

From Models to Meaning

The following sections briefly summarise the methods of the present study. Please do not hesitate to contact the study team if you have any further questions.

Countries in the Study

Ten countries were selected for this study. Our objective was to choose a diverse set of developed and developing countries across Europe, Asia and Africa.

Expert Survey

As part of this study, we conducted a small-scale survey of country experts from the Vodafone Group. In total, we approached 67 experts, of whom 43 responded to our survey (response rate 64%). All 43 experts completed our questionnaire consisting of a mixture of open and closed questions concerning the adoption, use and impact of mobile phones in the respective countries of their expertise.

Furthermore, Vodafone experts supported us with the forecasts for the economic impact of mobile phone adoption. They provided indications based on their market analysis and knowledge about how the variables we used for our model are likely to develop over the coming years.

Expert Interviews and Expert Workshop

In total, ten internationally renowned experts contributed to this study. We conducted five expert interviews on the phone and a workshop in November 2012, where the results of the econometric models were discussed critically. Six out of the ten experts involved in this study also wrote a contribution to the study from their field of expertise.

A full list of the experts can be found in the acknowledgements.

Econometric Models

Model 1: Mobile Phone Subscriptions and Voice and Accountability

$$\text{Voice and Accountability}_t = \beta_0 + \beta_1 * \ln(\text{mobile}_{t-1}) + \sum_{i=1}^{12} \alpha_i * \text{year}_i$$

All variables were transformed by subtracting the country mean to yield fixed-effects estimates of the coefficients.

Model Specifications:

Sample size: 2,429 observations for 202 countries; $R^2=.285$ (Within- $R^2=.018$); estimated coefficient for Mobile Phone Subscriptions: .021 ($p<.001$).

The Indicator for Voice and Accountability:

Voice and accountability captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. We consider voice and accountability a good proxy measure of democratic structures and values. In our estimation sample, voice and accountability ranges from -2.2 to 1.8, with higher values meaning more voice and accountability.

Model 2: Mobile Phone Subscriptions and Gender Inequality

$$\text{Gender Inequality}_t = \beta_0 + \beta_1 * \ln(\text{mobile}_{t-1}) + \sum_{i=1}^3 \alpha_i * \text{year}_i$$

All variables were transformed by subtracting the country mean to yield fixed-effects estimates of the coefficients.

Model Specifications:

Sample size: 457 observations for 148 countries; $R^2=.036$ (Within- $R^2=.529$); estimated coefficient for Mobile Phone Subscriptions: -.005 ($p=.013$).

The Indicator for Gender Inequality:

The Gender Inequality Index reflects the disadvantages women face in three dimensions – reproductive health, empowerment

and the labour market. The index shows the loss in human development due to inequality between female and male achievements in these dimensions. It ranges from 0, which indicates that women and men fare equally, to 1, which indicates that women fare as poorly as possible in all measured dimensions. As for these limits, it should be mentioned that the extremes are not reached in practice: in our estimation sample, the index ranges from 0.049 to 0.879.

Model 3: Mobile Phone Subscriptions and Education

$$\text{Education}_t = \beta_0 + \beta_1 * \ln(\text{mobile}_{t-1}) + \sum_{i=1}^{10} \alpha_i * \text{year}_i$$

All variables were transformed by subtracting the country mean to yield fixed-effects estimates of the coefficients.

Model Specifications:

Sample size: 1,542 observations for 188 countries;
 $R^2 = .021$ (Within- $R^2 = .827$); estimated coefficient for
 Mobile Phone Subscriptions: .005 ($p < .001$).

The Indicator for Education:

The education component is measured by the mean number of years of schooling for adults aged 25 years and expected years of schooling for children of school-entering age. Mean years of schooling is estimated based on educational attainment data from censuses and surveys. Expected years of schooling estimates are based on enrolment by age at all levels of education and population of official school age for each level of education. We think of the Education Index as a good proxy measure of education in general. In our estimation sample, the index ranges from 0.109 to 1.000, with higher values denoting more education.

Model 4: Mobile Phone Subscriptions and Economic Development

$$\text{gdp per capita} = c * \text{internet}^{a1} * \text{mobile}^{a2} * \text{law}^{a3} * \text{regulation}^{a4} * \text{property}^{(1-a1-a2-a3-a4)} * \exp(\text{trend} * d)$$

Or in logarithmic notation:

$$\ln(\text{gdp per capita}) = \ln(c) + a_1 \ln(\text{internet}) + a_2 \ln(\text{mobile}) + a_3 \ln(\text{law}) + a_4 \ln(\text{regulation}) + (1 - a_1 - a_2 - a_3 - a_4) \ln(\text{property}) + d * \text{trend}$$

The model was based on annual data for more than 50 countries between 2000 and 2010; $R^2 = .988$; estimated coefficient for Mobile Phone Subscriptions: .063 ($p < .001$).

Description of Independent Variables:

Mobile Phone Subscriptions (per 100 people)

Mobile telephone subscriptions are subscriptions to a public mobile telephone service using cellular technology, which provide access to the public switched telephone network. Post-paid and pre-paid subscriptions are included.

Fixed Broadband Internet Subscriptions (per 100 inhabitants)

Fixed broadband internet subscribers are the number of broadband subscribers with a digital subscriber line, cable modem or other high-speed technology.

Rule of Law Index

The Rule of Law Index reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police and the courts, as well as the likelihood of crime and violence.

Property Rights Index

This index measures the degree of protection for persons and their property from the aggression of others.

Regulation Index

This index measures how regulations restrict entry into markets and how regulations interfere with the freedom to engage in voluntary exchange. The index covers regulatory restraints that limit the freedom of exchange in credit, labour and product markets.

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The Vodafone Institute for Society and Communications was founded in 2011. With this study, the Institute aims to provide an initial overview of the fundamental impact that mobile technologies are having on our lives. The study was conducted by the Cologne Institute for Economic Research (IW) and explores the ways in which mobile technologies influence economics, society and people's private lives. In addition to shedding light on changes in developed countries, it focuses in particular on the progress brought about by the adoption of mobile phones in developing countries and emerging markets.

The study bases its findings on numerous sources, including interviews with ten acknowledged experts in the field, and a worldwide survey of Vodafone country experts. On the basis of this data, the IW has been able to quantify the economic and social effects of mobile technologies for the first time.



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