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**"ICTS FOR DEVELOPMENT AND FINANCIAL INCLUSION IN**  
**AFRICAN COUNTRIES"**

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## **ABSTRACT**

Il tema delle Tecnologie dell'Informazione e della Comunicazione (ICT) e il loro ruolo nel favorire la crescita economica e lo sviluppo ha assunto grande rilievo nel contesto dell'economia globale. Il presente elaborato illustra il predetto argomento con un particolare focus sull'inclusione finanziaria in Africa.

La letteratura in materia conferma l'esistenza di una relazione positiva tra telecomunicazioni e crescita. L'investimento in ICT non solo aumenta la crescita del relativo settore ma ha un'influenza positiva sull'economia in generale. Le ICT contribuiscono a migliorare la produttività diminuendo i costi di transazione, permettendo un flusso di informazioni più immediato e creando forti esternalità di rete. Si ritiene che l'avvento di Internet e la diffusione globale del telefono cellulare possano avere un potenziale trasformativo ancora maggiore. Queste implicazioni sono particolarmente rilevanti per i paesi in via di sviluppo.

Tuttavia, il compito di determinare l'effetto "catch up" dei PVS nei confronti di quelli industrializzati non può essere attribuito esclusivamente alle ICT, ma si rende necessaria l'integrazione di queste tecnologie in un più ampio quadro normativo e istituzionale nonché in una generale strategia di sviluppo. Tra i fattori complementari alle ICT, si possono citare lo sviluppo di settori economici che ne fanno uso intensivo, l'accessibilità fisica ed economica sul lato della domanda, la qualità dell'istruzione e il livello di alfabetizzazione digitale e, soprattutto, un contesto istituzionale che attui politiche favorevoli e introduca incentivi all'investimento e alla diffusione delle ICT.

In molti PVS, tra cui l'Africa in primis, si è verificato un "leapfrogging tecnologico" per cui sono state adottate le ultime tecnologie, i telefoni cellulari nello specifico, senza passare per le tipologie più tradizionali. I telefoni cellulari hanno delle caratteristiche particolarmente attrattive per paesi, come quelli dell'Africa subsahariana. Infatti, oltre ad essere più economici, sono adatti ad essere utilizzati in aree dove le infrastrutture e i servizi di base, come l'elettricità, sono assenti o inaffidabili. Il deficit infrastrutturale penalizza significativamente la produttività e la competitività delle imprese locali e impedisce il raggiungimento degli obiettivi di crescita economica e sviluppo umano.

La penetrazione della telefonia mobile in Africa è aumentata drasticamente negli ultimi di due decenni aprendo delle possibilità precedentemente impensabili. Uno dei canali tramite i quali i

telefoni cellulari hanno il potenziale di influenzare la crescita economica è quello dell'inclusione finanziaria. Attraverso i telefoni cellulari è possibile fornire servizi finanziari accessibili a quelle comunità non servite dal sistema finanziario formale. L'introduzione di servizi di m-banking, ossia iniziative che permettono depositi, pagamenti e trasferimenti di denaro tramite telefono cellulare, ha permesso di ridurre o addirittura eliminare le barriere spaziali, temporali ed economiche associate ai sistemi bancari tradizionali. Attualmente, in Africa subsahariana, sono attivi 140 servizi di "mobile money" in 39 Stati, tra questi il più celebre è M-PESA introdotto in Kenya da Safaricom nel 2007. M-PESA non solo è diventato lo standard di riferimento a livello mondiale, ma ha permesso al 2% delle famiglie keniate di uscire da una condizione di estrema povertà.

# CONTENTS

<b>INTRODUCTION.....</b>	<b>5</b>
<b>PART 1: ICTS AND ECONOMIC GROWTH.....</b>	<b>8</b>
TELECOMMUNICATIONS INFRASTRUCTURE.....	8
TRANSACTION COSTS AND NETWORK EXTERNALITIES .....	10
REVERSE CAUSALITY.....	11
<b>PART 2: ICTS IN DEVELOPING COUNTRIES .....</b>	<b>13</b>
THE CONVERGENCE HYPOTHESIS .....	13
CHALLENGES IN APPROPRIATING ICTS FOR DEVELOPMENT AND LEAPFROGGING .....	14
THE ROLE OF MOBILE PHONES .....	17
<b>PART 3: ICTS IN AFRICA .....</b>	<b>21</b>
THE INFRASTRUCTURE DEFICIT .....	21
ICTS AND THE MOBILE REVOLUTION .....	24
<b>PART 4: FINANCIAL INCLUSION AND M-BANKING .....</b>	<b>28</b>
FINANCIAL INCLUSION .....	28
MOBILE MONEY .....	31
<b>PART 5: THE CASE OF M-PESA IN KENYA.....</b>	<b>34</b>
THE SITUATION BEFORE M-PESA .....	34
HOW IT WAS BORN.....	35
HOW IT WORKS .....	36
USERS.....	37
USES AND ECONOMIC IMPACTS .....	37
REGULATORY AND POLICY ISSUES.....	40
AGENTS AND LIQUIDITY MANAGEMENT.....	41
<b>CONCLUSION.....</b>	<b>42</b>
<b>REFERENCES.....</b>	<b>44</b>

## INTRODUCTION

When discussing the determinants of economic growth and development, it is helpful to include non-traditional inputs like human capital accumulation, infrastructure and knowledge-based activities as they are crucial to achieving sustained growth (Dissou and Didic, 2013). Input-driven growth models incur in diminishing returns while technological progress allows for long-run growth. The essential role of the generation and distribution of knowledge and new ideas was stressed by Romer (1986; 1990) who identified the ‘natural externality’ of knowledge as an important engine of growth. The advent of the New Economy and the increased integration of global markets put new technologies and information into the foreground. This is testified to by the pervasive presence of Information and Communications Technologies (ICTs) throughout the developed world, and lately in several developing countries as well. In the current global context, information and communication are key to every transaction and ICTs are often as valuable as traditional inputs and basic utilities, such as water, electricity and transport, especially in developing countries.

ICTs can be defined as the ‘electronic means of capturing, processing, storing and disseminating information’ (Duncombe and Heeks, cited in Souter 2004) and consist of hardware, software, networks and media both traditional, e.g. radio, telephone and TV, and modern, such as computers, the Internet, mobile phones (Delponte et al., 2015). ICTs are increasingly considered having a great potential for improving productivity and efficiency, and consequently growth, (Datta and Agarwal, 2004) and for supporting the strategy of ‘leapfrogging’ (Steinmueller, 2001) in developing countries. The application of ICTs toward social and economic development with a focus on poverty reduction is referred to as ICTs for development (ICT4D). However, the benefits of ICTs are not usually distributed evenly across countries and social groups. The resulting digital divide risks to widen the gap with developed economies and exacerbate a pre-existing situation of poverty, inequality and social exclusion. Hence, this drawback must be weighed against the potential and the transformational opportunities envisaged by ICTs.

ICTs are ubiquitous and, since their technology is continuously improving, they are able to reduce costs and contribute to innovation. In particular, ICTs affect growth in both direct and indirect ways. The direct effects arise from the supply of telecommunications services and are related to the increase in domestic output, demand, employment, government revenues and an improved balance of payments. The indirect effects are connected to the use of ICTs and

include higher capital accumulation, increased productivity, better and larger markets, human development and financial inclusion (Kpodar and Andrianaivo, 2011). The effects of ICTs on growth have been described as characterised by network externalities. Therefore, it has been argued that only high-income countries are able to reach the threshold necessary to achieve a considerable impact on growth while developing countries are less equipped to take advantage of ICTs. Although the literature on the link between ICTs and growth in developed countries has flourished over the years, far less research has been conducted on the subject for developing countries. A common assumption is that the findings reached for developed countries will apply to developing countries as well, but this is not necessarily true. In general, the expected positive results from the introduction and spread of ICTs in the developing world are considered to be conditional upon the presence of a conducive environment consisting of an enabling policy and regulatory framework, investment in infrastructure and education (Souter, 2004).

Research on the effects of ICTs on economic growth and development has previously been focused on traditional technologies, such as fixed telephones. Most developing countries, however, have bypassed, or ‘leapfrogged’, this type of ICTs and proceeded to adopt the latest technology: mobile phones (Aker and Mbiti, 2010). These devices have several advantages which can appeal to developing countries, namely they are cheaper and apt to be used in areas where basic infrastructure, viz. electricity, is absent or unreliable. Since the 1990s, studies on the impact of mobile phones on growth and development have highlighted their potential to address long-standing social and economic issues.

In the developing world, Africa, and Sub-Saharan Africa in particular, presents a challenging picture. Africa lags behind other developing countries in a number of indicators, from human development to basic infrastructure, but is also the region where mobile phone uptake is growing the most. The phenomenon has been referred to as the ‘mobile revolution’ and has sparked a wave of optimism for the future. One of the channels through which mobile phone penetration may affect economic growth is financial inclusion (Andrianaivo and Kpodar, 2012). In Africa, a great part of the population is excluded from the formal financial system because of poverty, lack of infrastructure and the shortcomings of traditional branch-based banking. Mobile phones are multifunctional tools that can be used as platforms for the supply of different types of services. Hence, the development of mobile money services, which allow monetary value to be stored and transacted directly among users through mobile phones, has enabled the provision of cost-effective financial services to the previously ‘unbanked’ with

positive implications for growth and development. The most remarkable mobile money success story is that of M-PESA, introduced by the mobile provider Safaricom in Kenya in 2007.

The essay is organised as follows. Part 1 discusses the relationship between ICTs and economic growth taking into consideration the differences with traditional infrastructure, the network effects and the issue of reverse causality. Part 2 addresses the opportunities and challenges of ICTs in developing countries, with a focus on the role of the mobile phone. Part 3 considers the situation of Africa in relation to its infrastructure gap and the mobile revolution. Part 4 presents the problem of financial inclusion and how mobile money can help overcome it while Part 5 examines the case of M-PESA in Kenya. The last section concludes.

## **PART 1: ICTS AND ECONOMIC GROWTH**

Whether and how ICTs affect economic growth has been a topic of growing attention and debate by researchers within growth and development literature, in particular in light of the most recent trends in the global economy and the integration of world markets. Moreover, a focus on ICTs potential role in bridging the income gap existing between developed and developing countries has emerged.

### **TELECOMMUNICATIONS INFRASTRUCTURE**

Information and communications technologies are a specific type of infrastructure that can potentially have more influence on productivity and growth compared to other and more traditional types of infrastructure, such as transportation, water systems or electricity. Studies have reached contradicting conclusions regarding the correlation between public infrastructure investment and growth. An early study by Aschauer (1989) observes a considerable contribution of public 'core infrastructures' to output and TFP growth, also by stimulating private investment and enhancing returns on private capital. However, these results have been repeatedly criticised because of the presence of a spurious correlation and misspecifications in the equations as well as ambiguity about the direction of causality (Munnell, 1992; Greenstein and Spiller, 1995). While the role of public infrastructure in fostering growth remains controversial, telecommunications infrastructure is increasingly recognised not only as strategic for productivity but also for its indirect social effects.

One of the first studies on the issue is the one by Hardy (1980), who analysed 60 countries over 13 years to ascertain the telephone's contribution to economic development. The sample included both developed and developing nations and, through a cross-sectional time series, GDP per capita was regressed on lagged GDP per capita, lagged telephones per capita and lagged number of radios. Telephones per capita were found to have a significant impact on GDP, contrary to radios. However, estimating the regression separately for developing and developed countries, the coefficients were not significant, probably due to the limited number of observations available. Telephones are described as having a 'catalytic effect' on economic development and two main roles are identified as vehicles, an organizational and an informational one. The former entails an improved coordination of economic activity, for instance through economies of scale and more efficient allocation of resources, while the latter involves the transfer of information and knowledge regarding new production techniques. The results support the hypothesis that telephones positively influence



organizational factors whereas the correlation with information flows is found to be not significant. Hardy's seminal paper also brings to attention some questions that have later become central points of the ICT4D discourse. Primarily, the problem of reverse causality, that is the fact that the relationship between telecommunications and economic growth may be bidirectional, the link between ICTs and urbanization and industrialization and the potential of telecommunications for allowing an equal distribution of wealth across different regions of the world.

Cronin et al. (1993) present empirical evidence from the USA that telecommunications have consistently contributed to the country's productivity growth during the second half of the last century. Investment in telecom infrastructure has positive ramifications for other sectors, especially the information intensive ones such as finance, trade, transportation and real estate. In particular, the TFP of the telecommunications industry in the USA increased by 3% each year between 1963 and 1991, significantly exceeding the overall productivity growth of the economy, which averaged only 0.2%. The conclusion is that telecommunications have the capacity to substantially stimulate an economy and the modernization of their infrastructure should be encouraged by public policies. A study by Röller and Waverman (2001) lists several ways in which telecommunications can result in economic growth. Firstly, investment in ICTs increases the demand for related goods and services. Secondly, they reduce the cost of doing business, for example by allowing long-distance communication and diminishing transaction costs. In addition, telecommunications have considerable spillovers and produce externalities. In a more recent paper by Czernich et al. (2011), an IV approach is employed to estimate the effect of broadband infrastructure on economic growth on a sample consisting of 25 OECD countries between 1996-2007. Since the pre-existing voice telephony and cable network diffusion is likely to influence the extent of later and further broadband penetration, it is used as the exogenous source of variation in the model. The findings are that broadband had a relevant impact on GDP per capita; namely, its introduction caused an increase of 2.7-3.9% on average in GDP per capita growth and a 10 percentage points increase in broadband penetration determined a 0.9-1.5 percentage points increase in annual GDP per capita growth. In addition, Czernich et al. argue that broadband may have more extensive and higher-quality implications for growth and development than public infrastructure in general and, above all, traditional telecom infrastructure.

## TRANSACTION COSTS AND NETWORK EXTERNALITIES

In the context of a rising integration of the global economy, reliance on telecom infrastructure and services to provide an efficient and connected network that facilitates the transfer of information is more and more important for economic growth. Effective telecommunications generate benefits directly and indirectly by lowering transaction costs, that is the external costs involved in making an economic transaction which are negatively correlated to the facility of acquiring information and thus with aggregate output (Madden and Savage, 2000). Norton (1992) was one of the first to consider the existence of a link between transaction costs, telecommunications and economic growth. In his paper, Norton argues that telecommunications reduce transaction costs through the channel of capital and investment market efficiency, also by decreasing macroeconomic uncertainty, and by streamlining and rationalising the decision-making process. Czernich et al. (2011) point out that, whereas telephones improve coordination and decrease transaction costs, high-speed Internet broadband has even more pronounced positive consequences for productivity. For instance, it accelerates distribution of information and ideas allowing better decentralisation, market competition, product and process innovation, transparency, the emergence of new business models and work practices. Greenstein and Spiller (1995) remark that telecom infrastructure positively affects not only costs in the sector in which it is employed but it also has indirect effects on other related fields, which can spread geographically. Furthermore, high transactions costs can prevent markets for certain goods from existing and, according to Leff (1984), this is due especially to the fixed and variable costs of acquiring information and to the cost of negotiating transactions, both of which are curtailed by efficient telecommunications. This can have a far-reaching impact on growth allowing smoother information flows and communication, better managerial performance, increased entrepreneurship and more efficient allocation of resources. In addition, productivity gains derive from the improved physical dispersion of activities since firms can exploit comparative advantages and reduce production costs (Andrianaivo and Kpodar, 2012).

Norton notes that the improvement in X-efficiency that telecommunications generate in other markets is difficult to quantify since it is confused with the growth of those sectors. However, the presence of substantial spillovers and externalities associated with the introduction of telecommunications and which can potentially expand through multiple sectors of the economy is evident. In particular, a distinctive feature of telecommunications is the fact that they cause network externalities; in fact, their benefits and social value are higher the greater

the number of users and the cost of supplying this kind of technologies declines when the network expands. Leff (1984) refers to lower information and transaction costs due to telecommunications as 'net social gains' and affirms that some of those externalities can be categorised as public goods; for instance, the resulting enhanced ability of an economy to address promptly and effectively opportunities and problems. While Leff (1984) uses a social benefit-cost analysis to determine the welfare and network effects of investment in telecommunications, Röller and Waverman (2001) investigate the possibility of the existence of a critical mass in relation to the external economies created by telecommunications. Since the positive effects are larger the greater the network, it follows that the impact on growth is not linear and might be conditional to the network achieving a certain size. They estimate a micro-model of demand and supply for telecommunications and jointly a macro production function, using OECD countries as a sample. The results show that the causal relationship between telecom infrastructure and growth is stronger when a specific threshold is reached, thus confirming the hypothesis of a critical mass. This threshold is found to be set at high levels of telecommunications penetration, where the impact on output is twice that at low or medium levels. The high penetration corresponds to levels above 40%, which means 2-2.5 people per household, hence nearly universal service. In sum, telecom expansion can lead to a reduction in space and time of the production, distribution, exchange and consumption processes and to improved information flows both in quality and quantity (Madden and Savage, 2000). The existence of such externalities adds to the argument of correlation between telecommunications and productivity, and consequently growth, by allowing the diffusion of beneficial effects to the whole economy (Antonelli, 1995).

## REVERSE CAUSALITY

The first study to compare the ratio of teledensity, that is the number of telephones or telephone penetration, to GDP per capita was conducted by Jipp (1963). The result is known as 'Jipp curve' and shows a strong positive correlation, that is wealthier countries have higher teledensity compared to poorer ones. However, the direction of this connection is ambiguous since it could be determined by reverse causality and a distinction between two effects should be made in order to obtain correct estimates. The first effect is the higher growth attributable to increases in telecom infrastructure, the second is linked to the income elasticity of telecommunications demand, i.e. economic growth stimulates demand for telecom infrastructure investment (Röller and Waverman, 2001). Several studies have found evidence of a two-way causation, such as Cronin et al. (1993) and Madden and Savage (2000). Röller

and Waverman endogenize telecommunications investment through their jointly estimated micro and macro models thus controlling for simultaneity. They specify four equations: the first one is the aggregate production function, the second one is the demand for telecommunications, the third is the supply of telecom while the fourth represents the telecom infrastructure production function. In this way, the second equation separates the demand-increasing effects of GDP growth solving the endogeneity problem (Waverman, Meschi and Fuss, 2005). The results indicate that the coefficient on the telecom penetration rate in the aggregate output equation is significant and positive but the magnitude of the effect seems unrealistically large; in fact, according to this estimate, a 1% increase in the penetration rate variable should increase growth by 0.15 percent. When controlling for country-fixed effects, the impact changes considerably to 0.045 which, considering OECD countries, would mean that about one-third of economic growth can be imputed to telecommunications. Norton (1992) uses data from 1957-77 from 47 countries to estimate the effect of the average stock of telephones in the period on the mean annual growth rate. In order to identify the causal link, Norton controls for the initial year's stock of telephones and finds its coefficient to be significant concluding that the relationship is not due to reverse causality. Datta and Agarwal (2004) conduct an analysis with a similar aim and they use a macro growth model controlling for a lagged measure of teledensity as a proxy for telecom investment. This variable is found to be significant and this confirms the thesis that telecommunications infrastructure influences GDP growth. In conclusion, the positive relationship is not solely due to reverse causality but disentangling the two effects is necessary to have a clear picture since it is also apparent that an increased purchasing power contributes, to some extent, to augmenting demand for telecommunications services.

Therefore, having found extensive evidence that confirms a positive and strong relationship between telecommunications infrastructure and productivity, which translates into higher economic growth and development, it is necessary to mention the important implications that ensue, especially for developing countries. The question is whether new telecommunications can generate a growth dividend also in these areas of the world and whether they are able to allow them to catch up, breaking them out of their 'low telecoms trap'.

## **PART 2: ICTS IN DEVELOPING COUNTRIES**

Most developing countries experience a 'low telecoms trap', that is a circumstance in which the access to telecom networks is restricted and costs are high which limits telecoms investment and demand resulting in a catch-22 situation (Waverman, Meschi and Fuss, 2005). Information in developing countries is often 'poor, scarce, maldistributed, inefficiently communicated and intensely valued' (Geertz, cited in Leff, 1984 p. 257). In a context where knowledge and its access are deemed inputs as important as capital and labour, these countries appear overall less equipped to take advantage of ICTs than developed economies. While the evidence of a beneficial impact of ICTs on productivity and growth is undisputable for OECD countries, the debate remains open for the Least Developed Countries (LDCs). The widespread expectation that LDCs will catch up with the developed world with the help of new telecommunications technologies has to grapple with the fact that intrinsic differences exist between the two.

### **THE CONVERGENCE HYPOTHESIS**

Neoclassical growth theory implies the idea of convergence, i.e. per capita income growth is inversely proportional to the initial level of output or income per capita (Datta and Agarwal, 2004). In other words, the initial income of an economy is negatively correlated with growth rates, which is also known as 'catch-up' effect. From a cross-country point of view, this means that poor countries with little capital will grow at faster rates than rich ones because they are less affected by diminishing returns, in particular to capital. A logical outcome deriving from these assumptions is that every country will converge to the same long-run income level conditional, however, on other factors being held constant, namely investment rate and population growth rate, and on whether the same technologies are available to all of them (Barro, 1991). Endogenous growth models, instead, do not predict convergence and argue that growth can continue to be slower in less developed countries because presumptions about diminishing returns to capital and the exogeneity of technological change are not taken into account (Romer, 1986; 1994). In their regression to estimate the effect of telecoms on growth, Datta and Agarwal (2004) regress real GDP per capita growth on a set of variables, among which lagged GDP per capita, to measure the effect of the previous output levels on subsequent growth, and the square of the teledensity variable, to gauge the nature of the returns to scale to telecom investment. The coefficient of the lagged GDPPC variable is found to be negative and significant which means that countries with higher GDPPC grow at a slower rate thus confirming the convergence hypothesis. Furthermore, the teledensity square

variable is also negative and significant which suggests diminishing returns to scale to telecom investment and, as such, telecommunications should have a greater positive impact on growth in countries where the telecom infrastructure is scarcer, similarly to what happens with diminishing returns to capital. The implication for developing countries, in this case, would be that they can reap bigger benefits from the introduction of ICTs.

However, Datta and Agarwal's study is conducted on a sample of OECD countries so it is not certain that the same conclusions apply to LDCs. Moreover, Röller and Waverman's (2001) analysis of a group of OECD nations contradicts these results. They observe that the presence of network externalities and a critical mass, which corresponds to nearly universal service, supports the notion of increasing returns to telecoms infrastructure since countries that have surpassed the threshold would grow faster. As a result, 'marginal improvements in the telecommunications infrastructure in non-OECD countries might not generate the largest possible aggregate growth effects' (p. 921) but a more substantial investment would be needed instead. In this instance, the underlying hypothesis is not one of convergence but rather of divergence. Barro (1991) regresses average GDPPC growth rates for a cross-section of 98 countries for the period 1960-1985 on regressors including initial GDPPC, school enrolment as a proxy for human capital stock, government consumption to GDP ratio and measures of political stability. The notable findings are that the convergence hypothesis holds true only for a given starting level of GDP per capita. Moreover, given the initial level of GDPPC, a nation's subsequent growth rate is positively related to the initial human capital stock. Therefore, poor countries can catch up and bridge the income gap with rich ones, subject to the availability of a significant endowment of human capital which is not a common occurrence in LDCs. Norton (1992) remarks that contradictory evidence exists on the issue of cross-country convergence and that it seems more likely to happen for rich countries than poor ones. In addition, Norton notes that the convergence hypothesis appears more robust when variables measuring telecoms infrastructure are included. In conclusion, convergence is not a guaranteed outcome and although telecommunications might play a part in it, this is contingent on the actual ability of developing countries to exploit them to their full potential.

#### CHALLENGES IN APPROPRIATING ICTS FOR DEVELOPMENT AND LEAPFROGGING

Findings from studies conducted on OECD countries should not be assumed to work identically for developing countries without reasonable grounds. In fact, prospects for the

developing world, especially for LDCs, regarding ICTs are less encouraging and even if these countries will be able to replicate the technologies of developed countries, the impact will inevitably be different (Morales-Gomez and Melesse, 1998; Souter, 2004). Firstly, expectations on this matter are often exaggerated and based more on presuppositions rather than actual evidence, this being partly due to the lack of research caused by a shortage of historical and current data, methodological problems and the relative recency of the phenomenon. Secondly, the focus of ICTs in developing country has been more on poverty alleviation and their potential to help address and meet development goals, namely the Millennium Development Goals (MDGs), in areas such as health, education, empowerment as well as agriculture and finance (Delponte et al., 2015). Furthermore, not all non-OECD countries are the same and they find themselves at different degrees of development, from middle-income ones and transition economies to LDCs, where the developmental value of ICTs is particularly of interest.

In any event, ICTs cannot operate on their own but, in order to maximise their effectiveness, they need to be integrated into national socio-economic and development strategies through a concerted approach and they are greatly influenced by the presence of synergies with complementary factors (Morales-Gomez and Melesse, 1998; Souter, 2004). In particular, some factors have the ability to enhance, prevent or inhibit the economic impact of ICTs on productivity and growth. There are some important differences between developed and developing countries; for instance, LDCs' economies are based mainly on the commodity sector and on domestic or subsistence agriculture so, since ICTs are mostly used in the service sector and in modern manufacturing, their value is more limited and thus networking is also constrained by the weaker linkages with the national economy. Moreover, most developing countries lack production sectors and markets for ICTs because of difficulties and high costs of supplying remote rural areas and problems of affordability on the demand side due to the population's low disposable income. This poses challenges to the sustainability of ICT investment and to their accessibility by those who would need them the most. Another relevant issue is the shortage of human capital in developing countries. The importance of human capital in the technological progress process and, as a consequence for enhancing productivity, cannot be overstated (Romer, 1990). In developing countries, human capital, especially highly skilled one, is not widely available as it is in OECD countries and automating jobs is not as convenient because of the surplus of low-skilled cheap labour. Educational standards are poor and the costs of training and adapting the workforce to new practices are not compensated by the improved productivity and skilled labour is difficult to

retain because of more profitable opportunities abroad (Souter, 2004). Lastly, an essential complementary factor when discussing ICTs and their impact on economic growth and development is the institutional framework. Institutions constitute the system of incentive and constraints, of costs and benefits, that reduces uncertainties intrinsic to human, and more specifically, political, economic and social interactions and ‘they are the underlying determinant of the long-run performance of economies’ (North, 1990 p.107). Economic and political institutions are the primary and ‘deeper’ explanations for differences in economic performance across countries (Olson, 1996). The institutional underpinnings of an economy are fundamental for the creation of an environment conducive to ICT investment and diffusion. Therefore, governments should prioritise policies in this regard and businesses should facilitate their implementation. In particular, liberalisation and market competition drive private investment, increasing efficiency and reducing costs and prices. LDCs often have more onerous regulatory requirements, for example regarding licensing, IPRs, which make them less attractive. In a lot of developing countries property rights and rule of law are not consistently enforced, access to financing and market entry are restricted, entrepreneurship and innovation are not encouraged and authorities lack transparency and accountability and are often corrupt (Souter, 2004; Delponte et al., 2015).

An empirical analysis conducted by Bali moune-Lutz (2003) examines the determinants of ICT diffusion in a sample of 47 developing countries. Mobile phones subscribers and personal computers per 100 inhabitants, number of Internet hosts and users are used as indicators for ICTs. The variables tested as possible determinants are per capita income, education, trade openness, financial and freedom indicators. The results are in line with the previous assumptions, that is income, government trade policies and, to some extent, political rights and civil liberties have a positive impact on ICTs but, unexpectedly, education is found to bear no relation to ICT diffusion. This is consistent with other similar studies, among which Kiiski and Pohjola (2002) who do not identify education as a significant predictor of Internet diffusion in OECD countries. However, in both papers, some reservations are brought forward regarding the appropriateness of adult literacy, the UNDP education index or schooling years as measures of education. Moreover, Kiiski and Pohjola find that tertiary education is positively correlated with ICT diffusion and that years of schooling are significant when considering a larger sample including both developed and developing countries, likely because the variable presented a greater variability in this case.



The need to take into consideration the prerequisites for the appropriation of ICTs in developing countries are stressed also by Steinmueller (2001). In his article, Steinmueller recognizes that ICTs have the potential to allow ‘leapfrogging’, that is ‘bypassing some of the processes of accumulation of human capabilities and fixed investment in order to narrow the gaps in productivity and output that separate industrialized and developing countries’ (p. 194). However, the process of technology transfer is not straightforward and, above all, emulation of developed countries’ technologies is not always effective. Leapfrogging stages of technological development is made difficult by the fact that the benchmark for state-of-the-art technologies is constantly shifting and ICTs are prone to technological obsolescence. The presence of absorptive capabilities for production and adoption of technologies, access to markets of for equipment and complementary technologies and to the know-how as well as the development of downstream markets are characteristics of paramount importance. Furthermore, there is the issue of dependency and foreign control. In fact, in a situation where resources are scarce, multinational companies may have an advantage in investing in ICTs at the expense of domestic firms. This clashes with the need to enable the local environment and foster local capacity building. In this context, ICTs should not be considered as ends in themselves but means to achieve long-term objectives (Morales-Gomez and Melesse, 1998). If social, political, economic and other macro factors that are the original cause of poverty and inequality remain unchanged, ICTs will not suffice to bridge the development and income gaps. On the contrary, the risk is that ICTs will act as social and economic ‘dividers’, instead of ‘equalizers’, and exacerbate the very problems they are meant to solve. In other words, instead of promoting pro-poor equitable growth, they will worsen the disparities among income and social groups, genders, rural and urban communities, educated and illiterate people (Delponte et al., 2015).

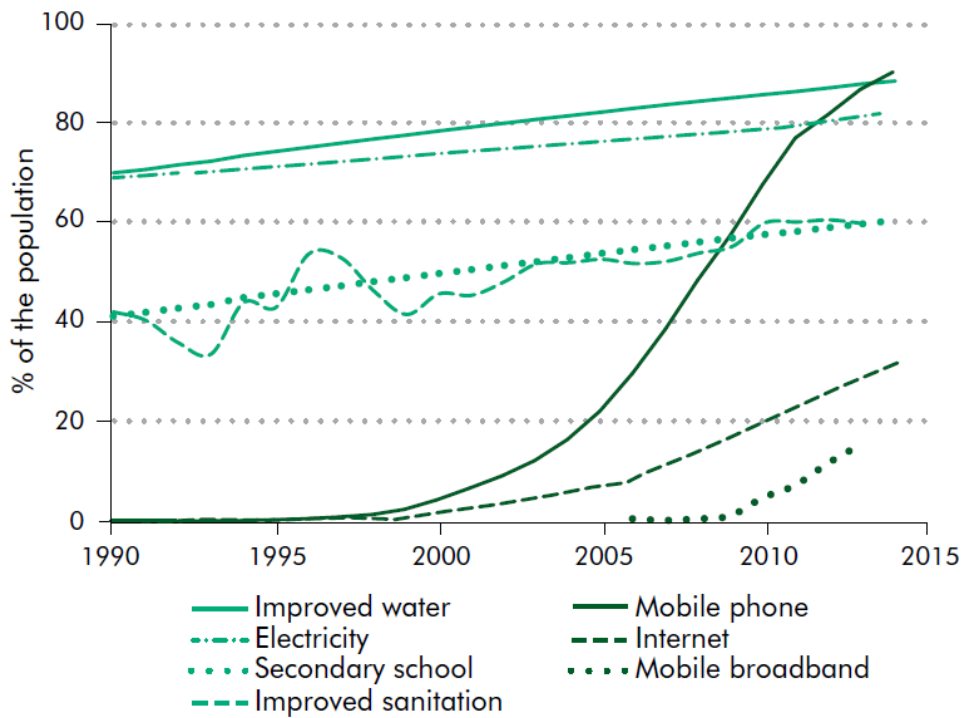
## THE ROLE OF MOBILE PHONES

A ‘leapfrog’ technology par excellence is the mobile phone. Most developing countries have bypassed investment in fixed landlines and leapfrogged directly to cellular phones. The introduction of mobile phones allowed to quickly and less expensively increase telecom penetration in areas where basic infrastructure is lacking (Sridhar and Sridhar, 2007). In fact, an obstacle to the diffusion of ICTs is the absence, unreliability and expensiveness of basic infrastructure, namely electricity supply. Wireless technologies can be recharged with generators where there is no electrical grid and mobile phone networks are cheaper, faster and easier to install than fixed lines. Mobile networks can cost up to 50% less per connection than

physical wires. Moreover, mobiles require smaller scale economies and their modularity makes them more versatile (Waverman, Meschi and Fuss, 2005). On average, 8 in 10 people living in developing countries own a mobile phone, among which almost 70% of the bottom fifth of the population. The poorest communities in these areas are more likely to own a mobile phone than to have access to clean water, sanitation or electricity (World Bank, 2016).

### Digital transformation in action

Digital technologies are spreading rapidly in developing countries

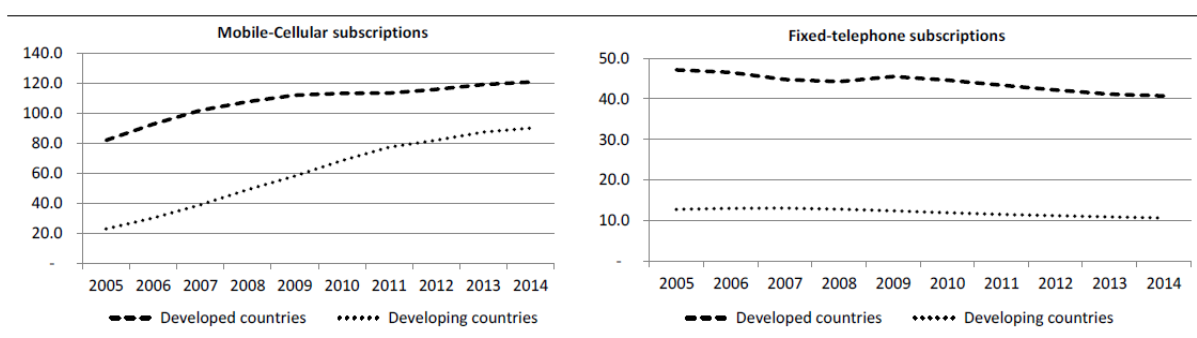


Source: World Bank (2016)

Even though about three-quarters of all mobile subscriptions are in low and middle-income countries and, according to the International Telecommunications Union (ITU), 95% of the world’s population lived in areas reached by a mobile signal in 2015, 4 billion people remain without access to the Internet and 90% of them are in developing countries (Delponte et al., 2015; World Bank, 2016). This is mainly due to affordability issues since mobile ownership is costlier as a percentage of per capita income for the poorest bracket of the population than for the richest ones. Mobile prices are falling steadily, they decreased by 20% of GNI p.c. in LDCs in 2015 and tariffs are decreasing also thanks to the availability of prepaid packages but mobile broadband, even if cheaper than fixed broadband, is still unaffordable for most (ITU, 2016). Nonetheless, mobile phones seem to be fulfilling the role that fixed telephones played in developed nations in the 70s/80s (Waverman, Meschi and Fuss, 2005) and are transforming

rural markets in the way the telegraph did when it was introduced in the 19<sup>th</sup> century (Abraham, 2006).

Comparison between fixed and mobile phone penetration in developed and LMICs



Source: Delponte et al. (2015)

The number of macroeconomic studies on the economic impact of mobile phones in developing countries is limited since the mushrooming of mobile phones started in the late 1990s and is thus a fairly recent phenomenon whose long-run implications are still not completely visible. Waverman, Meschi and Fuss (2005) used data from 92 high-income and low-income countries in the period 1980-2003 to verify the growth effects of the introduction and rollout of mobile phones networks. They find that mobile phones are positively and significantly related to economic growth and the impact in developing countries is twice as large compared to developed ones. In particular, for a developing country, having 10 additional mobile phones per 100 inhabitants would have meant a higher growth of per capita GDP of 0.59%. Other findings concern the income elasticity of demand, which is significantly above one making mobiles ‘luxury goods’ since demand increases more than proportionally as income rises. Furthermore, the cross-price elasticity between mobile phones and fixed lines is positive suggesting that they are substitutes. This is valid for developing countries but not for developed ones where they are, instead, complements. Sridhar and Sridhar (2007) estimate a system of equations that endogenizes economic growth and telecom penetration, disaggregating the effect of mobile phones and landlines separately for a sample of 63 developing countries from 1990 to 2001. They find that mobile phones contribute positively to national output; specifically, output rises by 0.01% for every 1% increase in mobile penetration.

The impact of mobile phones on economic performance has been shown also through microeconomic evidence. Jensen (2007) studies the effects of the introduction of mobile phones within the fishing sector in the Indian state of Kerala in 1997 on the functioning of the market. The initial situation was one of inefficiency and mismatch between supply and

demand due to information asymmetry. The author finds that mobile phone adoption allowed to considerably reduce price dispersion, misallocations, waste and to increase fishermen's profits and consumer surplus. Thanks to the use of mobiles, markets did not deviate anymore from the 'law of one price', i.e. the prices of the same good sold in two different locations should not differ more than by the transportation costs. It should also be noted that these improvements are permanent and provide an example of the valuable role of ICTs as carriers of information, especially in rural and underdeveloped markets. A similar conclusion is presented by Aker (2010) who determined that the introduction of mobile phones in Niger between 2001-2006 decreased price dispersion in grain markets by 10-16%. The effect is stronger for the more isolated markets and is higher the more markets are covered, indicating the presence of network externalities. The impact of mobile phones is not strictly limited to the economic side but they can also address the different dimension of poverty and improve the livelihoods of the poor. In particular, they provide access to tools and applications useful in areas such as health, known as m-health, or gender empowerment (Delponte et al., 2015). Abraham (2006) and Aker (2010) remark that, in any case, the role of mobile phones should not be exaggerated and lead to disregard of the necessity to invest in core infrastructure, such as roads or electricity.

To conclude, the revolutionary potential of ICTs to support economic growth and development is evident. ICTs are multifunctional tools and, especially mobile phones, have user-friendly interfaces that are accessible to communities where educational levels are low. Therefore, ICTs can support developing countries in tackling a wide range of social and economic problems, from extreme poverty and financial exclusion to health issue and empowerment of vulnerable social groups. However, some caveats and limitations must be noted. First and foremost, the absence of an enabling institutional and regulatory framework can hinder or outright prohibit the positive impact. Moreover, demand-driven bottom-up initiatives are preferable and more likely to succeed than top-down ones. Governments should concern themselves with the creation of a conducive and attractive environment for the private sector, which is often more suited than the public sector or NGOs to create profitable self-sustaining projects that serve the local population and are integrated and context-specific (Jensen, 2007).

## **PART 3: ICTS IN AFRICA**

Among developing countries, the case of Africa, and Sub-Saharan African countries specifically, has been the object of extensive research and analysis to determine the reasons behind their backwardness. The 1980s have been characterised as Africa's lost decade and the economic crisis extended into the 1990s. During this time, growth in terms of GDP per capita was mostly negative (Rodrik, 2016) and the region underwent a process of deindustrialisation since the 1970s (Page, 2011). Over the last two decades, however, growth has resumed. Nevertheless, the nature of this growth has been questioned because of its erratic pattern thus raising doubts about the solidity of the 'Africa rising' argument. Evidence suggests that the determinants of recent growth are not related to structural changes but rather to temporary boosts, namely natural resources, increase in commodity prices and a surge in domestic demand (Page, 2011). As a result, questions about whether Africa's growth can be sustained, which is the right path to follow and which policies should be prioritised have emerged.

Africa's growth tragedy (Easterly and Levine, 1997) cannot be attributed to a specific factor and it can instead be described as multi-causal. The causes of Sub-Saharan Africa's (SSA) slow growth rates and lack of development have been identified by Sachs et al. (2004, cited in Mengistu, 2009) in human and physical capital constraints that prevented investment and modernisation, low levels of savings, high rates of population growth and little technology spillovers. According to an analysis by Easterly and Levine (1997), Africa's poor growth is connected to a diverse set of variables, low schooling, political instability, underdeveloped financial systems, distorted foreign exchange markets, high government deficits and insufficient infrastructure, which in turn are determined by high ethnic diversity. In fact, ethnic divisions create a polarized society and give way to rent-seeking behaviours that make it difficult to implement good policies, resulting in inefficient investment decisions. Infrastructure is one the critical areas that have been highly disregarded and since it has a pervasive influence on every aspect of an economy, the consequences for growth and development can be severe.

### **THE INFRASTRUCTURE DEFICIT**

Africa's infrastructure increasingly lags behind that of other developing countries in the provision of electricity, telecommunications, water supply, sanitation services and transportation networks. According to data from ITU and the World Bank, in 2009, only 29% of roads were paved and 25% of the population had access to electricity. Moreover, quality is

low, supply is unreliable and disruptions are frequent. The infrastructure gap is a crucial growth bottleneck and is responsible for a large part of the higher costs, lack of competitiveness and poor productivity of the region (Page, 2011).

**Table :** Impact of Unreliable Infrastructure Services on the Productive Sector

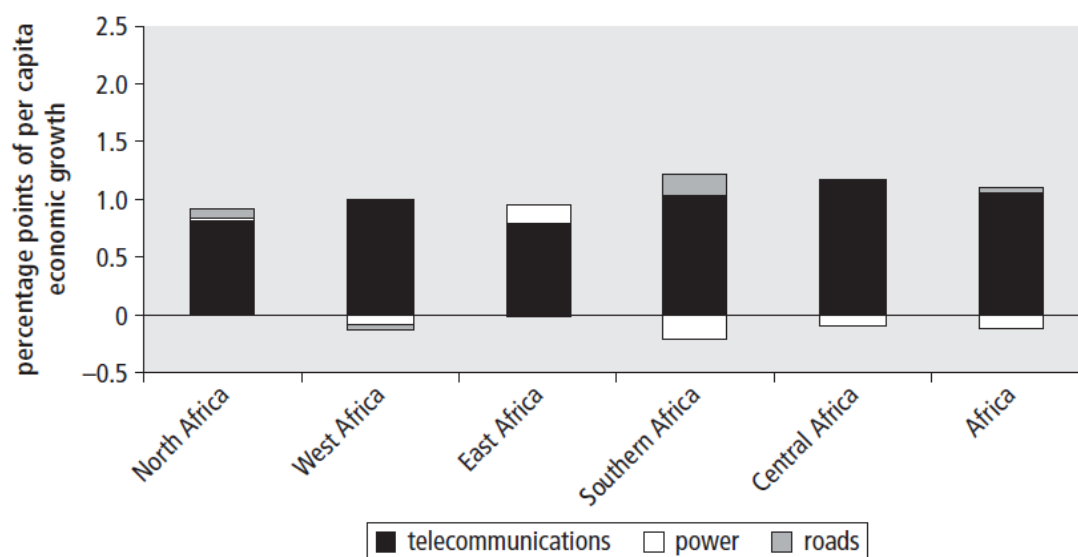
<b>Service problem</b>	<b>Sub-Saharan Africa</b>	<b>Developing countries</b>
<b>Electricity</b>		
Delay in obtaining electricity connection (days)	79.9	27.5
Electrical outages (days per year)	90.9	28.7
Value of lost output due to electrical outages (percent of turnover)	6.1	4.4
Firms maintaining own generation equipment (percent of total)	47.5	31.8
<b>Telecommunications</b>		
Delay in obtaining telephone line (days)	96.6	43.0
Telephone outages (days per year)	28.1	9.1

Source: Page (2011)

Eifert, Gelb and Ramachandran (2008) drawn on microeconomic data from the World Bank Enterprise Surveys to explain the origins of Africa's slow growth. They concentrate on the role of indirect costs, which are usually negligible in developed countries but important in developing ones. The authors argue that indirect costs linked to poor infrastructure and public service are a competitive burden for African firms. In fact, firms face higher prices coupled with lower quality compared to other parts of the world in areas such as transport, power, telecommunications and Internet services. Electricity is by far the biggest challenge: power outages are a regular occurrence and lead firms to losses of about 3-7% of total sales. This figure is as high as 20% for informal firms which cannot afford to pay high premiums for emergency power, i.e. backup generators. The overall economic cost of power shortages can easily reach 1-2% of GDP thus hindering longer-term solutions (Foster and Briceño-Garmendia, 2010). The possible explanations behind Africa's high input prices are multiple: diseconomies of scale, the absence of economies of agglomeration, inefficient technologies and allocation of resources, high-profit margins and inadequate price regulation. In total, the cost of doing business in Africa is 20-40% above that for other developing regions (Page, 2011) and infrastructure, in particular, lowers firms' productivity by about 40%. The infrastructure gap has also played a part in constraining the industrial sector, which has declined as a percentage of GDP since 1985. Infrastructure-related inputs are more intensively used in the industrial sector than in traditional agriculture and in the extractive sector and thus

poor infrastructure may have contributed to trap African economies in primary production where productivity is lower. At the household level, access to modern power, piped water, sewerage, all-season roads and landlines has progressed slowly since the mid-90s and universal access is still several decades away to be achieved. The problems are not only related to the physical rollout of networks but also to demand-side barriers (Foster and Briceño-Garmendia, 2010). Infrastructure is not only essential for long-run economic growth but it also contributes to achieving human development targets.

**Figure :** Changes in Growth per Capita Caused by Changes in Different Kinds of Infrastructure



Source: Foster and Briceño-Garmendia (2010) based on data by Calderón (2009)

A study conducted by Calderón (2009) assessed the impact of infrastructure development on 39 African countries from 1990-2005, focusing on three specific sectors: electricity, roads and telecommunications. Data for a sample of 136 countries over the period is used to run a regression on growth in real output per worker on a set of variables, including common growth determinants and indicators measuring infrastructure stock and quality. The results show that higher benefits for African countries derived from adding more infrastructure stock more than from quality enhancements. In particular, infrastructure contribution to per capita growth amounts to 0.99%, of which 0.89 is due to an increase in stock and 0.10 to quality, while the other determinants account for 0.68%, mostly coming from improvements in education. This might suggest that the current endowment is so low that emphasis on quality is not crucial in order to reverse the infrastructure deficit, at least until a certain level is reached. Most of the growth derived from infrastructure is attributable to advances in the penetration of telecommunications, about 94 basis points. Nonetheless, Africa fares poorly in

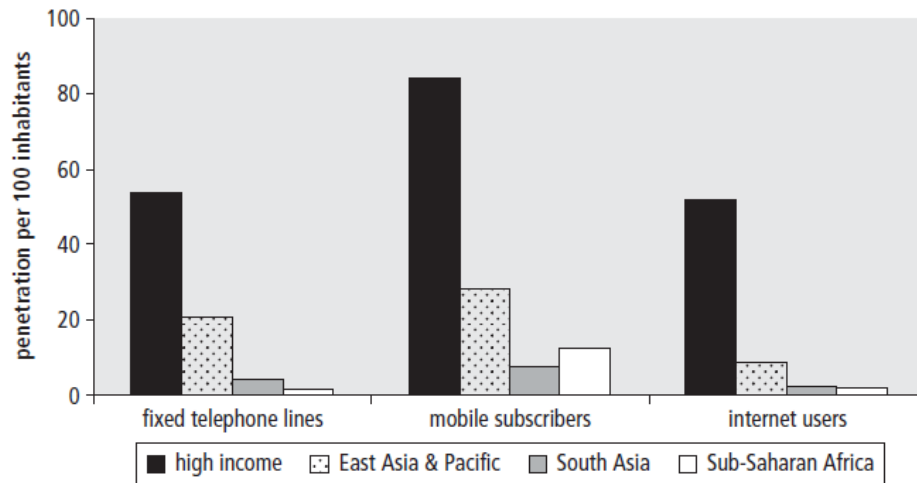
terms of telecommunications endowment compared to other regions. Africa's potential is stifled by structural deficits of which lacking infrastructure constitutes a large part and it has compromised the region's competitiveness, increased the cost of doing business, inhibited foreign direct investment, hindered trade and commerce and slowed down growth and human development.

## ICTS AND THE MOBILE REVOLUTION

Information and communications technologies' penetration has improved dramatically in the recent years in Africa, especially thanks to mobile phone services. In the period 1991-95 the average SSA's country had 10 main telephones lines per 1000 workers while in 2000-05 the figure was 93 between landlines and mobile phones, which is more than nine times than before (Calderón, 2009). Lee, Levendis and Gutierrez (2012)'s is one of the few studies to analyse the effect of mobile phones on economic growth in Sub-Saharan Africa. The results show that mobile phones indeed determine economic growth, in particular, their marginal benefit is higher where fixed lines are scarce. This confirms the hypothesis that cell phones and landlines are substitutes. In 2008, 60% of the population was reached by mobile phone coverage and mobile phone subscription increased by 49% between 2002 and 2007. Mobile phone subscribers measured by active SIM cards in the region went from 16 million in 2000 to 376 million in 2008 (Aker and Mbiti, 2010). This number might not actually reflect the actual penetration because many individuals own multiple cards; however, according to data from GSMA (2017b), SIM connections in 2016 were 731 million while unique mobile subscribers were 420 million, equating to a 43% penetration rate which was 27% in 2010. It should be noted that the most common type of mobile phones in SSA, and the developing world in general, are feature phones while smartphones account only for a quarter of connections in SSA. The figure doubled from 2015 to 2016 and, as affordability and second-hand markets grow, smartphones will become more popular (GSMA, 2017b). Internet access remains low, especially fixed broadband connection. According to ITU (2017), only 18% of Africa's households have access to the Internet and mostly through 2G or 3G mobile networks (GSMA, 2017b).

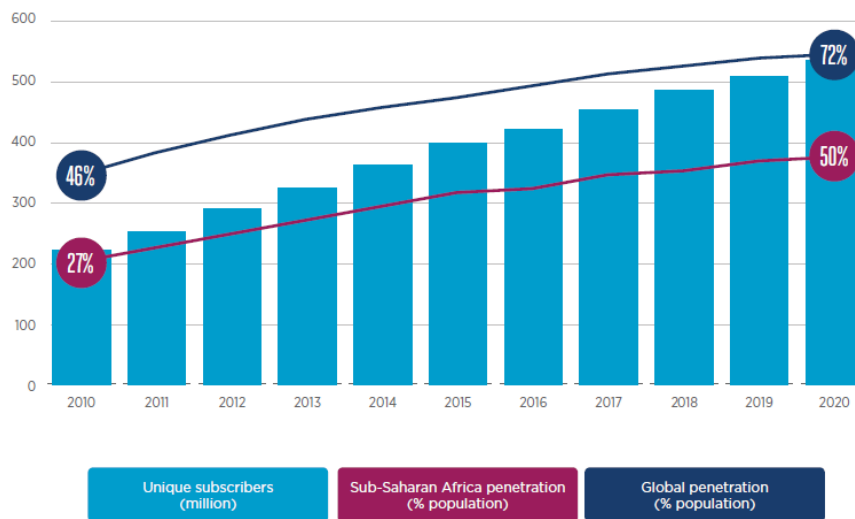


Growth of Mobile Subscribers in Africa, 1998–2006



Source: Foster and Briceño-Garmendia (2010)

### Sub-Saharan Africa unique mobile subscribers and market penetration



Source: GSMA (2017b)

In many areas, particularly in rural Africa, mobile phones were the first modern telecommunications infrastructure to become available to the local communities bringing possibilities that were previously inconceivable. The mobile phone has quickly become the most convenient way to communicate, considering that landlines and broadband Internet are underdeveloped and expensive. The phenomenon was largely unexpected and was ignited by some market liberalization and privatization in some key countries between the late 90s and early 2000s (Etzo and Collender, 2010). Another important determinant of mobile phone diffusion in Africa is the fact that service providers have adapted their offer to the needs of African consumers. An example are prepaid billing schemes that allow low-income clients who do not earn regular income or are unbanked to purchase service in small amounts and

control expenditures. Prepayment is used by 97% of users in Sub-Saharan Africa and it reduces credit risk and the cost of revenue collection (Foster and Briceño-Garmendia, 2010). Official data about the number of subscribers is probably an underestimation since mobiles are often considered as 'common property resources' by Africans, in the sense that sharing and free riding are normal practices especially among poorer rural people (Aker and Mbiti, 2010). Affordability and versatility are key features of this technology, which is able to respond to the needs of African consumers and firms resulting in tangible economic and social benefits. African communities were, therefore, able to appropriate and 'domesticate' mobile phones by exploiting them in specific ways, which are useful to the local context and often different from other places in the world (Hahn and Kibora, 2008).

Mobile phones are not simple communications devices but have evolved to become 'service delivery platforms'. Aker and Mbiti (2010) identify 5 channels through which cell phones are fostering economic growth and development in Sub-Saharan Africa. First, they save time, reduce search costs and information asymmetry providing cheap alternatives to traditional practices, which are mainly personal travels. They reduce price dispersion and enhance efficiency in rural markets, as shown by the previously mentioned case of grain markets in Niger, one of the poorest country in Africa, where mobile phones have reduced search cost by 50%. In Ghana, the VAS provider Esoko provides information to farmers about market prices, weather forecasts and technical advice through SMS alerts and IVR (GSMA, 2017b). Secondly, mobile phones improve coordination and productivity, especially in small-scale firms. In addition, mobile phones reduce risks both on a financial level and in terms of facilitating communication in case of natural disasters, conflict or crisis which are frequent in Africa. Ushahidi, a service first introduced in Kenya in 2008 to report post-election unrest and violence, has become a global platform to crowdsource information in crisis and emergency situations. These functions have been classified by Etzo and Collender (2010) as 'incremental' because mobile phones have increased the efficiency of activities that were already performed. Another benefit is related to production and the generation of additional employment in the sector. The mushrooming of mobile phones has given way to different forms of entrepreneurship, mostly in the informal sector, such as small shops and kiosks selling airtime and SIM cards, repairing devices, offering recharge or renting services in rural areas. Finally, several 'transformational' uses of mobile phones have emerged, in the sense that cell phones are used as platforms to provide innovative services and development projects. This phenomenon is referred to as 'm-development' and has enabled the start of various initiatives in different fields, namely health, finance, agriculture, education. M-health

projects focus on analyzing data for disease surveillance, providing remote diagnosis via telemedicine, health education, coordinating medical supply and drugs distribution. For instance, in Malawi, the government and NGOs send daily SMS reminders to HIV-positive patients on their treatment schedule while in DRC, mothers can contact health call centres to ask questions about their children's health (World Bank, 2016). In Ghana, the start-up mPedigree allows consumers to identify if a drug is counterfeit through a code sent via text (Etzo and Collander, 2010).

Mobiles phones were defined as 'the single most transformative technology for development' by the economist Jeffrey Sachs (Etzo and Collener, 2010 p.661) but the argument is not simply black and white. A considerable portion of the African population is still marginalized and victim of social exclusion and mobile phones might contribute to widen these divisions and reinforce the status quo with its embedded socioeconomic structures and power relations. Inequality and constraints in accessing and benefiting from ICTs are connected to the asymmetric distribution of economic, political and cultural capital (Carmody, 2012). Besides the problem of affordability, there is the fact that mobile phones are considered a long-term investment (Asongu, 2105) and have become so necessary that people are willing to spend more than they can afford to own them in fear of social exclusion and, in this sense, mobile phones might generate poverty. Moreover, access is constrained by lack of skills, illiteracy or the absence of content in the local languages. Another critical point is the role of governments which often fail to promote adequate regulation or even use mobile phones as a source of revenue by creating monopolies. In 2010, 4.1% of the total tax revenues of African governments came from the mobile industry (Delponte et al., 2015). At the individual level, technologies are used more to communicate with relatives and friends than to connect with the global economy. It is thus argued that Africa is participating in the global technological revolution in a passive-dependent way, that is as an importer rather than a producer. Carmody (2012) argues that mobile phones have become part of the pre-existing economic structures without changing them and that Africa 'is becoming an informationalized agrarian, resource extractive and informal economy produced through economic extraversion [...] rather than a knowledge economy' (p.12). In fact, research and development of new technologies is rare and it has not stimulated the establishment of better basic infrastructure or promoted diversification fostering, instead, the growth of the informal sector. This is to reiterate that ICTs are a means to an end and should be integrated into more comprehensive economic and development strategies aimed at eliminating structural deficits, and this can be accomplished only at the state level.

## **PART 4: FINANCIAL INCLUSION AND M-BANKING**

One of the channels through which mobile phones can affect economic growth is financial inclusion. The concept of financial inclusion is part of the idea of inclusive economic growth and development and, conversely, financial exclusion is part of the broader issue of social exclusion (Sarma and Pais, 2011). In Africa, the deficiency of traditional branch-based banking has created a niche for mobile phone banking which is allowing an increasing number of previously unserved people to access an essential tool to improve their livelihoods.

### **FINANCIAL INCLUSION**

The Center for Financial Inclusion characterises financial inclusion as ‘a state in which all people who can use them have access to a suite of quality financial services, provided at affordable prices, in a convenient manner, and with dignity for the clients. Financial services are delivered by a range of providers, most of them private, to a financially capable clientele’ (FI2020, 2013 p.3). This is, however, more a vision than a definition and what is commonly meant when discussing financial inclusion, especially in developing countries, is the ability for all members of an economy to access and afford the formal financial system in order to save and borrow money, contract insurance and use payment services (Weill and Zins, 2016). Between 2011 and 2014 the percentage of the world's adult population who owned an account either with a financial institution or through a mobile money service went from 51% to 62%. The unbanked were 2 billion in 2014, down by 20% from the 2.5 billion in 2011. These figures differ substantially between developed countries, where ownership is nearly universal (94%), and developing ones, where only 54% the population owns an account (Demirgüç-Kunt et al., 2015). Financial inclusion is critical to poverty reduction and participation in the financial system allows individuals to both plan for long-term goals, such as investing in education or start a business, and face unexpected situations and emergencies by making it easier to manage risks and shocks. Moreover, firms, especially micro, small and young ones, need access to finance to expand and innovate.

Financial development, that is the improvement in quantity, quality and efficiency of financial services, is crucial to economic growth. Calderón and Liu (2003) examined data from 109 developing and industrial countries in the period 1960-94 to determine the direction of causality between financial development and economic growth. The possible causal relationships accounted for in literature are three. The first is the supply-leading hypothesis, according to which increasing the supply of financial services promotes economic growth.

Inversely, the demand-following hypothesis implies that growth stimulates the demand for financial services. A third hypothesis is the stage of development one, which combines the previous two. At the early stages of economic development, the supply of financial services drives self-sustained growth. As an economy develops, however, the effect of supply is overshadowed by the demand-following financial development. The indicators used as proxies for financial development are broad money (M2) to GDP and credit to the private sector to GDP. A series of control variables measuring, inter alia, initial human capital, trade, government size and regional dummies are also present. The study finds that, although generally, financial development leads to economic growth in the full sample of countries, some bi-directionality is present when developing and developed countries are considered separately. In particular, financial deepening contributes more to growth in developing countries signalling that they have a larger margin for improvement. The results do not support the stage of development hypothesis but show that the effect of financial development takes time to manifest its impact on growth. Finally, capital accumulation and technological change are the channels through which financial development affects growth. Improvements in financial services increase capital formation by attracting capital and promoting savings. Moreover, resources are allocated more efficiently thus fostering TFP growth, especially in developing countries.

Hence, developing countries are the ones with more room for improvement but, consequently, are the ones where large brackets of the population are still financially excluded. Commonly cited barriers impeding individuals and firms from accessing financial services are cost, travel distance and documentation requirements and the poor, women, youth and rural population are the most affected. (World Bank, 2014). Sarma and Pais (2011) discuss the determinants of financial inclusion at the country level. Financial inclusion is measured by a multidimensional index of financial inclusion (IFI) that includes information on availability, accessibility and usage of banking services. The findings indicate that socioeconomic variables such as income level, adult literacy, urbanisation are positively and significantly associated with financial inclusion. Income inequality, proxied by the Gini coefficient, is negatively significant while the unemployment rate is not relevant. In relation to infrastructure, physical and electronic connectivity in the form of paved roads, which are needed to establish bank branches and ATM networks, telephone and the Internet have a positive effect on financial inclusion. This is in line with Balamoune-Lutz (2003) who finds a correlation between financial deepening and ICTs. Furthermore, some banking sector-related variables are studied. Contrary to common assumption, the percentage of non-performing assets (NPA) is negatively linked to

financial inclusion suggesting that promoting access to financial services for marginalised groups is not the deciding cause of NPAs. Capital asset ratio and foreign bank ownership negatively affect financial inclusion whereas interest rate and government ownership are not significant, which can mean that states are not effective in promoting access to the financial system. From this ensues that a financially inclusive society is the outcome of comprehensive policies tackling various areas, from education to communication infrastructure.

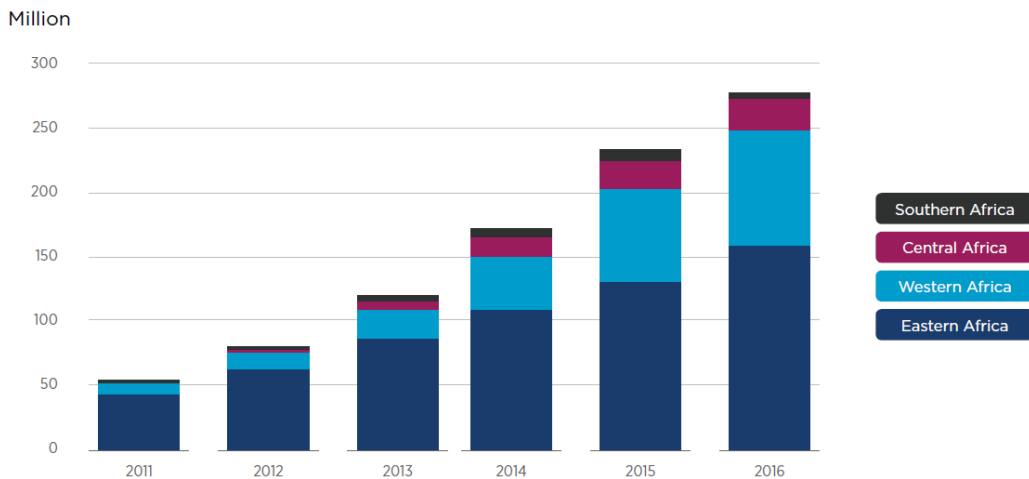
The problem of financial inclusion is particularly relevant in Sub-Saharan Africa where the financial system is underdeveloped and its outreach is limited. Financial inclusion varies considerably within the region, in 2016 account ownership at a formal institution was 51% in Southern Africa and 11% in Central Africa while the overall figure for the region was 35% (Weill and Zins, 2016). Barriers to formal account ownership are similar to those valid in general for developing countries and involve both demand and supply constraints: costs, distance and physical-geographical isolation, financial illiteracy, bureaucracy, lack of trust and cultural reasons. Fixed fees and high maintenance cost are often prohibitive: in Uganda, the annual cost of an account corresponds to 25% of GDP per capita. Moreover, rural clients are disadvantaged because of the lack of infrastructure and means of communication. Therefore, great part of the population resorts to informal alternatives, namely community-based savings methods such as Rotating Savings and Credit Associations (ROSCAs), tontines, Chit funds but borrowing from friends, family or informal private lenders as well as asset accumulation and saving ‘under the mattress’ are also common practices (Demirgüç-Kunt and Klapper, 2013). Weill and Zins (2016) analyse the determinants of financial inclusion in Africa considering formal account ownership, formal saving and formal credit. They report that these indicators increased from 2011 and 2014 but are still lower compared to the rest of the world: ownership went from 23% to 51% (the global figure is 61.5%), saving went from 11.5% to 15.4% (27.4%), credit from 5% to 6.7% (10.7%). The motives for using financial services, formally or informally, are influenced by the local socioeconomic context. 41% of account holders, corresponding to 10% of the African adult population, use their formal accounts to receive remittances, especially in fragile states. Reasons for saving are mainly education or to start a business while reasons for taking a loan are related to medical purposes or emergencies (15% of adults), funerals, weddings, school fees, especially among poorer people while richer people use loans for business or to buy a house or land. Overall, rich educated older men are more likely to own a formal account while women and the poorest segments of the population resort more to the informal sector (Demirgüç-Kunt and Klapper, 2013; Weill and Zins, 2016). Moreover, firms and especially SMEs face great

financing constraints that limit their growth opportunities. In particular, they have difficulties in accessing external credit (only 22% of firms have a loan or a line of credit) and thus they consistently finance themselves with internal funds, 84% of firms compared to 70% globally. A major source of improvement in the sector in the recent years is mobile money. Mobile money services, which result from the intersection of finance and telecommunications, are a form of branchless banking that is helping the African population to overcome structural barriers to financial inclusion.

## MOBILE MONEY

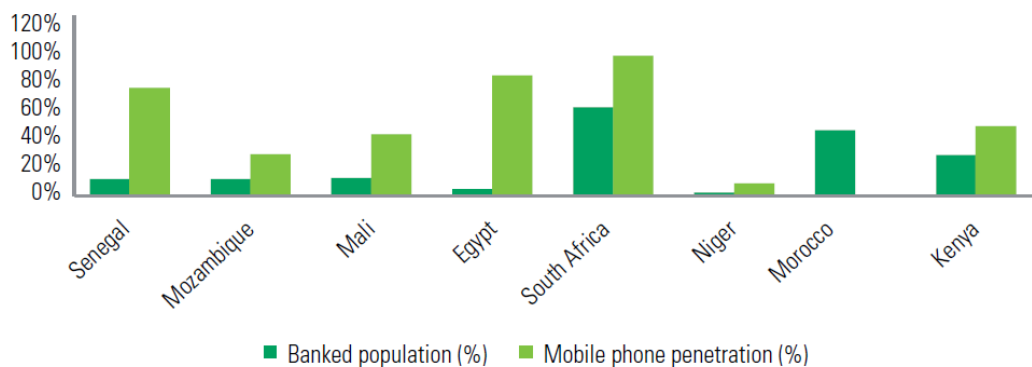
Technological innovations, such as mobile money, are creating new opportunities and instruments to create a more inclusive financial system. The increase in account ownership between 2011 and 2014 was mainly driven by a growth in account penetration of 13% in developing countries and to new technologies, namely mobile banking in Sub-Saharan Africa. In the region, 12% of the adult population has a mobile money account, while only 2% does worldwide, and 45% has only a mobile money account (Demirgüç-Kunt et al., 2015). In 2015, mobile money accounts surpassed bank account and in 2016 the active accounts were 100 million (GSMA, 2016a). As of December 2016, 140 mobile money services operated in 39 countries across the region and more than 40% of the adults in Gabon, Ghana, Kenya, Namibia, Tanzania, Uganda and Zimbabwe used their accounts regularly (GSMA, 2017b). Hence, m-banking (or m-payments, m-transfers, m-finance), i.e. ‘a set of applications that enable people to use their mobile telephones to manipulate their bank accounts, store value in account linked to their handsets, transfer funds, or even access credit or insurance products’ (Donner and Tellez, 2008 p.318) has become the preferred solution by the African population to the problem of financial exclusion. M-banking systems usually have three main functions: store value in an account via the handset that is either linked to an actual bank account or held by a mobile operator, in this last case savings do not generate interests; deposit and withdraw money either at a bank, at GSM providers’ retail stores, at kiosks and grocery stores or through agents; transfer stored-value between accounts generally by using a set of SMS messages and PIN codes (Donner and Tellez, 2008). Mobile accounts are mostly used for airtime purchases, person to person (P2P) transfers, bill payments while second-generation financial services such as saving, credit and micro insurance are less used (Faye and Triki, 2013). In a mostly informal and cash society such as the Sub-Saharan African one, the mobile money option is nothing short of revolutionary and has the potential to transform participation in the financial system.

## Registered mobile money accounts in Sub-Saharan Africa



Source: GSMA (2017b)

## Banking and Mobile Penetration Rates in Selected African Countries



Source: IFC, Central Bank of West African States (BCEAO), Finscope.

Given the high costs of formal banking, the high coverage of mobile phone networks and the large mobile customer base, mobile banking seems a logical and convenient opportunity. M-banking has several advantages, compared to traditional banking, which allow to reach previously unserved and unbanked parts of the population. M-banking cuts down transaction costs, lowers entry barriers and increases access. In particular, ICTs make processing large volumes of small transactions more convenient and facilitate the delivery of financial services in places where physical infrastructure is poor or absent. Besides being cheap, mobile money is secure, reliable, immediate and efficient (Ondiege, 2010; Faye and Triki, 2013). Moreover, m-banking generates new employment opportunities and, similarly to other ICTs, creates network externalities. The difficulties of households to implement effective risk diversification and consumption smoothing are often due to high transaction costs. Mobile money can considerably reduce these costs and allow people to rely on a wider support network (Jack and Suri, 2014).

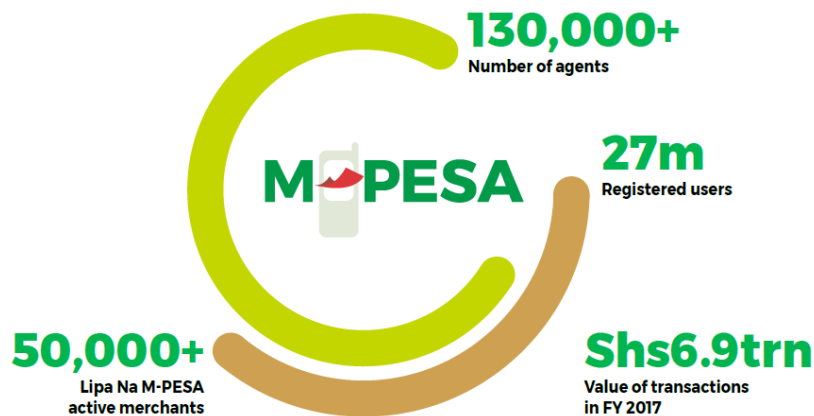


Mobile phones have become 'pocket-banks' or, more correctly, they can serve: as a virtual bank card, since bank account number and PIN can be stored on the SIM card; as a point of sale terminal (POS), because they allow the authorization of transactions; as an ATM and an Internet banking terminal that gives you access to any account and the possibility to make payments remotely. In the long-run, the introduction of mobile banking and the ensuing expansion of financial services results in an increase of domestic savings, increased incoming money transfer from diaspora, lower cost of doing business which will benefit SMEs and the whole private sector and higher government revenues (Ondiege, 2010). Mobile money services can be established through different business models depending on what type of institution handles the relationship with the end customers. Bank-focused models are an extension of tradition branch banks and the technology-based services are just additional options so they are not very effective in reaching the unbanked. Bank-led models offer m-banking as an alternative to traditional bank accounts and are usually implemented through a joint venture between a bank and a telecom operator. In non-bank-led models, account management and contact with customers are conducted by non-bank entities, often mobile operators. The last two solutions are the most beneficial for financial inclusion (Faye and Triki, 2013). In this context, a necessary step to allow the diffusion of mobile money is adapting the regulatory framework. For instance, regulation should allow non-bank entities, such as agents, retailers, mobile operators to handle financial transactions and give validity to electronic signatures, i.e. PIN numbers (GSMA, 2016a).

To conclude, evidence suggests that mobile money is serving as a tool for financial inclusion and economic development. Asongu (2015) and Andrianaivo and Kpodar (2012) conduct an empirical analysis to confirm the argument. The former takes into consideration 52 African countries between 2003-09 and regresses income inequality, measured by the Gini coefficient, on mobile penetration rate and a series of control variables. Asongu finds that mobile phones have a pro-poor income-redistributive effect and argues that the provision of basic financial services is one of the ways in which the equalizing effect of mobile phones operates. Andrianaivo and Kpodar examine the interrelations between mobile phones, economic growth and financial inclusion, proxied by the number of deposits and loans per head, in 44 African countries from 1988 to 2007. The results show that not only financial inclusion fosters growth but that the coefficient on mobile penetration rate decreases when controlling for financial inclusion indicating that mobile phones are a determinant of financial inclusion.

## PART 5: THE CASE OF M-PESA IN KENYA

M-PESA (M for mobile and 'pesa' is Swahili for 'money') is a mobile phone-based money transfer and store of value system launched by Safaricom, Kenya's leading mobile network operator, in March 2007.



### THE SITUATION BEFORE M-PESA

In 2006, 70% of Kenya's population lived in rural areas where availability of basic infrastructure and services and links to the cities were scarce or expensive. Financial services were underdeveloped even in urban areas: only 19% of the 35 million Kenyans had a bank account and there were just 450 bank branches and 600 ATM in the country. Banks had no incentive to serve the rural unbanked because the cost of establishing a new branch was not compensated by the additional profits, given the low population density and the fact that the services offered would likely have been too expensive for the poor rural communities (AFI, 2010; Aker and Mbiti, 2010). Moreover, Kenya's economy uneven structure caused the splitting of families when a member, usually the male breadwinner, migrated to the city to seek employment while the wives and children stayed at home in rural areas. Familial ties, however, remained strong implying not only regular visits but even more frequent money transfers (Mas and Morawczynski, 2009). Traditionally, people used several methods to transfer money, both formal and informal. Large bus companies provided formal money/parcel transfer services that allowed recipients to collect deliveries at bus terminals and smaller companies and independent operators offered the same service informally. The post office offered instant money transfers (PostaPay) while banks and other financial companies, such as Western Union or MoneyGram, were not commonly used because of their expensiveness and lack of penetration in rural areas. Hence, the most common way to deliver

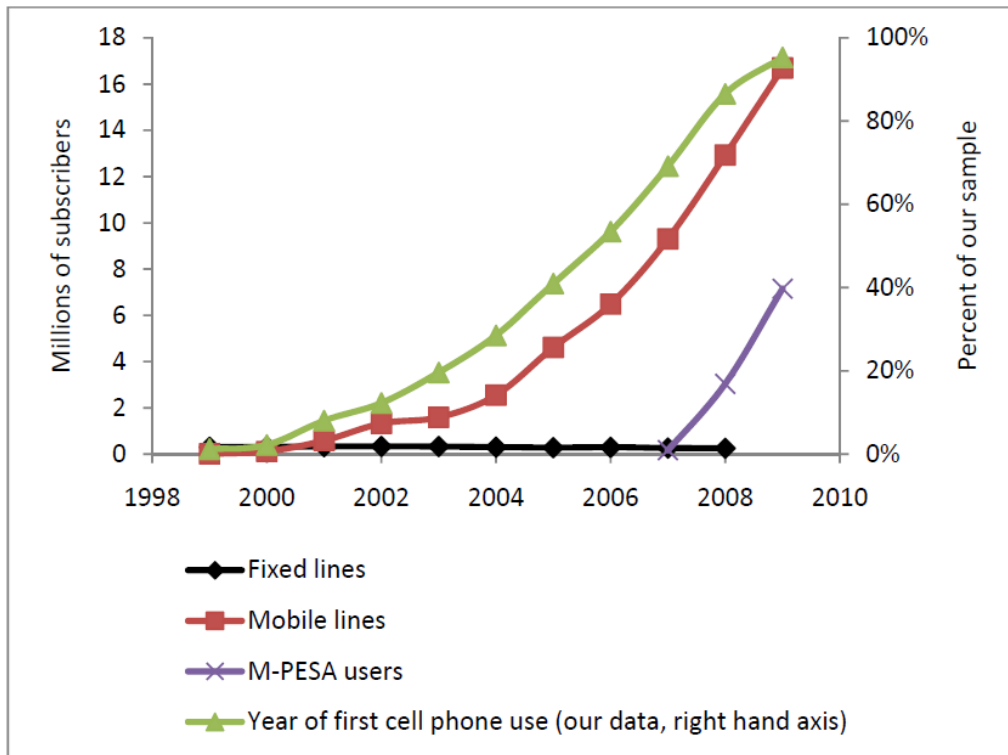
money was physical travel either personally or via an intermediary, i.e. the bus driver, friends and relatives, which entailed high costs and risks (Mbiti and Weill, 2011). On the other hand, a rapid means of communication whose penetration rate in 2006 was nearly 30% and growing significantly faster than that of bank accounts was the mobile phone (AFI, 2010). The first mobile phone companies were publicly owned and appeared in Kenya in the mid-90s. Safaricom, which was formed in 1997, was, and still is, the largest provider thanks to its strong and modern brand image. Safaricom is part of the Vodafone Group since 2000, which owns a 40% stake while the Government of Kenya owns 35% and 25% is free float. The main competitors are Airtel, Yu and Orange. Similarly to the general trend of the region, mobile phones quickly overtook fixed lines in Kenya as the primary telecommunications tool (Jack and Suri, 2011).

## HOW IT WAS BORN

The idea of M-PESA was initially conceived by a team within Vodafone as a micro-loans repayment system. In 2005, a pilot project was launched with the support of the UK Department of International Development (DFID). The pilot used the pre-established Safaricom network of airtime resellers as M-PESA agents to allow customers to deposit and withdraw cash. During the trial, it became apparent that the service had more potential as a P2P money transfer service. Moreover, the informal practice of transferring airtime between users to resell it or use it to purchase goods was already common among Kenyans (Jack and Suri, 2011). Safaricom was on board with the project considering it an additional source of revenue and a way to retain customers. The service was simplified for the national launch and agents were trained to perform the basic operations and to explain the product to new users. Safaricom asked the Central Bank of Kenya to give its approval and review the legal and regulatory implications of M-PESA. Despite the newness of the service and the lack of regulation on the matter, the CBK understood the opportunities that using mobile networks to facilitate money transfers presented in terms of increasing financial inclusion. Therefore, the CBK decided to approve the launch as an experiment while continuing to monitor its future developments (Hughes and Lonie, 2007; AFI, 2010; Mas and Radcliffe, 2010).

M-PESA was launched in March 2007 and it reached 20.000 subscriptions in the first month (Hughes and Lonie, 2009). In August 2007, an average of 5.000 people registered every day while in December new registrations reached 10.000 per day. In the span of two years, 40% of the adult population had an M-Pesa account (Jack and Suri, 2011). The introduction of M-

PESA practically eliminated other formal methods of transferring money and is responsible for about 60% of the price declines of competitors' services between 2003-10 (Mbiti and Weill, 2011). Consequently, other Kenyan mobile providers introduced their own mobile money services: Airtel Money and yuCash in 2009 and Orange Money in 2010. As of June 2011, there were 17 million mobile money users out of a total population of 41 million (Demombynes and Thegeya, 2012).



Source: Jack and Suri (2011)

## HOW IT WORKS

M-PESA is a SMS-based mobile money service that allows to perform three basic operations: depositing and withdrawing money and person-to-person transfer of monetary value. To access the service, Safaricom's customers need to register at an authorised M-PESA agent outlet. These outlets are also cash-in/cash-out points and the agents conduct other businesses there, i.e. mobile phone retailers, grocery stores, gas stations. An official form of identification (ID or passport) is required for the agent to exchange the SIM card with a new one where the M-PESA application is installed. Depositing money is free and the agent issues a corresponding amount of e-money (or 'e-float') to the user's account, or e-wallet. The e-float can be transferred to both registered and non-registered users via SMS or resold to an agent in exchange for money. Withdrawals and P2P transfers include fees on a sliding scale expressed in fixed terms rather than as a percentage of the transaction to make costs clear to customers. The fees are deducted from the users' accounts and paid to the agent on a

commission basis. To further advance financial inclusion, Safaricom recently decided not to apply charges for transactions below Ksh. 100 (less than 1€). All transactions require a PIN to be authorised and are capped at \$500. M-PESA has only a 'storage' function so it does not pay interests and does not make loans (Mas and Morawczynski, 2009; Jack and Suri, 2011).

## USERS

M-PESA had 27 million registered accounts as of May 2017 (Safaricom, 2017). Analysing micro-level data from the 2009 FinAccess survey, Mbiti and Weill (2011) observed that the most intense users of M-PESA were individuals with a higher socioeconomic status. In particular, wealthier, better-educated individuals and urban residents were twice as likely to use the service compared to their counterparts. Being already banked increased by 3 times the probability of using M-PESA and being male was also a positive factor. Therefore, demographic and economic individual characteristics play an important role in defining who benefits from the service thus casting some doubts about its inclusivity and distributional effect. However, Jack and Suri (2011) present the results of two surveys conducted a year apart from one another (2008 and 2009) and argue that a change in the composition of users is happening including a wider cross-section of the population. M-PESA was originally limited to more affluent groups and not owning a mobile phone was a critical constraint to access but as the awareness grew, network effects set in and mobile ownership increased, the unbanked poor began to adopt it as well. Moreover, early adopters had higher consumption and educational levels than late adopters who, in turn, have a larger income and better education than non-users. Early users were prevalently men but the figure evened itself out in the second survey. Ethnographic evidence from Morawczynski and Pickens (2009) show that there are two categories of users: male urban senders and female rural recipients. This is related to the common practice of domestic remittances within families and transfers consist either in recurrent payments as a form of income support or in lump sums for occasional needs or emergencies. In sum, the service has seen an evolution of its average user type and a broadening of its socioeconomic outreach.

## USES AND ECONOMIC IMPACTS

In relation to its different uses, besides the three basic transactions, M-PESA allows users to check their account balance, withdraw from ATMs and purchase airtime: more than 42% of credit top-ups are made through M-PESA (Safaricom, 2016). The service facilitates safe money storage and transfer. It is safer than hiding money at home or carrying cash around

while travelling and shopkeepers and vendors deposit their daily earnings for safekeeping (Demombynes and Thegeya, 2012). Studies show that the risk of mugging declined after the introduction of M-PESA (Donovan, 2012). It promotes trade by easing payments for goods and services, such as electricity or taxi fares. Person-to-person transactions include both 'scheduled payments', such as remittances and transfer of parts of the monthly salary to relatives and forms of finance and risk sharing. The cost of sending remittances has decreased by up to 90% after the introduction on M-PESA (World Bank, 2016). Moreover, M-PESA is being used for institutional payments, namely to pay salaries, by schools to collect fees and by companies to receive bill payments (Mas and Radcliffe, 2010). Small firms and micro-businesses, which mostly operate in the informal sector, use M-PESA because they find it more convenient, affordable, it increases circulation of money and helps to enhance growth (Mbogo, 2010).

M-PESA contributes to increasing household savings, allows to accumulate small money in larger sums and improves the allocation of resources and the person-to-person credit market. By allowing cheap transfers across large distances, it has improved human capital allocation and investment and has changed remittances pattern. Families have more incentives to invest in education and send members away to work and are able to send more frequent remittances but of lower value in a cost-effective way. Moreover, M-PESA users can send and receive money from broader networks. This increases the effectiveness of risk sharing. Informal risk sharing among people in close proximity, in fact, is a problem in case of external shocks, especially environmental ones, because it is probable that the whole network is equally affected (Jack and Suri, 2011). For instance, during the 2008 post-election crisis, M-PESA was one of the only ways to access money for urban residents, who received transfers and airtime from rural users to help them escape and communicate (Morawczynski and Pickens, 2009; Donovan, 2012). Mobile money enables risk diversification and access to a wider support network allowing a better management of emergencies and consumption smoothing. This is crucial for fostering poverty alleviation. Moreover, M-PESA empowers the more vulnerable members of the communities, such as women, by allowing them to save discreetly and be more autonomous. M-PESA has become a saving instrument because of its immediacy and safety. However, M-PESA does not seem to act as a substitute for formal banking but rather it is complementary, in the sense that it increases the demand for banking products. In particular, while M-PESA decreases the use of informal saving methods, it increases the probability of being banked (Mbiti and Weill, 2011).

In order to further analyse its usage, Mbiti and Weill (2011) calculate the velocity of M-PESA, that is the frequency at which an average unit of e-float is used in person-to-person transfers. They find a velocity of four transactions per month which indicates that it is halfway between a money transfer and a value storage service. The presence of an upward trend for velocity and the fact that the average balance per customer is quite low (700 Ksh.) suggest that, for the most part, users store small amounts of money and for short periods of time. This is confirmed by the short length of the ‘e-money loop’, i.e. the average number of person-to-person transfers a unit of e-float goes through between being transferred by an agent to a customer’s account and being returned to an agent. This implies that the most common form of use is of the deposit-transfer-withdraw type. One of the reasons why users are not inclined to store money for longer periods of time is probably because M-PESA does not pay interests. The poor use several financial instruments and saving mechanisms in order to diversify risk and depending on their needs: for daily consumption, they prefer safe but easily accessible tools while for long-term purposes they take into consideration interests and reliability (Morawczynski and Pickens, 2009; Mbiti and Weill, 2011).

Therefore, M-PESA responds mainly to needs of day-to-day cash management. This is why Safaricom has tried to meet the demand for other financial and payment products by developing a series of additional services, also by partnering with financial service providers. Some of these services are:

- M-Kesho: an interest-bearing bank-integrated mobile savings system introduced by Safaricom and Equity Bank in 2010 and accessible through the M-PESA application. There are no initial or periodic fees and it also offers micro-credit and insurance services (Mbiti and Weill, 2011).
- M-Shwari: similar to M-Kesho but operated in partnership with the Commercial Bank of Africa. Since its introduction in 2012, it has issued more than 21 million loans, mainly short-term ones. Loans are approved instantly based on M-PESA usage history and the service has a non-performing loan ratio of only 2%, compared to 5.4% of Sub-Saharan Africa (World Bank, 2016; GSMA, 2017a).
- Lipa na M-PESA (‘pay with M-PESA’): a retail payment feature that allows about 50.000 merchants in Kenya to receive cashless payments for goods and services. Customers only have to insert a number associated with the shop in the specific function of their M-PESA account and confirm the transaction (Safaricom, 2016).
- International Money Transfer (IMT): M-PESA has partnered with various authorized International Money Transfer organizations to allow money from abroad to be sent directly to the recipient’s M-PESA account.

These services add to M-PESA's value proposition and contribute to further driving financial inclusion.

## REGULATORY AND POLICY ISSUES

Mobile service operators are not licensed to provide banking services and Safaricom has not a banking licence. Initially, banks lobbied against M-PESA because it operated outside traditional banking regulation. The Central Bank of Kenya (CBK), however, audited M-PESA and concluded that it is not a banking business since no credit risk is taken, customers' funds are not on-lent and no interest is paid (AFI, 2010). In fact, M-PESA's e-float is entirely backed by liquid deposits held in three trust accounts at three different fully-regulated commercial banks in Kenya and the interest earned by Safaricom on the deposits is donated to charity (Mbiti and Weill, 2011). As a consequence, the e-money issued by the platform must always mirror the real money present in the bank accounts, otherwise, new currency would be created. Since the beginning, Safaricom had consulted regularly with the CBK to ensure the safety of the operation and the CBK had kept an open approach. M-PESA is legally considered a valued added service regulated by the Communications Commission of Kenya (CCK) since Safaricom is a mobile operator. However, there was a gap in the Kenyan regulatory framework regarding mobile money and payment services (AFI, 2010). In 2014, the Competition Authority of Kenya ruled that mobile money services providers must comply with CBK regulations. The lack of adequate regulation also meant that Safaricom was able to exploit its dominant position to lock agents in its system through exclusivity contracts thus preventing competing service providers from entering the market. The 2014 ruling proceeded to outlaw restrictive clauses in agents' agreements opening the system to other telecom operators (World Bank, 2016), even though Safaricom remains the leader with a market share of 71.9% in 2017 (Safaricom, 2017). Another point, argued by the African Development Bank (AfDB), is that the large uptake of M-PESA and, e-money in general, have contributed to increasing inflation. The AfDB observed that money supply had increased and the transaction velocity of M-PESA may be higher than the transaction velocity of other components of money by three or four times thus reducing the effectiveness of monetary policy (Simpasa et al., 2011). These possible implications were mentioned also by Mbiti and Weill (2011) and Jack and Suri (2011). The CBK, however, responded that M-PESA cannot add to money supply but only affects frequency<sup>1</sup> and the issue remains unresolved.

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<sup>1</sup><http://www.businessdailyafrica.com/markets/M-Pesa-linked-to-rise-in-inflation/539552-1327538-amj9uq/index.html>



## AGENTS AND LIQUIDITY MANAGEMENT

The network of agents tasked with converting customers' cash into e-money and vice versa is a fundamental element of the success of M-PESA. Agents are geographically dispersed in order to reach rural and isolated areas where formal banking services are absent. It is necessary that the number of customers and the number of agents grow simultaneously for the service to operate effectively but the number of customers per agent should not be too low, otherwise the activity would not be profitable. In 2011, there were more than 28.000 agents (Jack and Suri, 2014), 80.000 in 2014 (World Bank, 2016) and as of May 2017, the figure surpassed 130.000 (Safaricom, 2017). Agents have mobile phones with a different M-PESA menu than customers where they hold the e-float which they use in cash-in/cash-out transactions (Jack and Suri, 2011). The main challenge that agents have to face is liquidity management, that is maintaining enough cash and e-float to be able to meet customers' needs for withdrawals and deposits. For example, mirroring domestic remittances patterns, rural agents will experience more withdrawals than deposits and vice versa for urban agents. Agents have to rebalance their liquidity almost daily and incur in travel costs and/or safety risks. Safaricom has organised its agent network in a two-tier structure to facilitate liquidity management. Safaricom buys and sells e-float to a group of master-agents and banks (super-agents) through its custodian banks. Retail outlets (sub-agents) depend on the master-agents and transact e-float and cash only through them. This can happen by the retailer personally travelling to the master-agent or through banks and ATMs. Financial transactions with banks usually take 2/3 days to settle so agents have high working capital requirements. In return, agents receive transaction commissions: 30% is kept by master-agents and 70% goes to sub-agents (Eijkman, Kendall and Mas, 2010; Mas and Radcliffe, 2010). This is an intricate mechanism but it is a central aspect of the functioning of M-PESA.

M-PESA marked its 10<sup>th</sup> anniversary in 2017. It is an important source of revenue for Safaricom: 41.5 billion Ksh. with a 27% growth in 2016 (Safaricom, 2016). Its model has expanded to other countries and become the benchmark for mobile money worldwide. M-PESA was able to fill a gap in the market and benefit the whole Kenyan economy. The most recent study by Suri and Jack (2016) investigates the long-term impacts of M-PESA. They find that mobile money has increased financial resilience, consumption and savings and allowed 185.000 women to move from farming to business or retail occupations. Overall, M-PESA lifted 194.000 households, that is 2% of Kenyan households, out of extreme poverty, that is living on less than \$1.25 per day.

## CONCLUSION

This essay presents an overview of the impact of Information and Communications Technologies on economic growth and development, with a focus on financial inclusion and Africa. Far from making deterministic assumptions on the role of ICTs, the potential they offer for advancing progress toward economic and social development goals cannot be dismissed.

Research confirms the existence of a positive relationship between telecommunications and growth. Firstly, investment in ICTs increases the demand for related goods and services and secondly, they reduce transaction costs and produce positive externalities. By determining a smoother flow of information and creating strong network effects, ICTs are an important source of productivity improvement and consequently growth and development. The worldwide spread of mobile phones and the diffusion of broadband are considered having an even greater transformative potential. These implications are particularly relevant for developing countries. The global impact, wide applications and increasing opportunities represented by ICTs should not, however, be taken for granted.

The positive and pervasive nature of ICTs cannot be the sole responsible for allowing a catching-up process for developing countries. ICTs need to be integrated into the overall regulatory and institutional framework and into comprehensive development strategies. Among the complementary factors to ICTs, there is the development of related economic sectors, such as services and modern manufacturing. Demand-side elements that can inhibit the impact and penetration of ICTs are availability and affordability. Prices are diminishing and mobile network and broadband coverage are increasing but large brackets of the population are still excluded, especially in LDCs. Besides income levels, education is another strong determinant and it affects not only whether people use technologies or not but also how they use them. Users with higher levels of digital literacy are able to reap greater benefits from ICTs than individual with low educational standards. Finally, a conducive institutional environment is fundamental for the implementation of policies, subsidies and incentives aimed at fostering ICT investment and diffusion. Disregarding the broader context in which ICTs are introduced risks being counterproductive.

In more specific terms, the essay puts the spotlight on the situation in Africa. Africa can be regarded as the last area of untapped growth in the global economy and, as such, has the potential to attract investment and the leeway to grow and develop but the sustainability of

this growth is connected to the introduction of some structural changes. In particular, the continent, and the Sub-Saharan region in particular, are challenged by a considerable infrastructure gap. Basic utilities and transportation networks are far from the stage of universal access resulting not only in low human development but also in high costs of doing business and lack of competitiveness. Yet mobile phone coverage and usage have increased dramatically over the past two decades. In many rural parts of Africa, mobile phones were the first modern type of ICTs to be introduced with revolutionary consequences. Mobile phones are versatile and affordable and have evolved to platforms able to provide applications and services.

One of the reasons why poor regions of the world such as Sub-Saharan Africa are stuck in poverty traps is the limited access to the appropriate financial tools, to credit and to capital markets. The poor's incomes are at subsistence levels and often volatile and they make use of informal community-based saving methods to insure themselves against emergencies and external shocks. These are mainly cash societies where the formal financial system does not operate not only because of infrastructural deficits but also because it is unprofitable for banks to collect and reinvest small value deposits. However, mobile technology can be leveraged to provide financial services to the unbanked segments of the population (Mas and Radcliffe, 2010). M-banking allows money to be transferred electronically rather than physically thus reducing or outright eliminating the spatial, temporal and economic barriers associated with traditional branch-based banking. Sub-Saharan Africa is home to 140 mobile money services across 39 countries out of 277 worldwide (GSMA, 2017b) and this innovation is changing the financial infrastructure of the region. Mobile money has been transformational in Kenya where since the launch of M-PESA, 2% of households have been lifted out extreme poverty (Suri and Jack, 2016).

To conclude, a great responsibility rests in the hands of policymakers at the international, regional and national level. Facilitating investment in ICTs, promoting access to infrastructure implementing enabling policies and creating a conducive business environment are the critical preconditions to achieve financial inclusion and development and boost economic growth.

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