ICT Pathways to Poverty Reduction

Empirical evidence from East and Southern Africa

Edited by Edith Ofwona Adera, Timothy M. Waema, Julian May, Ophelia Mascarenhas, and Kathleen Diga

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Praise for this book

'In a fascinating world of fast-changing information and communications, dramatic changes in poverty and myriad relationships among them, *ICT Pathways to Poverty Reduction* is a gem. Focusing on Eastern and Southern Africa, it provides a wise development of theoretical perspectives and analytical studies, together with a knowledge-rich tapestry of the hundreds of ways in which ICTs are used by poor people and others in reducing (or sometimes increasing) poverty.

'Key public priorities are analysed in depth, pointing to good regulation, which largely determines cost and access; investment in the national ICT infrastructure; investments in the development of poverty-reducing and cost-saving applications in governance and public services – notably education, health and security; and sufficient support for research and innovation. It is a must-read for all interested in the changing global and local faces of economic, social and political life.'

Randy Spence, President, Economic and Social Development Affiliates, Canada

'This book challenges the conventional wisdom that access to ICT products is a solution to poverty. By viewing ICTs as a process, not a product, evidence from substantial research in Africa sheds light on the role of ICTs in the multidimensional process of poverty reduction.'

David J. Grimshaw, Visiting Professor in ICT4D at Royal Holloway, University of London

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We dedicate this book to the late Dr Mary Omosa who diligently led the Kenyan team and was an intellectual inspiration to the design of the research work.

We also remember Dr Louis Munyakazi, who unexpectedly passed away in Ghana in September 2013. Louis was a firm friend of PICTURE having assisted the Rwanda team with their sample frame, and later as a co-author of the final report and a chapter in this book. We remember him as a skilled statistician and dedicated researcher.

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Foreword

The research reported in this volume was undertaken at a time when the poor were starting to take part in the information society through the usage of ICTs. Current stories were and still are encountered in the press every day on how the mobile phone and internet are being used innovatively in resource-limited situations. What were previously potential possibilities of use by the most vulnerable are now possible. Nevertheless, we remain uncertain of whether the poor have been able to use these digital devices to move out of poverty. What are truly the changes in the lives of the poor? Are the poor truly participants within this context of fast growth of mobile phone services and mobile internet usage? How far can we go to measure the poverty level changes as a result of ICT usage? Lastly, with such evidence, what then are the ICT policies that need to be developed in order to support the progress of the poor?

In 2005, the former ICT4D Africa, also known as the Acacia Programme of Canada's International Development Research Centre (IDRC), provided research support in Africa on ICT4D research, worked together with researchers from South Africa, Namibia, Kenya, Tanzania, Rwanda, and Uganda, and eventually developed a research programme titled of *Poverty & ICTs in Urban and Rural Eastern Africa,* otherwise known as *PICTURE Africa*. By 2006, this group had developed an intensive research design which produced the first ever quantitative panel survey of ICT usage for poor enumerator areas, and complemented this study with qualitative research. Under the advice of an international scientific committee, the PICTURE Africa team grouped into four country teams and underwent this mixed methods approach to closely identify the ways in which the multi-dimensions of poverty were being affected by ICT usage. After interviewing over 1600 households throughout poorer regions of four countries in East Africa over the 2008–10 period, the PICTURE Africa team is now able to share with us the incredible stories of changing levels of ICTs, income, assets, vulnerability, and many other aspects of life which had remained anecdotal until now. To complement this study, the PICTURE Africa Project also included a study of how ICTs reduce poverty among micro and small enterprise owners in Tanzania using a quasi-experimental study which involved a benefit group that received a package of ICT interventions and a control group against which to assess the impact of the ICT interventions.

Motivated by the work being undertaken by PICTURE Africa, similar enquiries were undertaken in Southern Africa, and we are able to complement

this project with insights into Southern African changes of life in the form of adoption of the mobile internet in Namibia, and well-being changes through a participatory ICT action research project in the poorest province of South Africa. All in all there is a richness in the multiple disciplines and diverse research designs which has informed this wonderful edited collection of poverty and ICT research.

There has clearly been a change of thinking in ICT4D, where previously studies satisfied readers with a sole understanding of the numbers of those who are taking up the use of a mobile phone for everyday use. Today, we have taken a further leap to address the clear gap as to whether households or individuals in poor communities have been able to use these digital instruments to improve their lives and move out of poverty. A further culmination of global work (which includes PICTURE Africa) shows the influence of this research. The IDRC In Focus book entitled *The Information Lives of the Poor* highlights crucial findings and lessons on how the poor access, use, and benefit from ICTs, stemming from more than a decade of surveys of poor households in Asia, Africa, and Latin America and the Caribbean. The present PICTURE Africa book, hopes to be an enriching starting place for those interested in understanding poverty reduction and ICTs.

Edith Ofwona Adera, Timothy M. Waema, Julian May,
Ophelia Mascarenhas, and Kathleen Diga

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PICTURE Africa would not have been possible without the overall research direction from Prof. Julian May, the administrative back-up from the principal investigators, and most of all the dedication of the country teams who collected the data and prepared national reports. Team leaders Sharon Haba, David Obot, Prof. Mary Omosa, Prof. Ophelia Mascarenhas, and Prof. Timothy M. Waema provided unfailing leadership throughout the process. Their teams comprised Dr Felix Korbla Akorli, Claude Bizimana, and Dr Herman Musahara (Rwanda); Obadia Okinda Miroro, Timothy M. Waema (Kenya); Theophilus Mlaki, Prof. Sam Maghimbi, Hezron Makundi, and Raphael Mmasi (Tanzania); and Dr Henry Opondo, Prof. Grace Bantebya, Tobias Onweng, Ismail Barugahare, and Anthony Turyahebwa (Uganda). The Network of Ugandan Researchers and Research Users (NURRU) was responsible for the overall financial management of the project. In this context, Bowers Turyazayo is especially to be thanked for his attention to detail and persistence when eliciting overdue financial reports.

Our scientific advisory group participated fully in the design of the methodology and analytical plan, attending our inception, mid-term, and final meetings in Kenya, Rwanda, and Tanzania, and giving us critical comment, advice, and guidance throughout the process. We thank Prof. François Bar, Prof. Roxana Barrantes, Prof. Kingo Mchombu, and Dr Swapna Mukhopadhyay for their time and commitment. Others who assisted in the design and management of PICTURE Africa to whom thanks are due include Kathleen Diga and Dr Fred Muhumuza.

Finally, we must acknowledge our debt to the communities and households who tolerated our questions with patience and gave freely of their time.

Acronyms and abbreviations

3G third generation
B unstandardized regression coefficient
BOP bottom of the pyramid
BPO business process off-shoring
CCI comprehensive community initiative
CCK Communications Commission of Kenya
CDMA code division multiple access
CLF converged licensing framework
CLIQ Community-based Learning, ICTs and Quality-of-life
COSTECH Commission for Science and Technology
CPI consumer price index
CRAN Communications Regulatory Authority of Namibia
CS1 cross section 1
CS2 cross section 2
DFID Department for International Development
DMTF disaster management task force
EA enumerator area
EAC East African Community
EASSy East African Submarine System
EICV2 Enquête Intégrale sur les Conditions de Vie des Ménages de Rwanda or Integrated Household Living Conditions Survey
EPOCA Electronic and Postal Communications Act
ERSWEC Economic Recovery Strategy for Wealth and Employment Creation
e-society electronic society
ETACS extended total access communications systems
FCC Fair Competition Commission
FM frequency modulation
FRw Rwandan francs
G7 Group of Seven
GDI gender development index
GDP gross domestic product
GoK Government of Kenya
GoR Government of Rwanda
GSM global system for mobile communications
HBS Household Budget Survey
HDI human development index

hh households
HIV & AIDS human immunodeficiency virus / acquired immunodeficiency syndrome
HPI-1 human poverty index-1
ICT information and communication technology
ICT4D information and communication technologies for development
IDI ICT Development Index
IDP internally displaced person
IDRC International Development Research Centre
ISP internet service provider
ITU International Telecommunications Union
KCA Kenya Communications Act
KIHBS Kenya Integrated Household Budget Survey
KIPPRA Kenya Institute for Public Policy Research and Analysis
KNBS Kenya National Bureau of Statistics
KSh Kenyan shillings
KZN KwaZulu-Natal
LDCs least developed countries
LLO local loop operator
LRIC long-run average incremental cost
MIF Mo Ibrahim Foundation
MINALOC Ministry of Local Government
MINICOM Ministry of Trade and Industry
M-Pesa mobile pesa or mobile money in Swahili
MPND Ministry of Planning and National Development
MSE micro and small enterprise
MSME micro, small, and medium enterprise
MTC Mobile Telecommunications Company (Namibia)
MTN Mobile Telephone Networks (South Africa)
MTP medium-term plan
N$ Namibian dollars
NASSEP National Sample Survey and Evaluation Programme
NBC Namibian Broadcasting Corporation
NCS National Communications Secretariat
NICI National Information and Communication Infrastructure
NICTP National ICT Policy
NISR National Institute of Statistics Rwanda
NITA-U National Information Technology Authority Uganda
NRF National Research Foundation
NSO National Statistics Office
NTO national telecommunications operator
OECD Organisation for Economic Co-operation and Development
OLPC One Laptop per Child
P^0 poverty headcount
P^1 poverty gap

P^2 poverty severity
PC personal computer
PCA principal components analysis
PCE per capita expenditure
PDA personal digital assistant
PE political economy
PEAP Poverty Eradication Action Plan
PICTURE Africa Poverty, Information and Communication Technology in Urban and Rural Eastern Africa
PL international poverty line of PPP$2.50
PM participatory methodology
Posta Postal Corporation of Kenya
PPP purchasing power parity
PPS probability proportional to size
PRA participatory rural appraisal
PRSP poverty reduction strategy papers
PSU primary sampling unit
p-value student's test statistic
QoL quality of life
R^2 coefficient of determination
RCDF Rural Communication Development Fund
RIA Research ICT Africa
RITA Rwanda Information Technology Authority
ROSCA rotating savings and credit association
RURA Rwanda Utility Regulatory Agency
SE standard error
SEACOM submarine fibre optic cable network
SIDO Small Industries Development Organisation
SIM subscriber identity module
SL sustainable livelihoods
SLA sustainable livelihoods approach
SME small and medium enterprise
SPSS Statistical Package for Social Sciences
SSU secondary sampling unit
TC telecentre
TCC Tanzania Communications Commission
TCRA Tanzania Communications Regulatory Authority
TEAMS The East Africa Marine System
TzSh Tanzanian shillings
UCC Uganda Communications Commission
UKZN University of KwaZulu-Natal
ULF unified licensing regime
UNDP United Nations Development Programme
UNICEF United Nations Children's Fund
UNSD United Nations Statistics Division

USAASA Universal Service Access Agency of South Africa
USF Universal Service Fund
UTL Uganda Telecom
VCR/DVD video cassette recorders and digital video discs
VETA Vocational Education and Training Authority
VoIP voice over internet protocol
VSAT very small aperture terminal
VUP Vision 2020 Umurenge Programme

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CHAPTER 1

Introduction: The ICT/poverty nexus in Africa

Julian May, Timothy M. Waema, and Elise Bjåstad

While some views hold that information and communication technologies (ICTs) improve access to global markets and create conditions that enhance economic growth, others point to a growing digital divide. ICTs are argued to further entrench inequalities and to potentially lead to social exclusion. As such, ICTs can be defined as a process, and not simply as products. This is because socio-economic choices have a bearing on the final outcome, are implicitly or explicitly made in the process of technological innovation. This chapter reviews the literature on ICT and development and proposes that one way of resolving the link between ICT, development, and inequality is to see the digital divide not as the root cause but rather as a symptom of inequality and poverty. The implication is that access to ICTs cannot be a solution to poverty in and of itself, but can at best be adopted as a tool in poverty reduction initiatives.

Keywords: poverty reduction, information and communication technologies, Africa, policy, pro-poor growth

Information and communication technologies (ICTs) have been hailed by some as the solution for developing countries, one that provides the opportunity to leapfrog stages of development and enter directly into what has been labelled the information age. ICTs are said to enable developing countries to gain access to global markets and create conditions that enhance economic growth. However, others are more pessimistic, pointing to the growing digital divide that excludes some countries and regions unable to tap into the global marketplace, and makes the distance to those operating within the global network increasingly large. Seen through this perspective, ICTs simply represent a new way in which inequalities are further entrenched, a new source of social exclusion. Exactly how ICTs can contribute to poverty reduction remains elusive.

This chapter provides the context within which the rest of the chapters should be read, defining what is meant by ICT and reviewing what is known about the link between ICTs, growth, and poverty reduction. Although the link between ICTs and poverty has frequently been suggested, the mechanisms

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through which this link takes place have yet to be systematically interrogated. The chapter describes the sustainable livelihoods framework, which brings together a multi-dimensional approach to poverty with the assets and activities used by households in order to obtain the resources that they need. In this approach, ICTs are taken to represent a new asset and a new form of deprivation, and the chapter advances the theorization of 'digital poverty', defined as 'the lack of goods and services based on ICT' (Barrantes, 2007a: 30). Thus digital poverty can be included as the sixth dimension of poverty in addition to the five interrelated dimensions of financial, assets, physical, human, and social.

The chapter continues by providing the socio-economic and ICT context of the four East and two Southern Africa countries covered in this book, namely Kenya, Uganda, Tanzania, Rwanda, Namibia, and South Africa. It then offers the research questions that link these chapters.

Defining ICTs

It is not always clear what the concept of information and communication technologies or ICTs really refers to. Some theorists appear to equate ICTs with new technologies such as computers and the internet (Langmia, 2005) or deal with computers and internet connectivity alone when discussing ICTs (Polikanov and Abramova, 2003). However, the concept can be wider than this. In a document prepared by Batchelor and Scott (2005) for the Organisation for Economic Co-operation and Development (OECD), this point is elaborated:

> While the common use of ICTs tends to refer to the newer technologies of phone and internet, the term ICT is best used to also include more traditional communication media such as radio and television. Digital convergence is gradually bringing devices to the market that include the traditional media (phones with radio, media centres with computing capability and television), which will increasingly blur the distinction between old and new ICTs. (Batchelor and Scott, 2005: 11)

Hence, there is a common distinction between old/traditional and new/modern ICTs, although these lines are increasingly blurred. ICTs can also be defined in terms of their qualities or the set of tasks they can perform. The OECD panel of statistical experts have defined ICTs as '... the set of activities that facilitate, by electronic means, the capturing, storage, processing, transmission and display of information' (de Alcántara, 2001: 3). This definition captures the set of attributes associated with ICTs, rather than listing the various devices possessing these attributes, and is as such perhaps a more useful definition. This is even more so due to the digital convergence discussed by Batchelor and Scott (2005), in which phones can also be radios and mini-computers, while computers can be TVs, radios, and phones.

More than two decades ago, Lorentzen (1988) developed a theoretical framework for understanding technological innovation, which still has much to offer when trying to understand the concept of ICT and the role of ICTs in socio-economic development. She defines technology as a process, and not simply a thing that can be bought and used. This is because socio-economic choices, which have a bearing on the final product, are implicitly or explicitly made in the process of technological innovation. This makes technology a social product.

ICT, globalization, and development

Rapid developments in ICTs over the last two decades have prompted the question of not only what role these can play in development, but also of whether developing countries can in fact cope without them. As a way of understanding this field of research, Heeks (1999) has suggested that the debates concerned with the role of ICTs can be summarized by picturing two continuums. First, there is a continuum of views on technology impacts. This dimension ranges from ICT optimists, who believe that the new technologies have largely positive impacts such as wealth creation and improved service delivery, to ICT pessimists, who associate ICTs largely with negative impacts such as unemployment and growing social exclusion. Second, he suggests a continuum of views on impact causes from technological determinism, in which inherent features of the technology are seen to determine the impact of introducing ICTs, to social determinism, in which human choices within social structures shape the influence ICTs have.

Understanding these different points of view is important. As Castells (1999) argues, we are in the middle of a historical period of transformation that is made possible by the collapse of the Soviet Union and by new developments within ICTs. Although the capitalist pursuit of profit is not a recent development, there is something fundamentally new about the current brand of capitalism. Castells argues that it is driven by the new ICTs, which have tooled the development of new productivity sources, of new organizational forms, and of a new and global economy. For Castells, we have entered the information age, in which ICTs are the functional equivalent of electricity in the industrial age. However, he argues that the essential role of ICTs in stimulating development is a two-edged sword, and on the basis of this suggests two possible scenarios or paths for developing countries. These scenarios capture two prominent positions within the discourse on ICT and poverty reduction, which have strong roots in two opposing traditions within development theory.

The first scenario is one in which developing countries are enabled, by adopting new technologies, to leapfrog stages of development and increase their competitiveness faster than in the past. Several examples of economies that have managed this leap are found in the Asia Pacific region, such as Hong Kong, Taiwan, Singapore, Malaysia, and South Korea. Negroponte (1998) and

Primo Braga (1998) have suggested that ICTs might enable a similar development path for other developing countries:

> Developing countries can, for example, leapfrog stages of development by investing into fully digitized networks rather than continuing to expand their outdated analogue-based infrastructure. There are advantages of being a follower – e.g., not having to cope with the technological obsolescence of well-developed wireline networks – and they are illustrated by the fact that low-income economies presented a higher share of digital telephone lines (94.7 per cent) than high-income economies (85.5 per cent) by 1996. (Primo Braga, 1998: 2)

This view puts forward a vision of how modern digitalized ICTs can be introduced in developing countries and thereby changes in their development path achieved. A second position is one in which certain economies are unable to catch up or keep up with the technological developments. These economies fall increasingly far behind, and their retardation is cumulative. The situation is described as an increasing digital divide or gap that can be found both within and between countries (Gillwald, 2005).

These two positions have also been labelled ICT optimism/pessimism (Bedia, 1999) or utopia/dystopia (Hamelink, 1997). One has its roots in modernization and the other in dependency theory. In both positions, ICTs are placed at centre stage of development and seen as having either detrimental or highly beneficial impacts on the position of developing countries. Hence, together they also represent what Heeks (1999) has called technological determinism. However, a third possible scenario or position is available, one in which ICTs are assigned a less significant role in determining the future of developing countries and the poor, but simultaneously are seen to play a role in supporting efforts to reduce poverty or deprivation.

In some cases, ICTs have been given a central role in poverty reduction arising from their potential benefits for increasing incomes of the poor and enhancing overall national social and economic growth. Research designed to provide empirical evidence of this presumed relationship has tended to adopt a broad macro-level focus, as opposed to the micro-level at which the linkages between ICTs and poverty-reducing activities actually take place (Hamelink, 1997; Adhikari, 2002; Kenny, 2001). As a result, such studies have tended to make very general statements concerning the high correlations between higher levels of development and intensities of ICTs (see Sridhar and Sridhar, 2007; UNDP, 2003). Other research has studied the correlation between the level of socio-economic development and use of information or the size of the information sector (Jeong, 1990; Menou, 1985). Often, reference is made to the contribution of information to development at a global, national or regional level, avoiding any discussion of the potential benefits, costs, trade-offs, and conflict that might arise at the level of individuals, households, and communities (Menou, 1993). An opposing view is

depicted by Chowdhury (2000) who observes that 'the poor can't eat high speed internet access.' What does appear evident, though, as advanced in Primo Braga (1998) and Brown (2001) in Adeya's comprehensive review paper, is that excluding the poor from the benefits of ICTs will result in a widening of the economic gap between haves and have-nots. There is also an abundant literature supporting the argument that ICTs have the potential of combating rural and urban poverty if appropriately deployed (Samiullah and Rao, 2000, as quoted in Adeya, 2002).

A more optimistic scenario on what ICTs can do for developing countries is offered by Cairncross (1997) who predicts the 'death of distance':

> To allow communications to work their magic, poor countries will need sound regulations, open markets, and, above all, widely available education. Where these are available, countries with good communications will be indistinguishable. They will all have access to services of world class quality. They will be able to join a world club of traders, electronically linked, and to operate as though geography has no meaning. This equality of access will be one of the great prizes of the death of distance. (Cairncross, 1997, quoted in Venables, 2001: 1)

Many arguments have been put forward for how ICTs can impact on economic growth. The theoretical information approach to development provides that information asymmetries are among the major causes of transaction costs, uncertainty, and, therefore, also market failure (Wolf, 2001). The lack of access to information is a particularly prominent problem in poor populations and small firms, and therefore plays a central role in perpetuating disadvantage and inequality. A reduction in information asymmetries can enhance the efficiency of resource allocation and decrease the chances of well-informed large firms extracting rent from less-informed small firms. On a macro-level this can create faster growth and diversify the economy.

Jalava and Pohjola (2002) suggest three avenues through which ICTs can have growth-enhancing effects. First, the production of ICT goods and services can directly contribute to the gross domestic product (GDP) size of an economy. Second, the use of ICT as an input in the production of other goods and services can have growth-enhancing effects. In fact, they argue that these benefits can be even greater than the growth-enhancing effect of ICT production. Third, ICTs can enhance growth through the impact of ICT industries in multi-factor productivity. The OECD (2003) offers a similar view on how ICT impacts on productivity growth. First, the investment in ICTs contributes to labour productivity growth. That is, it contributes to a more efficient use of capital and labour. Second, progress in the production of ICT-related goods and services has contributed to increased labour and multi-factor productivity growth. This has been called 'competitive effects', referring to the effect of growth within firms, of the entry of new firms and the exit of declining firms, and of more productive firms gaining market shares. Thirdly, OECD

found investment in ICTs to contribute to an increase in overall efficiency, related to lower transaction costs and more rapid innovation.

Oliner and Sichel (2000) conducted a study measuring the contribution of ICTs to economic growth in the US economy of the early 1990s, but found the contribution to be modest since computing equipment only represented an extremely small fraction of the total capital stock. However, when the study was replicated in the late 1990s, a much more substantial contribution from ICTs was found. In fact, they conclude that information technology was the primary force behind the sharp rise in productivity growth in the late 1990s.

However, the majority of the evidence for the positive impacts of ICTs on economic growth has been collected in developed countries, and many of the findings cannot be directly transferred to a developing country context (Bedia, 1999). With Jalava and Pohjola (2002), Röller and Waverman (1996) argue that investment in telecommunications infrastructure will create economic growth only through the increased demand for certain products such as cables and switches. However, the extent to which an economy benefits from this increased demand depends on where these products have been produced. If they are imported, which is the case in most African countries, the demand for such products can further entrench a negative trade balance, even if it also stimulates trade within the country. Also, even if there is some evidence indicating that ICTs can contribute to general economic growth, there is not much evidence that the poorest countries are able to fully utilize the potential of new technologies to increase efficiencies in their industries, particularly since these are largely based on the production of raw materials and subsistence agriculture (Batchelor and Scott, 2005).

Through a review of relevant research, Jalava and Pohjola (2002) have established that investment in ICTs has had different impacts on economies around the world. They confirm the findings made by Oliner and Sichel (2000) that ICTs were an important factor in the improved economic performance of the USA in the 1990s. However, these effects are not equally strong elsewhere in the world. In other G7 countries, the contribution of ICTs to output growth was less than half of that found in the US economy of the early 1990s. In a more recent study comparing nine OECD countries, Colecchia and Schreyer (2002) show that output contributions have increased only in the USA, Finland, and Australia. Unlike the former two countries, Australia is not an ICT producer, indicating that ICT production is not a prerequisite for experiencing the growth-enhancing effects of ICTs.

A possible underlying reason for the differences found in impact is that a non-linear relationship exists between ICT and economic growth. There is a general understanding that the effect of ICT is reliant upon a certain level or a critical mass of ICT density (Bedia, 1999). Röller and Waverman (1996) found the density of telecommunication to have an impact on economic growth only when estimating an additional specification that allows for non-linear effects. They concluded that a 10 per cent increase in the penetration rate of telecommunication infrastructure would create a 2.8 per cent increase in

GDP, but growth was only generated once a minimum threshold of telecommunication density was achieved. This threshold was found to be at around 24 per cent, meaning that only once 24 per cent of the population has access to telecommunication, might growth be generated. The need for a threshold of ICT diffusion in order to observe effects from ICT investment is confirmed by Wolf (2001) conducting research in East Africa. Given the low ICT density levels of many developing countries, these findings suggests that the impact of investment in ICT infrastructure might be significantly different in developing than in developed countries. It also suggests that developing countries may have to make substantial investment in ICTs before seeing the desired growth-generating effects of these technologies. This idea reflects the 'big-push' theory that was launched by Rosenstein-Rodan in the 1940s, which holds that a high initial investment in infrastructure may be required before benefits can be reaped (Bedia, 1999).

Less ICT optimistic theorists have argued that there is very limited, if any, evidence that investment in ICTs generates economic growth, even in developed, high ICT dense countries. Using World Bank data, Forestier et al. (2002) found a strong link between per capita income and teledensity, but suggest that this was largely the result of telephones acting as consumption goods, i.e. as people become richer, they want a telephone. Whether there is a causal relationship the other way – from ICTs to growth – is less clear. A number of interacting factors make it hard to establish general conclusions about the impact of ICT roll-outs on growth without specifying under what conditions these findings apply.

Kenny (2002) concludes that 'there is limited evidence of a past spillover impact of investment in computers and the internet on economic growth in the US, and the case for a dramatic increase in productivity in the future is at least mixed, this suggests any benefits from the internet in LDCs are likely to be greatly delayed and comparatively small' (Kenny, 2002: 6). According to Kenny, the profits and productivity increases that have been found to be caused by the introduction of the internet are concentrated in the IT development and production industries. Hence, one of the main reasons for the lack of impact from ICTs in least developed countries (LDCs) is that these countries are largely importing ICT goods, not inventing or producing them. The likelihood of spillover effects from ICTs is further complicated by the costs of building out a network, resulting in low ICT density in LDCs as discussed above.

De Alcántara (2001) also questions the validity of some of the claims made about the role of ICTs in economic growth. She argues that the benefits in terms of economic growth have so far not been very significant in most of the USA, Europe, and Japan. She draws on a study conducted by Jorgensen and Stiroh (2000) showing that the sectors of the US economy that have invested the most heavily in ICTs have, in fact, seen lower than average gains in productivity. She further argues that the new ICTs facilitate an increasingly integrated world economy, with instantaneous computer-mediated financial markets, which amplifies the risk of economic instability.

Hence, the potential of ICTs to generate economic growth is not very clear. There seems to be a fair amount of consensus that ICTs have contributed to the economic growth seen in the United States over the last 20 years, but whether the same is true elsewhere is less sure. There is some evidence that ICTs have contributed to growth in other OECD countries, although to a lesser extent than in the US economy. Against this background, what role can ICTs play in generating growth in developing countries?

Even if ICTs do contribute to economic growth, the question remains as to how this growth is distributed in the population. If a few large companies are able to improve their performance, will this have poverty-reducing effects? This question takes us back to the old controversy over whether economic growth will trickle down from the rich to the poor, an idea that was launched in the 1950s and 1960s, and has more recently been defended by, for instance, Dollar and Kraay (2002). According to these theorists, economic growth generated by investment in ICTs will eventually trickle down to the benefit of the poor. However, other researchers have modified or countered the idea of a trickle-down effect. Lustig et al. (2002) argue that economic growth is a necessary, but not a sufficient, condition for poverty reduction, and that the impact on poverty reduction is significantly smaller in countries with initially high levels of inequality. Hence, redistribution is necessary in order for economic growth to have poverty-reducing effects.

Behind the prediction that developing countries will be able to leapfrog stages of development is a firm belief in what technology can achieve. As quoted earlier, Cairncross (1997) has announced the 'death of distance' and pictures a future whereby face-to-face interaction is no longer necessary and all forms of interaction can happen over a distance. This can be achieved through e-commerce (Chowdhury, 2000), e-learning (Chowdhury, 2000; Sciadas, 2005), and so on. Cairncross (1997) suggests that these services and trade opportunities will be available in all countries, given the right environment, and will put an end to global inequalities.

However, the validity of the above position has been disputed. For example, Grace and Kenny (2003) argue that the role of internet in education is potentially huge, but question the cost-effectiveness of a widespread roll-out of computers and internet in primary education, given the high price, the many barriers to a successful roll-out in LDC and the lack of evidence that it is worthwhile. In addition, Kenny (2002) argues that providing government information and services through internet alone would be both impractical and unsustainable in a context of high illiteracy levels, low levels of internet access, poor skills in dominant languages, and lack of computer skills. Kenny (2002) further argues that research in the US does not suggest that e-commerce will result in dramatically lower prices for the poor as consumers, and as a result the poor as producers will not see a dramatic increase in demand from putting their products online.

Evaluating the proposed 'death of distance', with regards to trade and production in particular, Venables (2001) argues that while the new

technologies will facilitate the transportability of certain activities and make these less dependent on face-to-face interaction, other activities will become even more deeply entrenched in high income countries, particularly in the cities, because this is where both the markets and the know-how are. The latter activities are typically complex, knowledge intensive, rapidly changing activities that require face-to-face communication. The activities that can be relocated to lower wage countries will be an important force for development, but are only likely to benefit a small number of countries since they will tend to cluster together. Hence, while the opportunities offered by new technologies might change the pattern of inequality in the world economy, they are unlikely to reduce them.

This leads some analysts to take a more extreme position in which they see certain regions, countries, or areas within countries, being excluded from the global economic network, widening the gap between the haves and the have-nots. Castells (1999) argues that this process is driven forward by the new ICTs. The new technologies make it possible for companies, which are competing in regional and global markets, to link up with everything that is valued in the current system of production and trade, and disconnect or exclude everything that is not valuable. Hence, through the new ICTs the global economy has the simultaneous capacity to include and exclude people, territories, and/or activities depending on whether they are of value as producers and/or consumers according to dominant values and interest. The prediction of ICT dystopia is that new developments within ICT will continue to facilitate growing inequalities worldwide, making it even harder for the poor to catch up. This argument however presupposes that the more ICT-marginalized nations are literally helpless and cannot choose mitigating strategies. This assumption is not correct because we have witnessed many economically developing countries implementing national ICT policies and strategies that place ICT at the centre of socio-economic growth, which in turn reduces inequality.

The digital divide is perhaps particularly obvious when looking at the pockets of high-technology hubs around the world, such as Silicon Valley, Bangalore, Mumbai, Seoul, and Campinas, drawing the best engineers and scientists the world has to offer, while the overall population in the host countries (except perhaps in the USA) remains in low-end, low-skill jobs, if employed at all (Castells, 1999). These are prominent examples of ICT-*producing* regions, but differences are also increasing in the level of ICT *use* around the world. African countries, in particular, are found to lag increasingly far behind in terms of most global average ICT indicators (Gillwald, 2005). For instance, Panos suggests that 'only 1 % of the world's internet users are Africans' (Panos, 2005: 2). Kelly (2005) provides that Africa's share of global internet users is 1.8 %, while the continent's share of mobile telephone users is slightly higher at 3.8%. The World Development Report 1998/1999 demonstrates the size of the global digital divide by looking at teledensity.[1] It reports that South Asia and sub-Saharan Africa have only about 1.5 telephone lines

for every 100 people, and compares this to the US which has 64 lines per every 100 people. In 2002, Kenny reported that low-income countries had 2.6 telephone lines per 100 people, as opposed to 66.4 in the US (Kenny, 2002). If, however, we use effective teledensity, the situation is much better for developing countries, because they have in the recent past witnessed the highest growth in mobile subscriptions.

The digital isolation of developing countries is therefore rapidly decreasing, largely because of mobile communication. According to the ITU 2012 report (ITU, 2012), many developing countries were rapidly bridging the digital divide. In Africa, the strongest performers in this regard are Kenya, Ghana, and Rwanda. In the mobile sector, developing countries accounted for the lion's share of mobile growth, posting double-digit growth in mobile subscriptions.

One way of resolving the link between ICT, development, and inequality is to see the digital divide not as the root cause but rather as a symptom of inequality and poverty (Hamelink, 1997; de Alcántara, 2001). Therefore, access to ICTs cannot be a solution to poverty in and of itself, but can at best be adopted as a tool in poverty reduction initiatives. De Alcántara (2001) argues that although ICTs are necessary for socio-economic progress in developing countries, they are not sufficient. Rather, ICTs can form part of a much broader effort to reach general development and poverty reduction goals. To this end, countries need to start incorporating ICT as a tool to achieve poverty reduction goals.

Recognizing that economic growth does not necessarily benefit the poor, Batchelor and Scott (2005) have made a distinction between the impacts of ICTs on economic growth in general and on pro-poor growth[2] in particular. They argue that ICTs can be used to complement existing practices within sectors that have the potential to enhance pro-poor growth, including infrastructure, private sector development, and rural livelihoods. Hence, ICTs can be utilized as a tool to support the implementation of overall pro-poor development strategies. It is argued that making ICTs a pro-poor tool requires a bottom-up approach that puts the needs of the poor at the centre, rather than a top-down approach focusing on the introduction and augmentation of technological capital (Heeks, 1999). This requires a micro-economic perspective that considers what information and communication needs actually exist among the poor, and how these needs can be satisfied in the best way possible by the ICTs available. In many ways this position is adding nuance to the ICT dystopian position, by arguing for moderate optimism about the contribution of ICTs to development and by focusing on the potential of social actors using their agency to shape technology within social structures.

Another argument behind this approach is concerned with cost-effectiveness. In a situation of limited resources, it is necessary to ask whether computers and internet connectivity are the most cost-effective tools to meet the information and communication needs of the poor. Kenny (2002) has evaluated the potential efficiency of radio, telephony and the internet as

tools for direct poverty alleviation, and argues that the low requirements for successful utilization of radio and telephone, in terms of price of acquisition, infrastructure requirements, skills requirements, and maintenance, make them far more sustainable technologies for the poor than the internet. Hence, before making heavy investments into expensive ICTs, the costs and benefits of different alternatives must be evaluated.

Further, there are concerns for the cultural and social impacts of the new ICTs, given that most of the content available on the internet is from alien contexts (Moralez-Gomez and Melesse, 1998; Heeks, 1999). It is argued that developing countries need to be able to shape the content and form of the technologies they use, if these are to contribute to sustainable human development (Moralez-Gomez and Melesse, 1998). Heeks (1999) argues that this is best achieved through organic information systems that are created from within their communities. In line with Kenny (2002), he suggests that it might be better to provide information through literate or intermediate technologies, such as telephones, rather than the most recently developed ICTs.

This perspective also echoes Lorentzen's theoretical framework (1988) in defining technology as a social process that is shaped by the social actors that are working innovatively with it. She describes the transfer of technology from one social context to the next as a process that must be driven from below, rather than implemented using a top-down approach, in order to have any real impact. Social structures nevertheless play a very important role as the framework within which technological innovation can happen. These can facilitate or counteract the innovative process. Further, Lorentzen emphasizes that technology should not be seen as a 'thing' or an additional production factor that can simply be added in adequate doses to existing production along the lines of the previous two approaches. Technology is an integrated part of the interaction between social actors and structures.

To use Heeks's (1999) conceptual framework, these theorists adopt a 'social deterministic approach' to the causal link between ICTs and society, by claiming that human choices determine what impact ICTs will have. This is a concept frequently used within media studies, for instance by Green (2002). However, 'determinism' is not very appropriate to describe an approach that emphasizes human agency. It can perhaps more accurately be described as social constructivist or people-centred.

What becomes obvious when reviewing literature that debates the existence and implications of a digital divide is the tendency to measure the digital well-being of a country or region in terms of per capita telephone lines, personal computers, internet hosts, and/or fax machines. The assumption is that if access to ICTs is evened out, the digital divide will gradually disappear and the development divide will follow suit. However, focusing on the enumeration of access to various ICTs seems to skew the debate and the policies related to ICT provision.

ICT and poverty reduction

Kenny (2002), Flor (2001), and Marker et al. (2002) argue that ICTs are powerful tools for empowerment and income generation in developing countries as well as for increasing access to education and other social services. Indjikian and Siegel (2005) confirm the positive correlation between ICTs and economic growth in the developed world, but argue that for this to occur in developing countries, policy makers have to implement policies that facilitate a faster rate of access and more resources into the ICT sector. Djiofack-Zebaze and Keck (2009) also note that regulation is a key factor affecting the performance of the telecommunications sector, especially the local fixed phone line segment.

The evidence linking ICTs to poverty reduction is less well developed than that concerning economic growth. Adeya (2002) provides a review of the literature concerned with ICTs and poverty overall, within special sectors such as health and education and by gender. She also looked at the methodological approaches used in doing research on ICTs and poverty. The review found that the poor still do not have adequate access to ICTs, but that there are efforts being made to address this gap, some more successful than others. Adeya concludes by saying that ICTs have the potential to alleviate poverty and problems faced by the poor. There are many challenges such as inadequate access, high costs, lack of funding, and low human skills, but it is important in this age to grasp the opportunities to empower the poor and give them real choices for the future. Methodologically, Adeya found that a number of the studies reviewed were more descriptive than analytical. She found very few empirical studies on the relationship between ICTs and poverty. Overall, there was an absence of a clear analysis showing impact. She argues that the impact of ICTs depends on the attitudes and expectations of the users, as well as on institutions, organizations, and management. It also depends on the role of policy makers in general. She recommends that more interdisciplinary research is needed on the social impact of ICTs, as this would help planners and implementers to design and evaluate better uses for them. Adeya also found that most of the studies used only quantitative methods and recommends that impact should be analysed by using generalized and expanded treatments of both qualitative and quantitative techniques, rather than simply using quantitative tools.

Another important overview of the link between ICTs and poverty is the study edited by Torero and von Braun (2006). The authors found that the 'variety of views about ICTs reveals that their role in development is unclear, especially without convincing evidence of their impact – little research has been conducted on the direct and indirect links between ICT and poverty reduction.' They conclude by saying that ICTs offer an opportunity but not a panacea, and that access to information through ICTs is a question not only of connectivity but also of capability to use the new tools and provision of relevant content in accessible and useful forms. Therefore, for the potential

benefits of ICTs to be effective in reducing poverty, many pre-requisites need to be put in place, including subsidies to reduce the access gap and innovative institutional arrangements to increase use. Regulatory frameworks, choice of technologies, and public action related to ICT investment should be more broad based and pro-poor.

Positive results have also been found at the micro-level. Mobile phone usage among fisherwomen and -men in Kerala has been shown to benefit both producers and consumers through improved information and better functioning markets (Jensen, 2007). Other studies go further to point out that the role of ICT is not limited to promoting income generation but also includes non-income dimensions of development such as empowerment and security (Gerster and Zimmermann, 2003).

There is a growing tendency to look at poverty beyond the narrow money-metric indicators such as income required to purchase a basket of basic goods, and to include other dimensions of poverty. One of these dimensions is what Nobel laureate Amartya Sen (1985) terms capabilities. Sen stresses the relationship of people to the resources that they have and the commodities that they require in meeting their basic sustenance requirements. In this framework, a person's advantage is determined by their capabilities, that is to say, what they can or cannot do, or can or cannot be (Sen, 1985: 670). The resources that are required to achieve some minimum level of capability may vary over time and by community.

In the context of ICT, the ability to adopt and use new technologies within the existing socio-economic environment of the livelihoods of the prospective users would require additional resources and new skills. Noting the inadequacy of explanations of access to technology that focus only on 'devices' (the computer, radio, or mobile phone) or 'conduits' (the ADSL connection, internet service provider, or SIM card), Warschauer (2004: 32) argues that literacy capabilities matter in determining ICT access. Literacy here goes beyond formal schooling to encompass the cognitive tasks involved in framing questions, solving problems, and applying knowledge. In the world of mobile phones for example, using SMS and beeping/buzzing instead of calling so as to reduce expenditure on communications, or transferring money through airtime, reflect how technology can build on existing capabilities and how, in turn, existing capabilities can absorb and utilize technologies in ways that were not considered in the original design of the technology. Kleine (2013) is more explicit in her application of the capabilities approach to ICT and takes account not only of the values of the users of ICT, but those embedded in the technologies themselves. Thus she considers how choice can be limited or widened by the structures and institutions within which a technology is provided.

Vulnerability is another important dimension of poverty and is a key aspect of the livelihoods of the poor. This refers to the negative outcomes of processes of change and has been defined as 'a dynamic concept generally involving a sequence of events after a … shock' (Glewwe and Hall,

1998). Several analysts argue that the poor are more vulnerable to changes than the less poor because they have fewer options and assets with which to buffer themselves from the effects of negative events (Chambers, 1983). Instead, poor households attempt to manage vulnerability by pursuing a mix of livelihood strategies (Devereux, 1993; Frankenberger et al., 2000). These aim to increase their income flows and stocks of assets (accumulation strategies), to spread risk through livelihood adjustments or income diversification (adaptive strategies), to minimize the impacts of livelihood shocks (coping strategies), and, in the extreme, to prevent destitution and death (survival strategies). ICTs can be said to be beneficial to the poor if they help to reduce vulnerability to the extent that they support these strategies. This is recognized in the context of ICT by Duncombe (2006) and applied to Asian ICT case studies in a volume edited by Grimshaw and Kala (2011). In addition to recognizing the role played by ICTs in reducing some vulnerabilities, such as price fluctuations, market access, and dealing with disasters, including climate change, some of the case studies also recognize that ICTs themselves can bring vulnerabilities in terms of poor coverage and the risk of loss of the ICT device or service (Grimshaw and Kala, 2011: 24).

A final dimension of poverty relevant to ICT is that of isolation or social exclusion. This approach broadens the notion of poverty by taking into account the role of individuals in society. Exclusion occurs when individuals, families, or communities lack the necessary resources and networks to be able to participate fully in the institutions and decision-making structures of society (Stewart, 2000). In a study undertaken for DFID, Beall and Piron (2005) suggest that social exclusion is a process in which certain groups are systematically disadvantaged because of who they are (by gender, caste, class, ethnicity, etc.) or where they live (poorer areas in the city, rural areas). Other writers draw attention to the many ways in which exclusion overlaps with the different dimensions of poverty including social capital, vulnerability, and capability deprivation (de Haan, 2000).

The link between social exclusion and ICT has received a good deal of attention in developed countries and most analysts believe that ICTs will play a role in determining both the persistence of social exclusion and the manner in which exclusion translates into material forms of deprivation. Equally, most analysts argue that ICT could have both positive and negative outcomes, perhaps allowing some of those previously excluded to participate better in society (the disabled or the long-term unemployed being examples), while worsening the exclusion of those who lack the resources, infrastructure, or skills to survive in an increasingly ICT-driven environment (Grimshaw and Kala, 2011; Phipps, 2000; Foley, 2004; Warschauer, 2004). Those excluded might also include people for whom the usefulness of ICT does not compensate for its cost, both in terms of resources and time. The exclusionary tendencies of ICT could be of particular concern in societies in which resources, infrastructure, and skills are highly unequal (Castells 1999; Zheng and Walsham 2008).

Dissenting views

Not all analysts are sanguine about the impact of ICT on poverty reduction. In their overview Torero and von Braun (2006) found that some studies have expressed scepticism of the beneficial effects of ICT. The authors of these studies, reviewed by Torero and von Braun (2006), argue that access to ICTs depends on income, education, and resources and that the so-called 'digital divide' is part of a much broader development divide. They argue that socio-economic development contributes to a greater use of ICT rather than the reverse. A more recent study at household level by Ndung'u and Waema (2011) established that the use of internet and mobile phones led to both positive and negative development outcomes and that households' decisions and choices were based on their perceptions of the role that the new technologies played in enhancing their quality of life.

As examples, Arunachalam (2002) argues that ICTs are a necessary but insufficient condition for development and recommends (among other suggestions) that the focus should shift from bridging the digital divide to poverty alleviation. A similar view is held by Kirkman (1999), who notes that to be useful, any technology must be placed within the local context of capabilities and needs. Still others argue that using ICT as an engine of growth is complex (Bollou and Ngwenyama, 2008); that development is not merely a matter of technology but needs a sound political economy along with the political will to prioritize development problems (Nulens and van Audenhove, 1999; Athreya, 2004); and that while ICTs are critical for getting and sending information, the role of information in development itself is contentious (Talyarkhan et al., 2005).

Mukhorpardhyay (2004) reviews a number of publications that have expressed scepticism about the role of ICT in reducing poverty and points to the fact that 'experiences with several ICT projects designed to assist the underprivileged seem to suggest the new technology can be harnessed to address poverty alleviations for many years now' (2004: 1). She argues that the differences in the role of ICT in poverty reduction are grounded in the fact that there is no 'comprehensive and universally accepted conceptual framework for assessing the relationship between ICTs and their impact on poverty reduction.' She concludes by saying that there are few studies that provide evidence-based analysis of the relationship that would confound the sceptics. Other reviews of ICT projects designed to bring about economic development and poverty reduction concur and argue that since few of these projects have carried out a systematic impact assessment, the results are not conclusive about the relationship of ICT to poverty reduction (Batchelor and Sugden, 2003; Slater and Tacchi, 2004).

To sum up, there is a rapidly expanding literature that has contributed to a better understanding of the potential impact of ICT on poverty reduction. Nevertheless, there remain many gaps, both in terms of how ICT and poverty are conceptualized and measured, as well as in terms of how

their interaction and impact are assessed. Rather than being an unqualified benefit to those who are poor, it seems probable that the impact of ICTs will be determined by the context in which these technologies are deployed, the preparedness of the users, and the opportunities that exist for their application. A continuum of costs and benefits seems a more realistic outcome than a simple dichotomy. Awareness of these gaps prompted the study whose results are reported in this book.

Digital poverty

As discussed above, the nature of the relationship between ICTs and poverty is still unclear and research to date has resulted in divergent conclusions. For example, some argue that the poor cannot benefit from ICTs. This is largely ascribed to what has been portrayed as digital poverty, which encompasses the lack of means with which to access ICTs, the lack of skills to use the ICTs, and inadequate information about the usefulness of ICTs.

In order to understand digital poverty, use is made of the work of Barrantes (2007a) and others who separate digital poverty from more traditional notions of economic or social deprivation. Thus, while socio-economic poverty has conventionally been described as 'fall[ing] short of a level of economic welfare deemed to constitute a reasonable minimum' (Lipton and Ravallion, 1997: 2553), and is often measured as the lack of income to acquire a minimum basket of basic goods, digital poverty has been defined as 'the lack of goods and services based on ICTs' (Barrantes, 2007a: 30). Digital poverty thus incorporates a demand component (the service cannot be afforded), a capability dimension (the skills to use the service are not available), and a supply component (the infrastructure to deliver the service is not in place).

Other writers have made similar suggestions. For example, Pruulmann-Vengerfeldt (2008) argues that in order to be able to use the new technologies, various skills are needed: *instrumental skills* to deal with the operational manipulation of technology, *structural skills* in order to understand the structures in which information is conveyed (format, language), and *strategic skills* which include the ability and readiness to actively search for information on which to make decisions. In addition, appropriate or relevant content is required in order to have real access (see Figure 1.1).

Warschauer (2004: 143) makes a similar point, although using a slightly different model, to understand what is required in order to have real computer access. Three types of resources needed in addition to the physical or supply side factors are identified. First, there is a need for *digital resources*, which refers to the content that is available through the new technologies, and whether this is relevant, comprehensible, and responds to the needs of the new users. Second, the use of ICTs requires *human resources*, i.e. the knowledge and skills necessary to use the tools in a meaningful way. This includes traditional literacy that allows you to read and write, but also a range of other

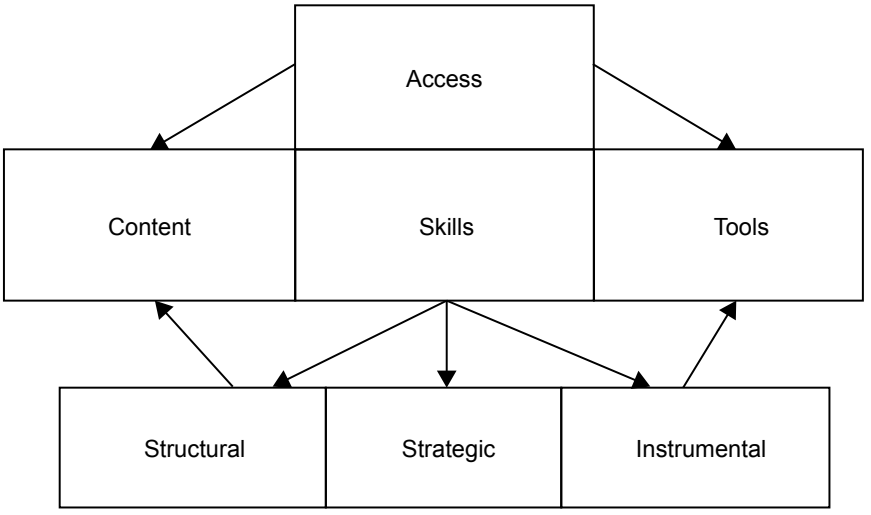

Figure 1.1 Dimensions of ICT access

Source: Pruulmann-Vengerfeldt, 2008, based on Steyaert, 2002

literacies, such as computer literacy, information literacy, multimedia literacy, and computer-mediated communication literacy. Finally, there is a need for appropriate *social resources*, which refer to the social relations, social structures, and social capital that are required to support meaningful use of ICTs in families, communities, and institutions.

Although these concepts of economic and digital poverty may initially seem to refer to quite distinct forms of deprivation, there are important linkages. Lok-Dessallien observes that poverty can be effectively defined in terms of the existence of 'physiological or sociological deprivation' (2001: 4). In this analysis, 'physiological deprivation' results in poverty as a result of a lack of tangible resources such as money, food, services and so forth. 'Sociological deprivation,' on the other hand, is a feature of poverty resulting from 'structural inadequacies' or 'inherent disadvantages' (Lok-Dessallien, 2001: 4). Further, the capabilities approach proposed by Noble laureate in economics Amartya Sen argues that it is neither the possession of an asset or commodity, nor the utility that it makes available that provides well-being. Instead, what the person is actually able to do with the commodity or asset given its attributes in combination with the users' own characteristics and external circumstances is that which is valued. While Sen has illustrated his own work with the example of a bicycle, the same logic can be applied to ICT access. A mobile phone (commodity) provides communication (characteristic); and depending on an individual's knowledge, wealth, and ability, as well as the state of the infrastructure, s/he can communicate or not, cost-effectively or not, for pleasure or for business (Sen, 1985).

Indeed the multidimensionality of access becomes more obvious when looking at ICTs in terms of the capabilities approach. As Barrantes (2007b), Warschauer (2004), Pruulmaan-Vengerfeldt (2008), and Sen (1999) argue, it is not the possession of an asset, nor the availability of certain utilities, that creates well-being. Of value is what a person is ultimately able to do with the asset (e.g. computer), which is determined by the attributes of the asset (e.g. typing), combined with the characteristics of the person (e.g. literate/illiterate), as well as external circumstances (e.g. power available or not). This has close parallels to the work of Rein (1983), where a key conclusion is that deprivation is not simply the lack of resources, but the inability to obtain these through individual or collective action.

Some characteristics of the digitally poor that are identified by Barrantes (2007a) are clearly included in these broader approaches to the conceptualization of poverty. These include those not having sufficient income to acquire ICT access, those not having the minimum abilities required to use ICTs, and finally those who do not have sufficient resources or live in communities without resources, and so are deemed ineligible by service providers for the extension of ICT infrastructure. The link with other components of digital poverty is less obvious. The lack of demand for ICTs arising from absence of a perceived need may be due to choice, the service provided being genuinely not useful or desired, or might arise from what has been referred to as an 'information asymmetry' (Greenwald and Stiglitz, 1986). That is to say, the lack of knowledge about the uses to which ICTs can be put results in ICTs not being desired. As Barrantes (2007b) comments, this may have a generational or gender dimension, but might also be indirectly related to economic poverty: the opportunity cost of acquiring the ICT service may be too high relative to other needs.

Deprivation, whether socio-economic or digital, is typically made up of three dimensions: *economic/financial* (comprising income and expenditure; investment and consumption); *social/human* (skills and knowledge, access to basic social services, social networking, communicating in emergencies), and *natural/physical* (infrastructure, natural resources, biodiversity). ICTs can act as facilitating factors linking social, economic, and natural well-being by improving communications and networking, whether social or economic in intention, and by reducing exclusion through information processing and dissemination, promoting economic inclusion, reduction of transaction costs, and building of social capital. Through ICTs, the poor are able to learn of new production strategies and technologies, access market information at a faster and more accurate level, and keep in regular contact with peers and other social and economic contacts and associates.

Conceptual framework

The objective of the research in the East African countries was to estimate the change in poverty status that results from a change in ICTs usage, taking into

account factors such as socio-economic and demographic characteristics and the policy framework that might also influence changes in poverty status. To achieve this, the research made use of the sustainable livelihoods (SL) framework, which brings together a multi-dimensional approach to poverty with the assets and activities used by households in order to obtain the resources that they need. This has been adopted by a number of development agencies and offers a coherent and widely understood approach.

Further, a systems-based approach to ICT has been adopted which recognizes that communication and the information that results are shaped not just by technical factors, but also by the economic and social context, which may enhance or retard the effectiveness of such information, and the complete range of communication, media, and information flows in a community. We make use of three components: technical, economic, and social. The technical sub-system comprises end-user technologies, networks, and access infrastructure, and the applications for use. The economic sub-system comprises economic institutions (including markets, enterprises, and consumers), cost structures, and regulatory frameworks. Finally, the social sub-system comprises social actors (communities, enterprises, households, and individuals), political processes, social interactions and networks, and the content of what is being delivered. Within the technical sub-system, we focus on broadcasting, including radio and television; telephony, including mobile, fixed line, fixed mobile (restricted mobility), and fax; and internet access, including email and web services. Forms of communication resulting from the use of technologies, such as digitally derived print, face-to-face conversation, and so forth are included in this focus, as well as innovations to extend the use of information derived from technologies.

The interactions between the different components of our conceptual framework are brought together with the SL approach. The vulnerability context (household and community exposure to risk and the shocks that result), along with the policy and institutional context (markets, government structures, and community networks) are the major conditioning influences. As a further influence on livelihood activities, outputs, and outcomes, we add what Barrantes (2007a) terms 'digital poverty'. Digital poverty is defined as 'the lack of goods and services based on ICTs' (Barrantes, 2007a: 30). Digital poverty thus incorporates a demand dimension (the ICT service cannot be afforded), a capability dimension (the skills to use the service are not available), and a supply dimension (the infrastructure to deliver the service is not in place). We propose that the availability of such infrastructure, resources, and skills constitutes a new asset for households that can be termed digital capital.

Recognizing influences on effective demand for ICT has resonance with our research question, thus we include an innovation of Dorward et al. (2003) who note that the nature and extent of demand for outputs from household livelihood strategies will determine the outcomes that follow. The interaction between the different components of our analytical framework is summarized

in Figure 1.2. In the upper part of the diagram we show the SL framework as it is conventionally presented, whereby assets are used by households in livelihood strategies to produce livelihood outcomes. These are the five asset categories described by Moser (1998) and others.

Dorward et al. (2003) introduce several other relevant innovations and separate livelihood strategies into activities and outputs. This allows their interaction to be explored in the lower part of the diagram where conditioning influences are shown. The first of the innovations concerns the vulnerability context (household and community exposure to risk and the shocks that result) and the second is the policy and institutional context (markets, government structures, and community networks). From the perspective of the implications for policy, the diagram also shows the four role players conventionally identified by the poverty reduction strategy papers (PRSPs) prepared by many countries, including those included in this research: markets, communities, government, and households. The functioning and performance of an ICT system is thus both a component of, and an influence on, the policy interventions that might be proposed by any PRSP. As a result, the ICT system can enhance (or perhaps limit) household livelihoods, and thereby impact upon social and economic dimensions of vulnerability and poverty and the successful implementation of national PRSPs.

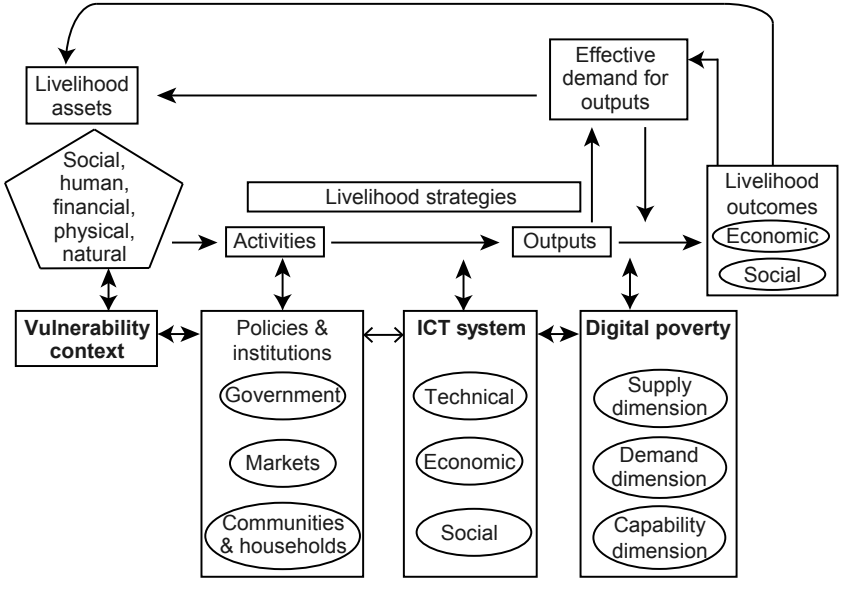

Figure 1.2 ICT, livelihoods, and multi-dimensional poverty

Source: adapted from Carney, 1999, and Dorward et al., 2003

Country context

To understand better the context of the countries covered in this book (Kenya, Uganda, Tanzania, Rwanda, Namibia and South Africa), the country socio-economic and ICT indicators need first to be described. Kenya and Uganda are categorized by UNDP as having 'medium human development', while Tanzania and Rwanda are categorized as having low human development. Namibia and South Africa have the highest human development indices among the six countries. The key indicators of socio-economic development reflecting this are shown in Table 1.1. The countries in East Africa are similar in many of the indicators except GDP per capita, where Tanzania fares badly with about half of the value in the other three countries. The two countries in Southern Africa generally have higher values for most indicators than the four countries in East Africa.

Table 1.1 Socio-economic indicators, 2007

Indicators	*Kenya*	*Rwanda*	*Tanzania*	*Uganda*	*Namibia*	*South Africa*
Human Development Index (HDI)[1]	0.541	0.460	0.530	0.514	0.686	0.683
Population (in millions) (2005)	35.6	9.2	38.5	28.9	2.1	48.6
Life expectancy at birth (years)	53.6	49.7	55.0	51.9	60.4	51.5
Population <15 years (%)	43.0	43.5	44.0	49.4	37.0	32.0
Adult literacy rate (ages 15 and above) (%)	73.6	64.9	72.3	73.6	88.0	88.0
Combined gross enrolment ratios (%)	59.6	52.2	57.3	62.3	67.2	76.8
Access to clean water (%)	57.0	65.0	55.0	64.0	93.0	93.0
People without improved water source (%)	43.0	35.0	45.0	36.0	7.0	7.0
Access to improved sanitation (%)	42.0	23.0	33.0	33.0	35.0	59.0
Access to electricity (%)	15.0	4.8	11.5	9.0	34.0	75.0
Unemployment rate (%)	n.a.	0.6	3.2	5.1	37.6	22.9
GDP per capita (PPP US$)	$1,542	$866	$1,208	$1,059	$5,155	$9,757

Indicators	*Kenya*	*Rwanda*	*Tanzania*	*Uganda*	*Namibia*	*South Africa*
Poverty levels (<$1 per capita/day) (%)	22.8	60.3	52.8	n.a.	49.1	26.2
Poverty levels (national poverty lines) (%)	52.0	56.9	35.7	37.7	n.a.	n.a.
Urban share of population (%)	22.2	18.9	26.4	13.3	38.0	61.7
Gini coefficient	47.7	46.7	34.6	42.6	74.3	57.8
Human Poverty Index-1 (HPI-1)[2]	29.5	32.9	30.0	28.8	17.1	25.4
Gender Development Index (GDI)/HDI[3]	0.994	0.998	0.994	0.992	0.995	0.996
Ibrahim Governance Index[4]	53.7	48.5	59.2	53.6	68.8	69.4

1 The HDI is a composite measure of human development based on life expectancy at birth, adult literacy and gross enrolment in education, and purchasing power parity GDP per capita.
2 HPI-1 is a composite measure of deprivation based on the proportion of people who are not expected to survive to age 40, the adult illiteracy rate, the unweighted average of people not using an improved water source, and the proportion of children under age five who are underweight for their age.
3 The GDI has the same components as the HDI but captures inequalities between women and men. The greater the gender disparity, the lower is a country's GDI relative to its HDI.
4 The Ibrahim Index measures the delivery of public goods and services to citizens by government and non-state actors. The index uses 84 criteria in four components: safety and rule of law; participation and human rights; sustainable economic opportunity; and human development.

Source: UNDP, 2009; MIF, 2009

Turning to the ICT context, there has been substantial growth in the ICT sector throughout the East Africa region over the last 10 years, particularly in mobile telephony. Kenya leads the way in East Africa for all methods of telecommunications: fixed phone lines, cellular phone, and the internet, with Tanzania second in the ownership of mobiles but the lowest in internet users. Generally, most ICT indicators for Namibia and South Africa are much higher than those of the East African countries. Table 1.2 shows the relative positions of each of the six countries.

Table 1.2 ICT indicators, 2010

Indicator	*Kenya*	*Rwanda*	*Tanzania*	*Uganda*	*Namibia*	*South Africa*
Fixed lines (/100)	1.1	0.4	0.4	0.1	6.7	8.4
Mobiles (/100)	61.6	33.4	46.8	38.4	67.2	100.5
Hh with computer (/100)	8.0	0.5	2.6	2.1	15.4	18.3
Hh with internet (/100)	0.4	0.1	0.7	0.4	3.9	10.1
Internet users (/100)	25.9	7.7	11.0	12.5	6.5	12.3
Rank (of 228 countries)	115	142	138	140	113	97
ICT Development Index (IDI)[1] 2010	2.29	1.44	1.51	1.49	2.36	3.00
IDI Global Rank Change (2008–2010)	1	1	3	0	1	–3
ICT Development Index (IDI) 2008	1.74	1.18	1.23	1.24	2.06	2.71
IDI change (2008–2010)	31.6%	22.0%	22.8%	20/2%	14.6%	10.7%

1 The IDI is calculated by the International Telecommunications Union (ITU) and is a composite index of ICT infrastructure and access, ICT use and intensity of use, and ICT skills and capacity to use ICT. The index has 11 components. The IDI of the surveyed countries can be compared with the top ranking countries: Sweden at 7.5 and the Republic of Korea at 7.3, as well as the USA at 6.4.

Source: ITU, 2011

This overall pattern is overlaid by a skewed distribution in each of the countries characterized by a significant bias towards the urban areas. For instance, in Rwanda, 75 per cent of the internet cafes are located in the country's capital, Kigali (Bizimana, 2010). The rate of internet access is supposed to have increased after three submarine cables, The East African Marine Systems, the East African Submarine System (EASSy), and SEACOM became operational in 2009/10 in East Africa. For example, in Kenya, the estimated internet users per 100 inhabitants were 26.4 by the second quarter of 2010/11 (CCK, 2011).

All six countries have an ICT policy and some elements of an ICT strategy either embedded in the national policies for growth and reduction of poverty, as in Kenya, or as a distinct strategy, as in Rwanda. Of the four countries in East Africa, this aspect is weakest in Tanzania and strongest in Rwanda, where the government has even introduced buses which act as moving telecentres so as to take the technology to rural areas. The pro-active role of the government in Rwanda aims to replicate the successes of countries such as the United Arab Emirates, Malaysia, and Mauritius, which have deliberately used ICT as a development enabler with remarkable success. In all countries, however, there are many challenges for effectively integrating ICT into economic and social development.

Objective and structure of the book

Previous research was designed to provide empirical evidence of the relationship between ICT access and economic growth/poverty reduction, and has tended to adopt a broad macro-level approach and to focus on money–metric indicators, such as gross domestic product (GDP). There have also been methodological inadequacies, as has been pointed out by several reviewers of such research (Adeya, 2002; Mukhopadhyay, 2004). As a result, the nature of the relationship between ICTs and poverty remains unclear and the information deficiencies raise concerns among policy makers, who are being urged to increase investments into ICT infrastructure and regulatory frameworks. To resolve this, evidence is needed to attribute and measure changes in the level of poverty that follow from ICT initiatives that specifically target the poor.

The overall objective of the book is to provide credible evidence on the impact of ICTs on growth and poverty reduction in the African context in order to facilitate policy making regarding the role and practice of ICTs in poverty reduction strategies and plans. Most of the chapters in the book are from the Poverty and Information and Communications Technology in Urban and Rural Eastern Africa (PICTURE Africa) research project in four East African countries, funded by IDRC. The specific objectives of this research project were to:

- provide evidence of the relationship between poverty and the ownership and use of ICTs within households in East Africa;
- use the findings to influence current policy and practice concerning the use of ICTs for the reduction of poverty in East Africa and elsewhere;
- improve and develop methodologies for investigating the link between ICTs and development generally, and poverty reduction more specifically;
- build capacity for undertaking analysis on the ICT/poverty nexus in East Africa; and
- raise the profile of researchers and institutions in East Africa who undertake research on the relationship between ICTs and poverty.

The book is organized as outlined in the following. This first chapter provides an in-depth review of research around ICT and poverty, as well as the latest debates in this field. This literature analysis is then followed by Chapter 2, which provides an overview of the conceptual framework around the PICTURE Africa household panel study. Using panel data collected in East Africa in 2007/8 and 2010, this chapter also explores the relationship between ICT and poverty and demonstrates that ICT can indeed assist in poverty reduction. Chapter 3 complements much of the research findings, and analyses how ICT policy and regulation leads to ICT market structures that influence poverty reduction. It shows that of the different ICTs, mobile phones and radio contributed much more to improvement in people's social and economic livelihoods than internet and fixed-line telephone. Chapter 4

follows with an understanding of how ICTs were used in the livelihoods of the poor in East Africa, especially to derive the following benefits to individuals: travel time and cost reduction, information about the latest news, socialization, jobs and running individual businesses, and security in emergencies. Chapter 5 goes in-depth at the country level; it describes the current state of Kenya and utilizes the sustainable livelihoods framework in order to understand better the up-close nature of poverty reduction through the use of ICTs. A qualitative case study was conducted in two villages in Tanzania, and the latest findings on the changes of ICT usage amongst small and microenterprise owners are found in Chapter 6. Chapter 7 brings to light the global food crisis which took place during the PICTURE Africa study, and focuses on Rwanda and the socio-economic changes with the presence of access to ICTs. From East Africa, we move to South Africa in Chapter 8, where we examine a participatory action research project which looked at quality-of-life changes in the lives of individuals in four poor communities in the province of KwaZulu-Natal. This South African study was inspired by the PICTURE Africa research. Chapter 9 provides readers with some of the latest understanding around mobile internet growth through the latest statistics in Africa and specifically in the country case of Namibia. Finally Chapter 10 concludes the work done in East and Southern Africa and provides conclusions and recommendations on the way forward around the issues of poverty reduction and ICTs.

Notes

1 Kelly (2005) has critiqued the use of fixed telephone lines as a measure of teledensity with the recent surge in the use of mobile phones, and suggests effective teledensity as a more meaningful basis on which to compare. Effective teledensity measures the number of fixed lane or mobile users, whichever is highest per 100 inhabitants.
2 Pro-poor growth has many definitions, ranging from growth that leads to poverty reduction, to growth that allows the poor to benefit proportionally more than the non-poor (Batchelor and Scott, 2005).

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CHAPTER 2

Information and communication technologies as a pathway from poverty: evidence from East Africa

Julian May, Vaughan Dutton, and Louis Munyakazi

Even prior to the current era of widespread mobile telephony and internet access, causal relationships between telecommunications infrastructure and economic output had been identified in the literature. Information and communication technologies (ICTs) have also been argued to have a broader developmental impact and are proposed as powerful tools for empowerment and income generation in developing countries as well as for increasing access to education and other social services. Not all analysts are as sanguine about assuming a positive impact of ICTs on poverty reduction and some have expressed scepticism of the benefits of ICT. Access to information through ICT is a question not only of connectivity, but also of capability to use the new tools and relevant content provided in accessible and useful forms. Using panel data collected in East Africa in 2007/08 and 2010, this chapter explores this relationship and demonstrates that ICT can indeed assist in poverty reduction.

Keywords: poverty reduction, impact assessment, information and communication technologies, Africa, livelihoods

Although policy makers are being urged repeatedly to invest a substantial part of the national budget in information and communication technology (ICT) infrastructure, evidence concerning the impact of ICT on poverty reduction remains incomplete. In this situation, it is tempting to question whether investments in ICTs represent a worthwhile option for poor communities. A common mistake made by many existing studies is the collection of data at a level that is too general, leading to an over-investigation of macro- over micro-level trends. Because changes in the well-being of individuals and households are not necessarily directly linked to changes in economic output at the national level, it is important to extend the analysis of the ICT/poverty nexus beyond the national and towards the household level. Using data from two waves of household data collection in the PICTURE Africa study, funded by the International Development Research Centre (IDRC), this chapter seeks

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to make a contribution to the ongoing discussion. We use two multivariate approaches to examine the likely links between changes in poverty status and changes in access to ICT.

Conceptual framework and methodology

The concern of this chapter is to identify what change in poverty status results from a change in ICT access. To answer this question, we define change in ICT access as the access gained between 2007/08 and 2010 by a household to SIM cards, mobile phones, personal computers, and email accounts, and the availability of the internet at home. Following a similar approach to that used for other forms of impact assessment, the research question can then be framed as the impact of the change in ICT status on the change in a household's poverty level, controlling for possible demographic, socio-economic, and spatial confounders.

We adopt a financial or money-metric indicator of poverty and, as our proxy, use monthly per capita household expenditure (PCE) adjusted for domestic inflation rates and the International Comparison Programme's 2005 estimates of purchasing power parity (PPP). While recognizing that other forms of deprivation exist, this means that for the purposes of our analysis, financial deprivation is narrowly conceptualized as the inability to attain an absolute minimum standard of living reflected by a quantifiable and absolute indicator applied to a constant threshold that separates the poor from the non-poor (Ravallion et al., 1991).

Many methods exist for calculating an absolute threshold for financial deprivation; we make use of the commonly used international poverty line (PL) of PPP$2.50. Besides allowing comparison, this line corresponds most closely to the national poverty lines in the four countries in which research was undertaken. PCE of the sampled households was first adjusted by domestic inflation rates to 2005 prices and then converted into PPP$. We also generated a poverty score based on the chosen poverty line which was then normalized against household size. Thus a score of 1 is a household whose PCE is equal to the PL, while 0.5 would be a household whose PCE is equal to half the PL. Due to the presence of extreme values, the logarithm of this score was used in the statistical analysis.

A growing literature stresses the importance of the underlying economic stocks that determine income flows (Reardon and Vosti, 1995; Carter and May, 2001; Carter and Barrett, 2006). We take account of this and make use of the asset-vulnerability framework developed by Moser (1998) and others to identify further dimensions of deprivation. This approach takes account of the 'asset portfolio' of households, identifying five forms of capital that make up the portfolio. We include four of these for which we have measures: economic, human, physical, and social, and do not consider natural capital (land, biodiversity, the environment, water, and so forth) as we do not have household-level information on these assets. Due to data limitations, our

indicator for most of these capitals is restricted to the number owned by each household rather than their estimated value.

Physical capital reflects access to essential services and is largely derived from a basic needs approach to development. Indicators relating to housing and access to essential services such as water, sanitation, and electricity have been combined into a single index describing access to physical capital (Alampay, 2006). Following Fiadzo et al. (2001), de Vos (2005), and others, we have chosen not to use principal components or factor analysis to develop these indices, and instead opt for an approach that theorizes a structural relationship between the components of each of the unidimensional measures of housing quality and networks. The variables to be used are selected by assessing their intercorrelations and item–rest correlations, calculating a reliability statistic, Cronbach's α, and then excluding components that increase α and which we assume to be measuring other dimensions of deprivation. This proxy ranges from 0 (the dwelling is constructed of impermanent materials and no services are provided) to 5 (the dwelling is constructed of permanent materials and all services are provided).

Human capital is measured by the presence of at least one household member who has completed their secondary education. Finally, the absence of social capital is recognized as a dimension of deprivation, and for the purposes of this study we focus on participation in social institutions through group membership, as well as participation in governance processes (Coleman, 1988). These capitals, and the indicators used as proxies, are summarized in Table 2.1.

Table 2.1 Description of capitals

Capitals	*Proxy*	*Unit*
Economic	Durable assets	Index based on the number of durable assets owned by the household plus whether livestock are owned
Physical	Access to services and housing	Index based on number of services and housing attributes
Human	Formal education	Index based on whether at least one resident adult has completed secondary education
Social	Participation in local institutions	Index based on the number of group memberships and participation in local decision-making structures

As already mentioned, our data are from the PICTURE Africa project, a collaborative research project undertaken in Kenya, Rwanda, Tanzania, and Uganda between 2007/08 and 2010. The methodology for PICTURE Africa is a panel study consisting of a quantitative household survey at the start of the project repeated about 24 months later using the same households. The 'before and after' period is used as a window to assess the impact

of ICT on changes in poverty indicators. The unit of analysis is usually the household, although one adult member in each of the sampled households was interviewed about their personal access to, and ownership of, ICTs. Both waves of the quantitative survey were supplemented by qualitative surveys using a number of participatory methodologies including focus group discussions, in-depth interviews, and profiles. Quantitative data collection comprised a structured questionnaire administered to approximately 400 households in each country, thus totalling approximately 1600 households for the whole study in wave one. The sampling design involved the purposive selection of census enumerator areas (EAs) as the primary sampling unit (PSU), within which households, randomly selected, formed the secondary sampling unit (SSU). In principle, the purposive selection was based on the identification of the 20 poorest EAs in each country using data collected by the national statistical offices. At the level of the household, the sample can thus reasonably be described as being representative of the poorest regions in the four countries.

The analysis in this chapter focuses on the quantitative data from the two waves of data collection in all four countries covered by PICTURE Africa. Unless indicated otherwise, 1508 and 8049 are the sample sizes (n) in all tables and figures referring to households or household members in the first wave, or cross section 1 (CS1), while 1092 households and 5783 members are the sample sizes used in tables and figures referring to the second wave, or cross section 2 (CS2). When referring to the 'matched' data, we mean households that were surveyed in both periods, and which could be identified and linked in both surveys. Before using these data, it is important that we first consider the likely effects of attrition given the panel study research design.

When working with panel data, attrition is almost always present and refers to the circumstance in which a proportion of the respondents from the first cross section are not present in the second cross section. This may be due to a large number of reasons: respondents may have moved out of the area; they may have passed away; they may have been away from the household at the time of visit; and so on. Attrition is not necessarily a problem and, at times, can be ignored. At other times, however, it has the ability to bias findings to a significant degree, introducing false patterns into the data. In this circumstance, in which continuing members differ systematically from those who drop out, the sample of continuing members is no longer representative of the original population. This may result in erroneous conclusions being drawn and bad recommendations being made. In this sense, a pattern in the attrition refers to whether there is a correlation between attrition and a variable of interest. In this circumstance, attrition would be biasing the variable. Following Baulch and Quisumbing (2011), we chose to deal with attrition by means of a three-step methodology. The first step involved identifying whether attrition was indeed present; if so, which variables it was related to, if any; and whether the relation between these variables and attrition

was random (in which case no correction would be required). Finally, if the attrition was not found to be random, the calculation of weights would be required.

The first step required that the panel be examined for the presence of attrition; it showed that 35 per cent of respondents included in CS1 were either not present in CS2, or were successfully interviewed but could not be matched to CS1. This indicates that attrition was present in the sample and therefore requires analysis. Having established that attrition is present, the next step was to identify whether or not there is a pattern to the attrition which would cause a bias to be introduced in the second cross section. This requires the identification of which variables correlated with attrition. The degree of randomness between attrition and the variables of interest was then assessed. A logistic regression was used for this purpose with participation in CS2 used as the dependent variable (0 = was interviewed in CS1 but not CS2; 1 = interviewed in both CS1 and CS2). Independents included all the variables of interest (the five dimensions of poverty) as well as variables which were not of theoretical interest but which may nonetheless affect attrition (we used age, location (rural or urban), and household size).

The results showed that the constant was significant and, therefore, that the null model should be rejected (i.e., the regression was valid). The model coefficients indicated that the model used fits the data and shows significance, which implies that the inclusion of the independent variables into the model is justified. Finally the result indicates that the Nagelkerke R^2 is very low (0.086). This is an important output, because it indicates that the baseline variables and attrition explain about 9 per cent of the panel attrition between 2007 and 2010. The Nagelkerke R^2 can be taken as an indication of the degree of randomness of attrition; thus the attrition between CS1 and CS2 is 91 per cent random and corrective measures for attrition such as weighting the data are not necessary. This chapter therefore makes use of unweighted matched data from CS1 and CS2.

Poverty dynamics 2007/08–2010

Money-metric poverty

We start by comparing the standard measures of money-metric poverty and inequality for the sample in the two cross sections, the poverty headcount (P^0: the percentage of households below the PL), the poverty gap (P^1: the average distance from the PL showing the depth of poverty expressed as a percentage of the PL), and poverty severity (P^2: the gap squared to give greater emphasis to those that are most poor, which is simply an index). The results are shown in Table 2.2; the difference between italicized figures is not statistically significant at the 95 per cent confidence level.

Table 2.2 Money-metric poverty status

Poverty measure	*2007/08 (CS1)*	*2010 (CS2)*
Headcount (P^0)	55.0	58.4
Gap (P^1)	23.5	27.6
Severity (P^2)	13.2	16.5
Tanzania P^0	57.9	53.5
Kenya P^0	46.1	55.9
Rwanda P^0	53.3	61.1
Uganda P^0	*60.7*	*62.7*
Urban P^0	38.7	45.9
Rural P^0	*68.3*	*66.4*
Gini coefficient	*0.48*	*0.48*
N	1476	1086

Although there is no change in inequality (as shown by the Gini coefficient), the data reveal that the households surveyed in CS1 and CS2 experienced an increase in poverty; poverty rose from 55 per cent of those surveyed in 2007/08 to 58 per cent in 2010. This is true for all measures of poverty and particularly for the poverty gap, confirming that on average, poor households had slipped further below the PL by 2010. If we restrict our analysis to the matched sample only (households surveyed and linked in both waves), the headcount was marginally lower in 2010 than in 2007/08, but the gap and severity measures reveal the same trend of increasing poverty.

Table 2.2 also shows that these changes in poverty did not affect all households equally; poverty headcounts increased in urban areas and decreased in rural areas. There were also differences between the four countries. Only Tanzania experienced a modest decline in the headcount, while in Kenya, the headcount increased by almost 10 percentage points. East Africa was not the only region in which poverty increased during this period. The World Bank's Global Monitoring Report for 2010 estimates that the global economic crisis left 50 million more people in extreme poverty in 2009 worldwide, with an additional 64 million expected to fall into extreme poverty by the end of 2010 relative to pre-crisis trends (World Bank, 2010). These data suggest that the immediate impact of the crisis fell most heavily upon the urban population as the livelihoods of the employed and self-employed were eroded, and perhaps on those regions more integrated into the global economy. The Tanzania data suggest that, at least during the survey period, households may have been initially buffered from the crisis.

Finally, the poverty dynamics of households surveyed in both waves can be seen in a transition matrix which reveals the extent of chronic financial poverty (households observed to be poor in both waves) as well as movements into and out of poverty. This is shown in Table 2.3, in which the cells represent the percentage of households that had a per capita expenditure of

less than half the PL, between half and the PL, one to two times the PL and more than twice the PL. The diagonal line shown in italics reflects households who were found in the same PL band in both 2007/08 and 2010, while those to the right of this are households whose position had improved.

Table 2.3 Transition matrix 2007/08–2010

2010 2007/08	*< 0.5 PL*	*0.5–<1PL*	*1PL–<2PL*	*2PL+*	*n*
< 0.5 PL	*53.7*	28.3	14.3	3.7	244
0.5 <1PL	29.6	*37.4*	25.6	7.5	348
1PL <2PL	15.8	32.0	*28.7*	23.5	247
2PL +	8.1	15.6	38.1	*38.1*	160

Table 2.3 suggests considerable mobility, and that despite the general increase in poverty during the survey, around 29 per cent of all households managed to improve their 2007/08 position by 2010, while a similar share fell into a lower poverty category. Such 'churning' has been observed in many studies making use of panel data (Baulch and Hoddinott, 2000). However 40 per cent of the sample were poor in both periods and are potentially caught in a poverty trap in which upward mobility is constrained.

Multi-dimensional poverty

We can now move on to compare the situation of all households using the five dimensions of deprivation already discussed. We adopt a similar methodology to that used in the 2010 Human Development Report in which a multi-dimensional indicator of deprivation is provided and adjustments have been made to the Human Development Index (UNDP, 2010). In the case of the physical, economic, and social capitals, the index is derived from the actual score for each household minus the minimum score for the entire sample, divided by the maximum score attained minus the minimum. The index thus reflects actual attainment in the dimension being measured in comparison to the range that is possible, and is thus absolute in the sense that the indices can be compared over time and in differing contexts. In the case of the financial capital, the logarithm of the poverty score is used, the maximum value is the highest score earned by the sample in both years, and the minimum value is the poverty score of those receiving less than one quarter of the poverty line (PPP$0.50). Finally human capital is simply the percentage of households that have at least one resident adult member who has completed secondary education. This means that all indices run from zero to one, in which one represents low deprivation and zero is high deprivation. Figure 2.1 compares the levels of multi-dimensional poverty for the matched sample for 2010 and 2007/08, as well as for the four countries in 2010.

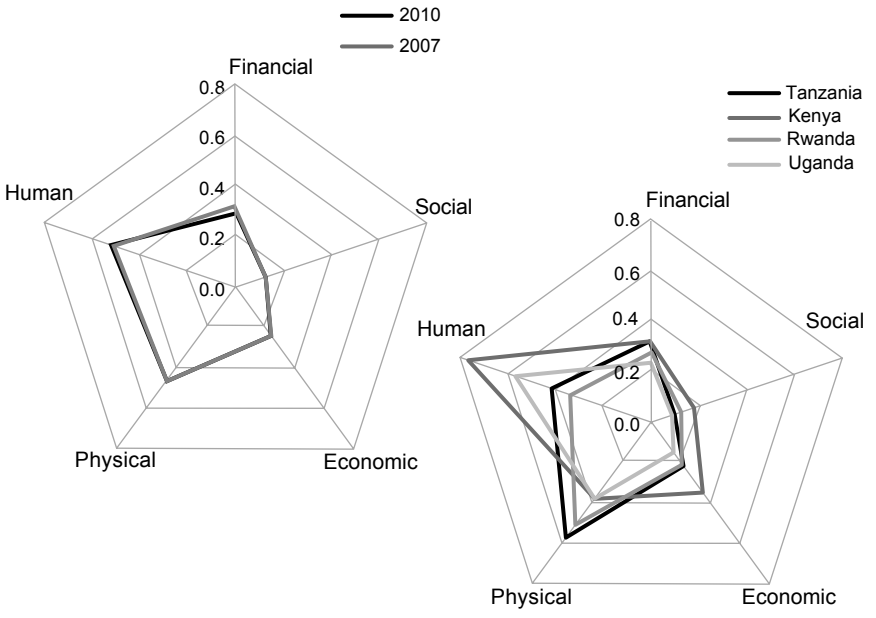

Figure 2.1 Multi-dimensional poverty of households (matched and by country, 2010)

The indices suggest that households in all countries were well-resourced in terms of human and physical capital but were less well-resourced in terms of social, economic, and financial capital. Comparisons by year confirm the rise in financial poverty in 2010, but suggest that other forms of deprivation did not change over the two-year time period, although human capital did increase. This is to be expected in a panel study, as children age and progress through school. Comparisons by country in 2010 show that Kenya was relatively better endowed with human and economic capital, while Rwanda and Tanzania were better endowed with physical capital. Uganda recorded the lowest financial capital index showing that a greater share of the sample lies below the PPP$2.50 poverty line. A similar pattern (not shown) occurred in 2007/08.

ICT dynamics 2007/08–2010

Attention can now be turned to the access and use of ICT. 'Access' is taken to mean ownership, although access can also be obtained through using ICTs that are owned by others or through public access points such as internet cafes or public telephone booths. Table 2.4 shows the ownership of all forms of ICT for the four countries in 2010, as well as for other communication technologies such as radios, TVs, VCR/DVDs, and landlines. Aggregated results from 2007/08 and 2010 are compared; again differences between the italicized figures are not statistically significant.

Table 2.4 Household ownership of ICTs (%)

ICT	*2007/08*	*2010*	*Tanzania*	*Kenya*	*Rwanda*	*Uganda*
Radio	*70.2*	*72.9*	65.3	*79.2*	*76.6*	*70.5*
TV	*24.1*	*24.5*	24.5	39.3	23.8	10.5
VCR/DVD	*13.2*	*16.1*	15.1	24.8	20.9	3.6
Landline	*1.5*	*0.5*	*0.0*	*0.3*	*1.4*	*0.4*
Email	*17.8*	*15.2*	7.4	20.1	25.9	7.6
Mobile phone	61.7	67.8	63.7	82.5	71.6	53.5
Computer	*4.2*	*5.0*	*4.0*	*7.1*	*8.0*	*0.4*
Internet connection	*0.7*	*0.5*	*0.0*	*1.2*	*0.9*	*0.0*

Access was highest in the Kenya sample for radio, television, VCRs, and mobiles, but had some striking exceptions such as access to landlines, computers, internet connections, and email addresses (in other words most of the ICTs). Rwanda was better off than other countries in terms of computers, landlines, and email addresses. Access to most forms of ICT had increased, with the exception of landlines, internet connections, and email addresses, perhaps due to attrition of younger members of the surveyed households.

Radios were the most commonly owned communication asset, but this was closely followed by mobile phones, which ranged from 54 per cent of sampled households in Uganda to 83 per cent in Kenya. The very low percentage of households with a landline or internet connection or computer is indicative of a major constraint to the delivery of privately owned internet access through conventional technologies common to most countries in Africa. The low level of access to the internet may also be due to the low levels of education in general, and skills in using computer-based ICTs in particular, among the majority of the sampled households.

Table 2.5 shows that overall just under 20 per cent of households that did not have access to ICT in 2007/08 had acquired such access by 2010, although unexpectedly a substantial share had lost access. These changes were statistically significant and were not geographically equal.

Table 2.5 Changes in ICT status 2007/08–2010 (% households)

	Total	*Rural*	*Urban*	*Tanzania*	*Kenya*	*Rwanda*	*Uganda*
Gained ICT	19.1	21.1	16.1	17.7	18.9	24.3	15.4
Lost ICT	11.0	12.8	8.4	7.0	3.0	2.3	31.6

Almost 19 per cent of households in Kenya gained access to ICT, 58 per cent of those that did not have access in 2007/08. In Tanzania, a similar percentage of households gained access to ICT, but this was less than 40 per cent of those without access in 2007. Households in Kenya also reported

the smallest loss in ICT access in 2010, with 3 per cent of households, while households in Uganda experienced the greatest change. In terms of socio-economic characteristics, households that gained access to ICT tended to be urban, not poor, and to have at least one household member with secondary education. Those that lost ICT access by 2010 tended to be rural, poor, and without any family member who had completed secondary education. The changes in access to the digital forms of ICT were strongly associated with changes in financial poverty status (Table 2.6).

Table 2.6 ICT dynamics 2007/08–2010 (US$)

ICT access status	*Mean change in PPP$ p/m CS1–CS2*	*Mean PCE $PPP p/m 2007/08*	*Mean PCE $PPP p/m 2010*	*Mean change in poverty score*	*% poor 2007/08*	*% poor 2010*
Never had ICT access	–$1.86	$57.66	$56.13	–0.02	81.9	79.6
Always had ICT access	–$9.45	$125.57	$118.94	–0.12	45.5	45.8
Gained ICT access	$20.76	$72.98	$92.84	0.27	72.5	62.6
Lost ICT access	–$6.58	$72.19	$65.85	–0.09	64.3	70.3

Those that gained access to ICT experienced a real gain in their PCE between CS1 and CS2, with their expenditure increasing by just under US$21 per month. This is even more apparent when looking at the mean change in the poverty score (our proxy for financial poverty), which shows that while all other groups experienced a decline in their poverty status (became more poor), those gaining access to ICT gained 27 per cent on the poverty score (became less poor). This is striking, since 50 per cent of this group had been categorized as poor in CS1.

Those that reported no access to ICT in both CS1 and CS2 were the poorest of the four groups in both waves, with around 68 per cent of this group below the US$2.50 per day poverty line in both periods. This is in marked contrast to those that had ICT access in both periods, of whom 30 per cent were poor in both periods. Although this group experienced the largest absolute loss in PCE during the survey period, it amounted to only 7 per cent of their PCE in 2007/08 compared to the 9 per cent drop experienced by those who lost access to ICT. Although not shown, these differences can also be observed in some of the other dimensions of poverty. While provocative, these findings do not demonstrate causality as it is possible that the increase in PCE caused households to gain access to ICT rather than the reverse.

Impact of ICT access

The effect of improved PCE on gaining access to ICT seems the most intuitive causal link between ICT and poverty and this will be our point of departure. We thus first consider the association between household ICT access in both waves and their poverty score, along with a number of control variables and the four other dimensions of deprivation using a binary logistic regression. The results are shown for 2007/08 and 2010 in Table 2.7; coefficients that are significant at the 0.05 confidence interval are shown in bold. Of the control variables, only location was found to be significant and so was retained. Countries are compared against Tanzania, and geo-spatial location against being resident in a rural area. The sex and education of the household head was dropped.

Table 2.7 Predictors of household ICT access

	2007/08		*2010*	
	*B**	*Odds ratio*	*B*	*Odds ratio*
Location (urban)	**0.557**	1.746	**0.483**	1.620
Kenya	**0.677**	1.969	**0.819**	2.268
Uganda	0.018	1.018	**0.927**	2.527
Rwanda	**0.987**	2.684	–0.076	0.927
Logged poverty score	**0.801**	2.228	**0.996**	2.707
Social capital	0.065	1.068	**0.247**	1.280
Economic capital	**0.372**	1.450	**0.326**	1.386
Physical capital	**0.281**	1.325	**0.386**	1.471
Human capital	**1.490**	4.435	**1.349**	3.854
Constant	–1.829	0.131	–1.585	0.205
Nagelkerke R^2	0.320		0.280	
N	1462		1003	

As anticipated, the model shows positive and significant associations between all the dimensions of financial poverty and ICT access except for social capital in 2007/08. The odds of gaining access to ICT are more than doubled (2.228) by a unit improvement in the logarithm of the poverty score. Stronger results are found for our proxy for human capital (we used education). The odds of a household with ICT access containing a member with secondary education are around four times those of households without this asset. The odds of having ICT access in urban areas are just over 1.5 times those in rural settlements. Excluding the country-fixed effects in which Tanzania is the reference country does not change the sign or significance of

any of the predictors but does increase the contribution to the model that is made by differences in PCE. This reflects the differences in the poverty headcount of the four countries

Impact of ICT access on poverty

Having shown that a higher household poverty score (higher PCE) improved the odds of having ICT access in both years, we shift our attention toward investigating any causal link between ICT access and the underlying analytical model. In the context of both our focus and the available data, this presents several challenges. Firstly, the pathways through which ICT influence changes in poverty status remain under-theorized and offer little guidance in terms of variables that should be included, excluded, or used as instruments. Second, we have neither an experimental design nor a clear counterfactual. Finally, we have already demonstrated the strong reverse causation whereby higher PCE is shown to increase the odds of access to ICT.

Mindful of these limitations, we make use of lagged access to ICT as a predictor of the change in financial deprivation, and hypothesize that prior access to ICT cannot have been determined by the rate of change in PCE between CS1 and CS2. Thus in a methodology analogous to Granger testing used in time-series analysis, we test for the statistical significance of the coefficient of determination of our model when we include ICT access in 2008 as an explanatory variable (Menard, 1991). The logic of this method holds that x causes y if we are better able to predict y with all the possible causes than with all possible causes minus x (Granger, 1969). The causal variable of interest, x, is therefore evaluated alongside a range of other possible causes rather than on its own – as might be the case in a simple correlation. The test therefore requires the estimation of two models: one with the independent of interest (unrestricted model) and one without (restricted model). The restricted and unrestricted models are then compared in order to yield an estimate of the effect of the restriction (which is then conceptualized as the strength of causal influence exerted by the excluded variable).

Other possible causal variables that are included are social, human, physical, and economic capital, and household variables such as location, and the sex and education of the household head. The unrestricted model includes these variables, the interactions of the household variables with the dimensions of poverty, and ICT access; while the restricted model includes only the household variables and their interactions, and does not include ICT access. If we can better predict PCE with ICT access included in the model, we can conclude that ICT access *causes* changes in PCE, at least in a statistical sense. It must be cautioned that this is not equivalent to absolute causality, and should rather be seen as a 'smoking gun' that might indicate the presence of causation.

Lagged access model

In practice, the lagged variable test is a regression, in which the dependent variable is predicted using all the predictors and then using all predictors minus the independent of interest. The independent of interest (ICT access) is lagged in order to take advantage of the temporal dimension in the data. The intention is that prior ICT access cannot be affected by current levels of PCE, nor should prior ICT access be affected by the growth in PCE between waves. Thus, any relationship that is shown is more likely to reflect the outcome of prior ICT access on PCE. The difference between the corresponding model residual sum-of-squares and the associated degrees-of-freedom make up the test (SAS, 2009; Hood et al., 2008; Hurlin and Venet, 2003).

The F-test is a common instrument to evaluate the significance of a parameter restriction in an ANOVA (linear models). The null and alternative hypotheses are

H_0: independent did not cause the percentage change in PCE in 2010

H_a: not H_0

The rejection of the null hypothesis provides evidence of causality of one on the other. Failure to reject means that the independent of interest does not statistically cause changes in the dependent.

In our analysis, the independent of interest was ICT access and the dependent was the logarithm of PCE in 2010 in national currency adjusted for domestic inflation, and the change in PCE between 2007/08 and 2010. Unlike the previous analysis, we did not first convert the dependent variable into PPP$ and then into the poverty score as the conversions are potentially sensitive to the differences between countries in terms of the surge in prices that was experienced between CS1 and CS2. Since we were attempting to compare actual levels of expenditure and were concerned rather with change in PCE, we argue that this is acceptable, and instead used the national currencies.

Further, unlike the previous discussion, the independent variable of interest (representing ICT access) was constructed as an index rather than as a binary (No ICT/ICT). The construction of an index was considered pragmatic because it allowed the inclusion of the greatest amount of information (or conversely, the loss of the least amount of information). A principal components analysis (PCA) was employed in order to create the scale. Our data contain many candidate variables with which to construct the multidimensional index of ICT access. The following variables were collected in both waves: per capita SIM and mobile access, per capita email access, household access to a landline and household access to the internet. PCA allows the creation of indices that account for most of the variation in the data. As opposed to the original variables, the newly created variables are uncorrelated.

Because the PCA is a data reduction technique, it is usually the first index (or first principal component) that is subject to a particular interpretation. In our case, the first principal component explains 35 per cent of the total variation and the second, 18 per cent. When we compute the correlation between the original (correlated) variables with the first two new non-correlated principal components, we find that all the first indices have a high and positive correlation with per capita mobile and per capita email regardless of the variable that is dropped from the PCA, and that interpretation associated with our index of ICT access should place emphasis on per capita mobile use and per capita email more so than the other access variables.

As before, we include all variables from the available dataset that are commonly theorized to have an effect on financial poverty. These include geographic location (urban/rural), maximum education in the household, the average education of the household, the sex of the household head, the age of the household head and the four indices representing other dimensions of deprivation. Four models are estimated:

1. Response is *PCE for 2010*
   a. *Unrestricted* model with no interactions vs. *restricted* model with no interactions
   b. *Unrestricted* model with interactions vs. *restricted* model with interactions

2. Response is *the logarithm of the differences in PCE* (the change in PCE between CS1 and CS2)
   a. *Unrestricted* model with no interactions vs. *restricted* model with no interactions
   b. *Unrestricted* model with interactions vs. *restricted* model with interactions

The unrestricted model refers to a model in which, in addition to the other factors, the following variables were included: 1) principal component scores for every household, this variable is lagged and thus constructed from the elements of year 2007/08, and 2) PCE in 2007/08, which is introduced as a control variable since we already know that PCE 2007/08 is correlated with ICT access in 2007/08. Missing values approximate 26 per cent of the total number of observations and are assumed to be missing at random and no attempt to impute them was made.

The results for the four unrestricted models are shown in Table 2.8; as we are interested only in comparative strength of the models, coefficients are excluded for clarity.

Table 2.8 ICT and per capita expenditure

	Model 1 PCE 2010, no interactions	*Model 2 PCE 2010, interactions*	*Model 3 PCE difference, no interactions*	*Model 4 PCE difference, interactions*
R^2	0.4216	0.463	0.3506	0.4112
N	754	754	754	754
PCE2007 p test	0.0005	0.0001	0.0001	0.0001
ICT score p test	0.0149	0.0021	0.1914	0.0377
ICT score coefficient	11.006	13.663	0.0017	0.0367

In the restricted model, the ICT score is omitted. All the other factors (linear and interactions) remain the same. Inclusion of two-way interaction terms was based on their contribution to the overall fit (a = 0.05). The Granger test indicates that the null hypothesis must be rejected in favour of the alternative when using both in-sample-F-test (p-value = 0.013) and the asymptotic chi-square test (p-value = 0.012). Thus Model 1 indicates that the 2007/08 ICT index contains new information that predicts the (log) difference in PCE (p-value = 0.038) above and beyond the information contained in the restricted model.

The inclusion of the PCE in 2007/08, in the same model as the ICT index, usually makes it harder to find a significant relation between the ICT index and change in PCE. The results show that the connection is non-negligible (slope = 0.037 with p-value = 0.038). Therefore the conclusion is that the relationship between the two truly exists. This indicates that we have enough evidence to conclude that the ICT index *statistically causes* change in PCE and the rate of change in PCE. The interpretation is that two individuals with one unit difference in their ICT indexes are expected to differ in the logarithm of PCE change by an amount equal to the corresponding slope. This implies that a one unit increase in ICT access over the two-year gap is associated with a 3.7 per cent improvement in poverty status between 2007/08 and 2010

Is ICT access pro-poor?

Having demonstrated likely causality between ICT access and a reduction in financial deprivation, the next question is whether this impact is pro-poor and thus a potential resource with which households can eventually escape from poverty. In other words, do those less financially resourced benefit from improved access to ICT more than those that are better endowed? In this section, PCE was split into two groups of 'poor' and 'very poor' based on the percentile in the distribution of PCE. A series of analyses of covariance (ANCOVA) are performed to quantify and test the slopes' parallelism at each percentile. The full model contains most of the elements presented previously (see Model 1). At each percentile level, estimable functions are used to extract

from the ANCOVA the parameters of intercepts and slopes from the interaction (Table 2.9).

The hypotheses tests are

1. Are the slopes equal to zero?
2. Are the slopes parallel?

The results are presented in Table 2.9, together with the intercept, slope, and sample size. Significance tests are described in the text. Although all percentiles were analysed, only percentiles from 25, 50, 75, and 90 per cent are shown. These point estimates allow the speed with which the groups evolve across percentiles to be calculated.

Table 2.9 Threshold between the poor and the very poor

	25%			*50%*			*75%*			*90%*		
	Int	*Slope*	*N*	*Int*	*Slope*	*N*	*Int*	*Slope*	*N*	*Int*	*Slope*	*N*
Poor	2.03	*0.0198*	558	2.12	**0.005**	378	2.25	**–0.017**	197	2.38	*–0.10*	61
Very poor	1.58	*–0.0407*	196	1.71	**0.010**	376	1.82	**0.003**	557	1.83	*0.023*	693

Note: bold = 0.001, italics = 0.10; Int is the intercept, N = number of observations in group

The results indicate that the slopes are different from zero especially for the poor group at percentiles of 75 per cent or less. However, the slopes diverge significantly at the extreme values, generally at p-value equal to 0.10. At low percentiles, the slopes are positive for the poor and negative for the very poor. After the 75th percentile, the very poor have positive slopes and the slopes of the poor become negative. Moreover, it can be seen that the slopes of the very poor keep rising until they reach a significant level (p-value = 0.1), whereas the slopes of the poor tend to decline as the level of the percentile poverty line increases. The speed of 'recovery' for the very poor is positive (slope = 0.14%) and is significant at 0.01. The slope of 'decline' for the poor is negative (= -0.29) and unchanged (0.05%). All the intercepts are significantly different from zero and from each other (p-value<0.001). These values represent the predicted 2010 percentage change in the logarithm of PCE of individuals who did not have any form of ICT in 2010.

In order to assess the sensitivity of our analysis, we consider the following: first we investigate changes of the correlations brought by the removal of one variable at a time from the PCA. The assumption is that if the relationships remain unchanged, then the highly correlated original variables are truly the ones to include in the ICT index, and therefore the content (and interpretation) of the index should be confined to those variables. Regardless of the removed variable, we find both 'per capita mobile use' and 'per capita

email' have, for the most part, the most dominant correlation with the first principal component. This means that variations in the outcome (change in PCE) were not affected by variations in the input due to removal of variables of the first principal component.

Second, the first principal component is used in Model 1 to assess causality in the presence of PCE in 2007/08. We may then monitor whether changes in the input variables to the PCA equation create inconsistencies in the subsequent tests of parallelism. We further split the PCE 2007/08 into the two groups (poor and very poor). The interaction between PCE and the first principal component is the test of parallelism.

In this analysis it is easy to lose sight of the importance and implication of intercepts. What we see is that in all levels of the percentiles (25, 50, 75, and 90 per cent), the intercepts of the very poor group are significantly lower than those of the poor. This finding, together with the positive slope of the very poor above the 50 per cent percentile, implies that the ICT index is pro 'very poor'. The ICT index is for the most part represented by the per-capita-mobile-phone-use variable.

This result is depicted in Figure 2.2, in which the horizontal axis shows the number of ICT months (the number of 'technology units' available to a household over time) and the vertical axis depicts gains made to the poverty score of poor and non-poor households.

Over a 10-year time period, the modest additional gains from ICT can be seen to disproportionately benefit the very poor (those below median PCE) compared to the rest of the sample. This results in a slow but steady convergence between the two groups. Another way of interpreting this finding is that over a decade, the gains resulting from ICT access for the most poor are twice that for the non-poor.

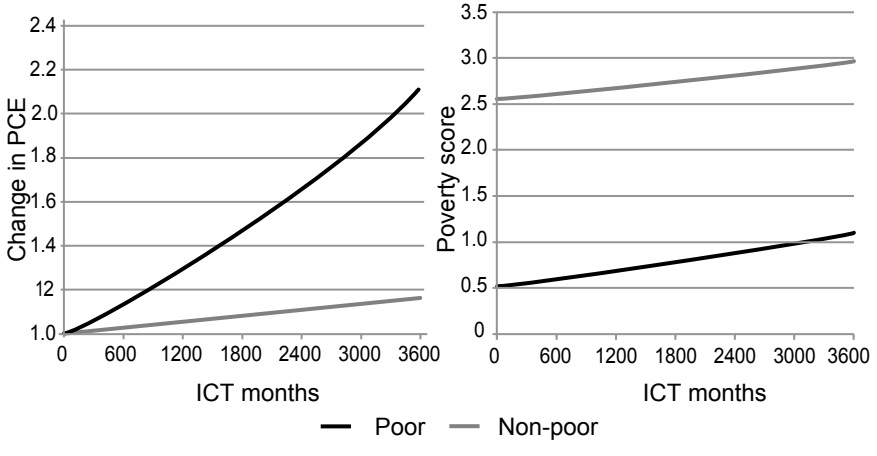

Figure 2.2 ICT gains over time

Conclusion

It is tempting to question whether investments in ICT represent a worthwhile option for poor communities given the myriad of other necessities that are required but which may not be affordable. Most macro-studies that investigate the contribution of ICT to socio-economic development rely upon evidence that has been collected at a level that is too general, thereby neglecting the micro-level data required for the interpretation of macro-level trends. It is important to go beyond this, and to analyse the role and impacts of ICT on poverty reduction at the micro-level. Although important for economic growth, in the face of inequalities and a possible 'digital divide', changes in economic output at the national level are not necessarily linked to changes in the well-being of individuals and households.

The two waves of PICTURE Africa have attempted to address these concerns and are informative about inequalities in ICT access in East Africa as well as the obstacles that hindered better and more equitable access. The data suggest that the odds of gaining ICT access improve by more than 100 per cent relative to the decline of financial poverty, while an additional year of education increases the odds of having ICT access by around 30 per cent. Not living in an urban area was found to significantly reduce the chances of having ICT access by about 50 per cent. Being female was also found to reduce the odds of ICT access by 50 per cent. These relationships did not change significantly across the two waves of the study, suggesting some intransigence in terms of who benefits from ICT access over time, and both waves of data paint a picture of a heterogeneous ICT landscape.

A multivariate analysis confirmed the importance of formal education, but suggests that there is also an interaction between education and income, and that this enhances ICT access. The determinants of individual access to ICT were largely similar in both waves, although there was a clearer gendered distribution of ICT access, with women 1.5 times less likely than men to have a mobile phone or email address, controlling for income and education.

The analysis of the causal link between ICT and poverty reduction indicates that there is a small but positive ICT benefit to the very poor group compared to the poor group. This is evident in the rates observed over the range of percentile levels. The availability of mobile phones in particular is therefore a potentially valuable tool to improve the livelihoods of the very poor over the medium term (6–10 years) and enable their escape from poverty traps produced by low stocks of assets and limited opportunities for their use. A panel study of more than two waves is needed to confirm this finding and would allow us to move beyond reliance on testing for statistical causality, and instead to make use of a more reliable difference-in-difference approach.

An important issue is the relation between ICT access and usage. The analysis in this chapter limited itself to access, and did not attempt to relate access to usage. It was felt that attempting to extend the analysis from access to

usage would have compromised the validity of the analysis by introducing assumptions about the link between the former and the latter. So although ICT usage is an important variable to understand in this context, we avoided it in order to keep our research as clear, simple, and trustworthy as possible. It is worth noting, however, that those-who-use-ICTs are always a subset of those-who-have-access-to-ICTs. Translating ICT access into usage requires the availability of ICT, the resources and skills to use it, and the time, space, and norms that permit usage by particular groups, most notably women. A proportion of those with access will, therefore, potentially be excluded from the usage. With this in mind, it is quite possible that the effects found in this analysis are stronger than reported because fewer people (or more accurately, fewer ICT usages) are generating the observed effect.

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CHAPTER 3

Political economy of ICTs and their effect on poverty

Obadia Okinda Miroro and Edith Ofwona Adera

This chapter analyses how ICT policy and regulation lead to ICT market structures that influence poverty reduction. It is based on a thematic synthesis of PICTURE Africa and Research ICT Africa reports from Kenya, Rwanda, Tanzania, and Uganda. Findings show that ICT policies and regulations in these countries are at various stages of development and implementation, and that they do not have a common ICT policy and regulatory framework. Policies and regulations led to a market structure that enabled widespread use of mobile phones, cooperation between mobile operators and financial service providers, provision and utilization of mobile banking and money transfer services, and proliferation of radio stations. Consequently, mobile phones and radio contributed more to improvement in people's livelihoods than internet and fixed-line telephones. Fixed-line telephone and internet have an urban bias, although competition and operationalization of fibre optic connectivity have resulted in a lower cost of international bandwidth.

Keywords: information and communication technologies, market structure, political economy of ICTs, poverty, East Africa, mobile phones, radio

Introduction and outline of the problem

The growth and spread of information and communication technologies (ICTs), especially mobile telephony, in East Africa has been phenomenal. For instance, Safaricom, Kenya's leading converged communications company, is the largest company in East Africa in terms of revenues, provision of mobile money transfer, and internet services. Mobile money transfer services offered by telecommunication operators in East Africa have enabled a large number of the unbanked to access financial services. Again, Safaricom is leading the pack with over 14 million users of M-Pesa services (mobile money transfer). The proliferation of FM radio stations is notable with some broadcasting in indigenous languages. More recently, the landing and operationalization of four submarine fibre optic cables on the East African coast – SEACOM,

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The East African Submarine Cable System (EASSy), The Lower Indian Ocean Network (Lion2), and The East African Marine System (TEAMS) – have brought enthusiasm regarding improved access and lowering of bandwidth costs. Coupled with initiatives to build national fibre backhaul networks, the international cables have increased focus on the potential of ICTs to enhance socio-economic development and poverty reduction.

Governments in the East African Community (EAC) have implemented various reforms in the ICT sector resulting in increased ICT penetration among other positive metrics demonstrating evidence of successful intervention at policy and regulatory levels. At the same time, there is increasing interest and a burgeoning literature on the relationship between ICTs and poverty reduction. Some of the studies have shown that access to and use of ICTs has contributed to improvement of people's livelihoods (Tiwari, 2008; Chacko, 2005; McNamara, 2003; Gerster and Zimmermann, 2003; Sreekumar and Rivera-Sánchez, 2008). Despite this growing evidence, some studies call for a critical review of the contribution of ICTs to poverty reduction (Leye, 2009; Dymond and Oestmann, 2002; Wade, 2000; Soriano, 2007; and Akpan-Obong, 2010). In Africa, Research ICT Africa (RIA) has for the last few years assessed the state of access and use of ICTs among communities to profile the demand-side dynamics in 20 countries in Africa (see www.researchictafrica.net). RIA has also undertaken policy and regulatory research to document the supply-side dynamics and their outcomes (market structure) in the same countries.

On the basis of such studies, ICTs have been hailed as holding great hope for developing countries, while opponents warn of a growing 'digital divide' between the rich and the poor that must be narrowed (Marker et al., 2002). The contrast between the complexity and expense of some of these technologies and the urgent basic needs of the poor has led to questions over the exact link between ICTs and poverty reduction, and whether public and private expenditure on ICTs represents the best investment for the poor. The PICTURE Africa research project was initiated on the premise that some of the poverty reduction outcomes and impacts observed among communities using ICTs can be ascribed directly to the use of the technologies rather than to economic growth more broadly. The project set out to analyse the ICT/poverty nexus to provide empirical evidence of the effects of access and use of ICTs on the circumstances of poverty of households in four East African countries: Kenya, Rwanda, Tanzania, and Uganda. As part of this project's research outputs, this chapter links up with those studies that show the growing concern to understand ICT access and usage from a political economy perspective (Wade, 2000; Leye, 2009; Gillwald, 2010; Esselaar et al., 2007). Gillwald (2010: 80) laments that 'there is little rigorous evidence in Africa linking communications sector policy and regulatory reforms aimed at increased penetration and lower costs of communications to growth, development, and particularly to poverty alleviation'. The freshness of a political economy (PE) approach is that it acknowledges the role of politics in understanding how and why ICT policies and regulation are implemented and the

resulting outcome from a poverty perspective. When investigating how ICTs contribute to people's livelihoods, there is a need to examine how ICT policy reforms and regulations influence ICT access via market structures that are created by these policies and regulations. Thus, a PE approach is useful in explaining the institutional policy and regulatory context which influences the operations of private firms and attainment of such initiatives as universal access (Leye, 2009).

Analyses of the poverty/ICT nexus which recognize policies and regulations as outcomes of political processes that influence the extent to which people access and use ICTs to improve their livelihoods are important. Gillwald and Stork (2008: 2) indicate that effective regulation ensures fair competition and economic efficiency, and addresses issues of equity and inclusion. By focusing on the political context within which policy reforms and ICT regulations take place, this chapter analyses the political economy of ICTs, conceived as the interplay between ICT policies and regulations and a market structure largely characterized by a strong private sector, and how these influence access and use of ICTs by people to improve their livelihoods.

Conceptualizing the political economy of ICTs

Political economy (PE) has been defined in different ways. According to Graham (2007), PE refers to 'studying how different types of values are produced, distributed, exchanged, and consumed; how power is produced, distributed, exchanged, and used; and finally, how these aspects are related'. Elsewhere, it is the 'study of the social relations, particularly the power relations, that mutually constitute the production, distribution, and consumption of resources, including communication resources' (Mosco, 1995: 25). Several authors (Dunn, 2005, cited by Asif, 2008; Leye, 2009; Gurumurthy and Singh, 2005) point out that PE in relation to ICTs looks at their ownership and control, investments in ICT infrastructure, cost structure, and institutions.

The PE approach conceives ICTs within historical socio-economic, cultural, political, and institutional factors (Leye, 2009), which would allow for a greater understanding of what enables or inhibits effectiveness to translate market-based reforms into action (Gillwald, 2010: 80). By incorporating the link between the state, markets, and institutions and their dynamic relationship, a PE approach is useful in explaining the nature of reform in the ICT sector and the outcomes (Gillwald, 2010). The PE approach is also useful in examining how policies influence exclusion or inclusion of individuals, groups, or communities in ICT systems. This is relevant in understanding the complex relationship between ICTs and poverty in contrast to the 1990s neoliberal approach that depoliticized policy reforms. As an example, Adam and Gillwald (2007) argue that access to some ICTs reflects the business model of private firms, involving investment in lucrative sectors only after contentious privatization of public telecommunication firms.

PE approaches have been utilized in studies that focus on how ICT policy and regulation reforms influence access to and use of ICTs (Gillwald, 2010). In this chapter, the PE of ICTs looks at how ICT policies and regulations designed within a political context influence ICT markets (supply and demand), and how these eventually explain the contribution of ICTs to people's livelihoods. This acknowledges both the political and economic dimensions of ICT policy reforms and regulations in explaining outcomes of the deployment of ICTs in poverty reduction. While policy and regulatory reforms and links will be examined at a macro-level, outcomes of ICT reforms will be examined in terms of how the PE plays out at a micro-level.

During the study period, internet access via mobile phones had not fully emerged. In cases where people had internet-enabled phones, they were either unaware of how to use the function or found it unaffordable. There are other cases where people had internet-enabled phones and used the services. While the four-country PICTURE study was carried out when internet access through mobile phones was not common, the other studies in the book capture mobile internet as they were carried out at a later time when mobile internet was available and increasingly affordable. This chapter focuses on the four-country PICTURE study and therefore does not capture internet-enabled phone use.

Analytical framework

Analysis in this chapter draws on the sustainable livelihoods approach (SLA), a framework used in understanding the multidimensional aspects of poverty and poverty reduction strategies. The SLA illustrates the different linkages between livelihood assets, vulnerability context, institutions, and policies, and people's livelihood outcomes (Messer and Townsley, 2003). The approach emphasizes the importance of the capital or assets that people have access to or draw on, and the context within which they devise strategies to improve their livelihoods. Due to its flexibility in understanding people's livelihoods and poverty reduction, the SLA has been extended and used to analyse ICT applications for poverty reduction (Duncombe, 2007). The framework (Figure 3.1) shows the linkages between livelihood assets and the context including the vulnerability context that mediates people's livelihood strategies and leads to livelihood outcomes.

This framework is operationalized by use of Sen's notion of the set of 'functionings' and 'doings' in people's capabilities (Sen, 1999). The argument by Sen is that what matters in people's well-being is what they are capable of being or doing with the goods to which they have access. In addition to seeing ICTs as the complete range of communication, media, and information flows in a community with a technical, economic, and social dimension, this chapter analyses what people are able to do with ICTs to improve their livelihoods. In this sense, ICTs can act as facilitating factors linking social, economic, and natural well-being (Gigler, 2011). As part of the context,

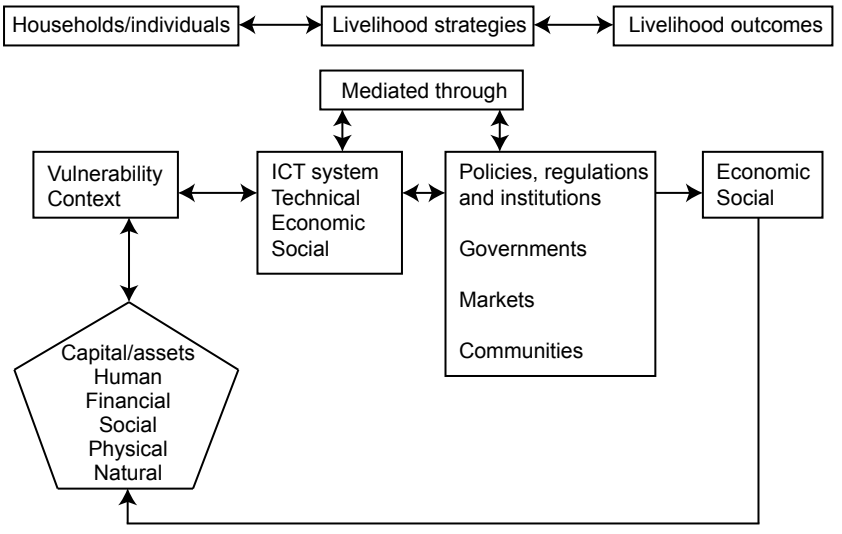

Figure 3.1 The livelihood analysis framework

Source: adapted from Duncombe, 2007

policies, regulations, and institutions influence people's livelihoods strategies (Messer and Townsley, 2003). For example, at the macro-level, ICT policies enacted may have the potential to favour or disfavour the poor through provision of ICT infrastructure and services (Duncombe, 2007). Policies and institutions may help make it easy or difficult for people to achieve their livelihood objectives by controlling access to those assets, or by influencing how, where, when, and by whom they are used (Messer and Townsley, 2003). Therefore, livelihood outcomes result from the combination of livelihood assets at the disposal of households or individuals, the vulnerability context in which they operate, and the policies, institutions, and processes around them. Livelihood outcomes can be adequate or inadequate for individuals or households. In this regard 'Poverty can be thought of as an "inadequate" livelihood outcome' (Messer and Townsley, 2003: 8), while poverty reduction is conceived as an improvement in people's economic (e.g. assets, income, and expenditure) and social/human dimensions (e.g. skills and knowledge, social networking, communicating in emergencies).

This chapter focuses on how people's livelihoods have improved. An attempt is made to link changes in the political context (ICT policy reforms and regulations), the ICT market (supply and demand involving access, affordability, and availability of ICTs) and the changes in people's livelihood assets (economic and social). This is not to suggest that the relationship or linkage between these elements is linear or unidirectional. ICT policies are not neutral and result from political bargaining and negotiations between

actors (Moodley, 2005; Cowhey et al., 2009). ICT policy choices made by governments are also influenced by global ICT regimes and policy reforms are susceptible to power relationships and interests (Adam and Gillwald, 2007).

ICT markets evolve depending on politics and policy (Adam and Gillwald, 2007) because policies and regulations influence who the actors are, what actors compete over, how firms compete with one another, and competitiveness of the sector (Calandro et al., 2010). Similarly, sector-specific policies like universal access levies and taxes on ICT equipment and services can influence costs (Calandro et al., 2010). Further, policies influence industry regulation, infrastructure development, and privatization, all of which influence marketplace dynamics (Vaughan, 2006: 5; Cowhey et al., 2009: 28). It has been pointed out that particular policies and regulatory regimes influence the composition of firms, business choices, the direction of technology, and incumbent activities (Cowhey et al., 2009; Gillwald, 2010). For example, during policy reforms in the 1990s in Africa, liberalization and privatization of public utilities led investors to invest only where profits are to be expected (Leye, 2009). Moreover, 'The IT and telecom departments in most developing countries tend to focus more on business and technology issues and carry a strong pro-market bias and policies prioritized revenue models' (Singh and Gurumurthy, 2006: 110). This explains why growth in Africa's ICT sector has largely been driven by the private sector, and the reason that some ICTs have performed better than others, as will be discussed in the subsequent sections.

From the foregoing discussion, contribution of ICTs to people's livelihoods is influenced by policy, regulations, and institutional choices (Leye, 2009: 34), and the market structure that results from these choices. Thus, this chapter looks at access and use of ICTs by the poor to improve their livelihoods, as influenced by ICT market structure, an outcome of ICT policies and regulations.

Sources of data and methods of analysis

This chapter draws on PICTURE Africa research project reports and RIA primary documents based on a series of surveys conducted over the past few years in 20 African countries including the four East African countries that form the focus of the chapter. Quantitative and qualitative reports from Kenya, Rwanda, Tanzania, and Uganda were used for review. The data on which the reports are based were collected in 2007/08 and 2010 as panel data by each country team. In addition, two synthesis reports derived from the merged quantitative data for all four countries, in the periods indicated above, was utilized. RIA primary documents were obtained from their database, and all documents that had information regarding ICT policies and regulations in the four countries were utilized.

Once selected, PICTURE Africa primary documents were reviewed and information was extracted for analysis. This was achieved through thematic synthesis of the reports as well as the primary documentation from PICTURE Africa and RIA studies. This involves the process of coding text beginning

with the development of descriptive themes and generating analytical themes (Thomas and Harden, 2008). In addition, comparative analysis was also done focusing on salient features of ICT policies and regulations and how they influence ICT markets within countries and between the four countries.

ICT policies and regulation in Kenya, Uganda, Rwanda, and Tanzania

Each of the four countries has an ICT policy and sector regulations, formulated at different times. Further, with the exception of Rwanda, which has a regulator that also regulates other utilities, the countries (Kenya, Uganda and Tanzania) have a regulator that focuses on the ICT sector.

The ICT sector in Uganda is governed by the Uganda Communications Act, enacted in 1997 to facilitate the implementation of the 1996 policy and derived regulations by the Uganda Communications Commission (UCC), the sector regulator established in 1998. Until 2005, when the National ICT Policy (NICTP) framework was adopted, the ICT sector remained under the 1996 ministerial statement. In 2006, an ICT ministry was created as recommended in the policy document; all licences are issued by the minister responsible for communication (Mulira et al., 2010). The Uganda Communications Act Chapter 106, which led to the restructuring of the communications sector, including liberalization and introduction of competition, was passed by parliament in 2000. Further, to promote and monitor the ICT sector and its contribution to social and economic development, the National Information Technology Authority Uganda (NITA-U), an autonomous body which is also an agency of government, was established by an Act of Parliament in 2009. Moreover, in response to emerging security issues, the Parliament of Uganda passed into law two cyber bills on October 2010 to provide for the long overdue legal regulations for security of electronic transactions.

In Kenya, the amended Kenya Communications Act 1998 (KCA 1998), which led to the liberalization and introduction of competition in the sector, provides the framework for regulating the ICT sector. The enactment of the KCA 1998 led to the establishment of the Communications Commission of Kenya in (CCK) 1999. The Kenya Communications (Amendment) Bill, 2008, which amended the KCA 1998, was signed into law in January 2009. In 2010, the CCK introduced new regulations to deal with dispute resolution; tariff regulations; compliance monitoring, inspections and enforcement; fair competition and equality of treatment; and interconnection and provision of fixed links, access, and facilities. Further, the CCK introduced an open market-based licensing system, which works on a first come first served basis if a potential operator meets the requirements (Waema et al., 2010).

The telecommunications sector in Tanzania was liberalized by the enactment of the Tanzania Communications Act of 1993, which also established the Tanzania Communications Commission (TCC). The main policies guiding developments in the telecommunications sector are the National

Telecommunications Policy (1997), the National ICT Policy (2003), the National Postal Services Policy (2003), and the National Information and Broadcasting Policy (2003). In 2003, the TCC became an independent regulator of the ICT sector, the Tanzania Communications Regulatory Authority (TCRA), under the TCRA Act No. 12 of 2003. The Fair Competition Commission (FCC) was established under the Fair Competition Act 2003 as an independent government body to promote and protect effective competition in trade and commerce, and to protect consumers from unfair and misleading market conduct. In 2010, the various legislations, the Tanzania Broadcasting Services Act No. 6 of 1993, Tanzania Communications Act No. 18 of 1993; Tanzania Communications Regulatory Authority Act No. 12 of 2003; and Universal Communications Service Access Act of 2006 were harmonized and replaced by the Electronic and Postal Communications Act (EPOCA). The EPOCA, among other things, had clauses that required mobile operators to float shares on the Dar es Salaam stock exchange, re-distribute frequencies in the aftermath of digital broadcasting, share network resources and infrastructure, and register SIM cards (Behitsa and Diyamett, 2010).

In Rwanda until 1993, the telecommunications sector was centralized and government-based, where the Ministry of Telecommunication played both the role of service provider and the regulator. Since the late 1990s, an ICT Policy dubbed Vision 2020 was established, which aims to make ICT an integral part of its socio-economic development through national information and communication infrastructure (NICI) plans,. The first, second, and third NICI plans focused on programmes, projects, and initiatives that promote the utilization and exploitation of ICT in society and the economy, while the fourth NICI plan focuses on production of ICT goods and services for the domestic and export markets. The telecommunication law, which guides the sector, was passed by the Transitional National Assembly in 2001 (Nsengiyumva and Baingana, 2007). The key institutions in the ICT sector include the Ministry of Infrastructure; the Rwanda Utility Regulatory Agency (RURA), established in 2003 as part of telecommunications reforms to regulate energy, transport, communications, water, and waste management utilities; and the Rwanda Information Technology Authority (RITA), which has since been merged under the Rwanda Development Board.

Issues that arise from the overall policy and regulatory frameworks

What emerges from the above review is that all four countries have an ICT policy. Regarding the approach to policy development, whereas Rwanda followed an elaborate framework and implementation plan, the other three countries utilized an incremental approach to formulate and implement their policies (Adam and Gillwald, 2007). An examination of the ICT and development/poverty policy link shows that some elements of an ICT strategy are either embedded in the national policies for growth and poverty reduction,

as is the case in Kenya and Uganda, or are a distinct strategy, as is the case in Rwanda, while this link is weakest in Tanzania. For example, the Uganda Telecommunications policy was driven by the key elements of Uganda's Poverty Eradication Action Plan (PEAP) (Tusubira and Ndiwalana, 2006). However, May et al. (2011:6) caution that 'Within Eastern Africa, there are many challenges for effectively integrating ICT into economic and social development'.

The regulatory framework in all four countries is changing to allow for a technology-neutral and horizontal licensing (converged) framework. The TCRA introduced a Converged Licensing Framework (CLF) in 2005 in Tanzania. Kenya migrated to a Unified Licensing Regime (ULF) in 2007 (Waema et al., 2010). In Uganda, the separation of the licensing of infrastructure from the service provision increased competition, and convergence has yet to be addressed on the side of the governing law and regulations, despite the creation of a converged ministry (Mulira et al., 2010). According to Mulira et al. (2010), despite the technology neutrality policy and regulatory framework, GSM (Global System for Mobile Communications) remains the dominant mobile standard in Uganda.

Although with variations, the four countries have adopted universal access principles. This has partly been through rollout obligations or through funds collected from operators in order to promote ICT investment and services in under-served areas. In Kenya, a Universal Service Fund (USF), managed and administered by the CCK, was established in 2009. However, this has yet to be implemented by the CCK (Waema et al., 2010) and mobile operators (Safaricom and Celtel, now Airtel) have resisted the USF because of their view that they have attained their rollout obligations, while Telkom Kenya Ltd. failed to meet the minimum targets stipulated in the licence (Calandro et al., 2010). In Uganda, universal access was previously done through rollout obligations to providers, but in 2003, UCC established a Rural Communication Development Fund (RCDF) for a rural access programme. Some projects have been implemented, although the performance of the RCDF was perceived as inefficient (Calandro et al., 2010). Perhaps to remedy this, the new rural communications development policy focuses on coverage, connectivity, and content (Mulira et al., 2010). The Universal Communications Services Act of 2006 provides for special concessions to service providers in the ICT sector in Tanzania. However, the Universal Access Fund was only established in 2009 and there is little evidence of progress made (Calandro et al., 2010). Further, although there were plans to provide telecommunication facilities to villages by 2020 and generally extend services to rural areas, there has been little investment in rural areas since liberalization of the sector in 2003 (Behitsa and Diyamett, 2010). A presidential Order in place in Rwanda obliges each operator to pay 2 per cent of their turnover exclusive of taxes and interconnection fees, to create a fund to be used to expand access to rural areas. Further, operators are required to provide public telephone services within certain deadlines (Nsengiyumva and Baingana, 2007). Overall, although universal

access service policies and strategies are in place, they have yet to attain their objectives (Esselaar et al., 2007).

Regulation of market entry and fair competition has yet to be fully tackled and institutional arrangements and political processes have constrained the autonomy of regulatory agencies (Calandro et al., 2010). In Uganda, working between the ministry of information and the regulator remains unclear, there seem to be tensions and conflicts among ICT institutions, UCC is considered soft in dealing with violations by operators and an appeals tribunal has yet to be formed (Mulira et al., 2010). In Kenya, ICT responsibilities are distributed in different arms of the government, with little coordination; CCK does not have a formal relationship with the Monopolies and Prices Commission and mechanisms to regulate competition in the industry have had setbacks (Waema et al., 2010). This is evident in the inability to bring about competition in the fixed network and interference by the Kenyan government in the regulatory process (Esselaar et al., 2007). As an example, the CCK suspended implementation of the new tariff regulations due to protest by a leading mobile service provider despite the new regulations having been gazetted by the government (Waema, et al., 2010; Calandro et al., 2010). In Rwanda, a multi-sector regulatory agency, RURA, has weak institutional capacity (Nsengiyumva and Baingana, 2007; Esselaar et al., 2007). Tanzania does not have adequate capacity to maintain a proactive legal framework or coordinate the respective ministry, and there is no law that enforces the national ICT policy (Behitsa and Diyamett, 2010). As a result, an enabling competitive and innovation environment continues to experience challenges (Calandro et al., 2010).

The ICT sector is a regional industry in the East African Community (EAC) but the EAC member states do not have a common ICT policy and regulatory framework. Thus, the EAC Common Market Protocol and regional framework for integration do not provide guidelines and approaches for broadcasting, internet, and postal services, or ICT applications (Nsengiyumva and Baingana, 2007). Within the EAC, divergence is evident because all member states have national and subsidiary ICT policies in place as well as legislative and regulatory frameworks. Development of the ICT sector in the EAC would benefit from a common policy and regulatory framework for the benefit of the people in the region. There are multiple ICT policy and programme initiatives in place for the establishment of a regional ICT policy and regulatory framework (Waema et al., 2010), but the process is slow due to disquiet among some member states that a harmonized ICT policy framework would favour some countries (Calandro et al., 2010: 5).

ICT market structure and contribution to improving people's livelihoods

The key proposition of this chapter is that ICT policies and regulations shape the ICT market structure, which influences availability, accessibility, and affordability of ICTs. With reference to access and use of key ICTs in the four

countries, this section examines how the policies and regulations in place influence market structure. Further, drawing on livelihood assets, this section discusses the implications of such ICT markets on people's access to and use of ICTs, and the improvement in their livelihoods. As evident in PICTURE Africa findings and RIA studies (Bizimana et al., 2010; Waema and Okinda, 2011; May, 2010; Gillwald and Stork, 2008), access to ICTs may or may not be through ownership, because of sharing of ICTs and use of public ICTs like public telephones or internet cafes. Further, this chapter analyses each ICT used in these countries separately. This approach in no way negates ICT convergence, rather it recognizes that for a long time, ICT policies and regulations influenced each of the discussed ICTs differently, at least in some ways. The ICT market structure that resulted from ICT policies and regulations is captured by looking at the key ICTs in terms of access and use and issues that arise from such topics as interconnection, tariff regulation, pricing and prices of ICT services, regulation of anti-competitive practices, end of roaming, mobile banking and money transfer systems, universal service obligations, and others. These issues are analysed by looking at the different ICTs used in the four countries.

Fixed-line telephony

Generally, in the four countries, fixed-line telephone services have been very limited, unreliable, and of poor quality, with minimal signs of recovery (Calandro et al., 2010). Figure 3.2 shows the number of fixed lines as a percentage of the population.

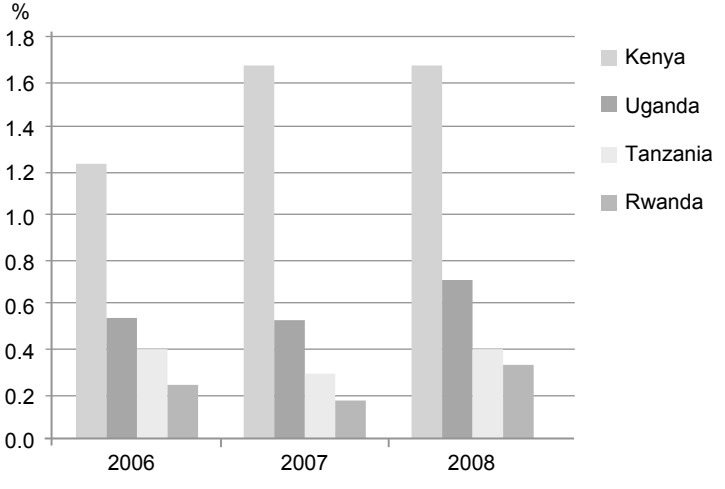

Figure 3.2 Number of fixed lines as a percentage of the population

Source: ITU statistics

In Kenya, Waema et al., (2010) show that the fixed-line service has continued to perform poorly with a low increase over the last decade. Fixed-network services are offered by Telkom Kenya Ltd and two local loop operators (LLOs), EM Communications (Popote Wireless) and Flashcom. Notable is that the state continues to maintain dominance over fixed-line incumbent operators in all four countries (Calandro et al., 2010:8). In Kenya, Telkom Kenya enjoys a monopoly over fixed telephone services and the licensed second national operator (Econet Wireless) has not been able to roll out fixed-line services (Waema et al., 2010). In Uganda, fixed voice services continue to be provided mainly by the incumbents, MTN and UTL, under the National Telecommunications Operator (NTO) licence. Fixed-line telephony is mainly provided over wireless access networks and the optical fibre rings have greatly improved the quality of the services (Mulira et al., 2010). In Tanzania, until early 2006, the fixed-line telephone service was the monopoly of Tanzania Telecommunications Company Ltd in mainland Tanzania and Zantel in Zanzibar. In 2006, Zantel received a national licence to offer telecommunication services on the mainland. In Rwanda, Rwandatel largely provides fixed line services and Artel, a universal access company provides fixed-line telephones over satellite mainly in remote areas.

As shown in Figure 3.3, using data from the RIA survey, provision of fixed-line services in the four countries shows an urban bias with only Kenya demonstrating some degree of equity between urban and rural provisioning, while in Rwanda, fixed services are almost exclusively urban (Gillwald and Stork, 2008). In Uganda, the fixed-line network is mainly concentrated in Kampala, and central and southern parts of the country (Mulira et al., 2010).

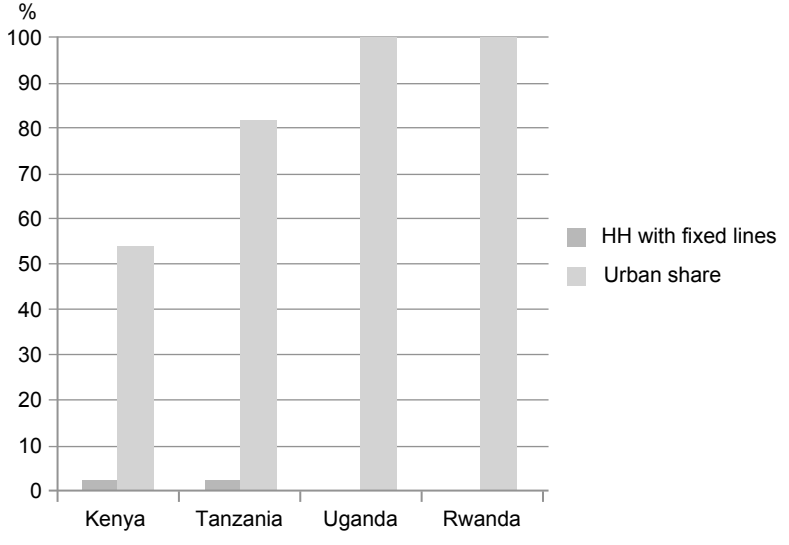

Figure 3.3 Fixed-line access (RIA household total/residential)

Source: Gillwald and Stork, 2008: 6, 8

This market structure, characterized by limited, unreliable, and slow growth of fixed-line telephone services, largely available in urban areas, has been attributed to several reasons. According to Calandro et al. (2010), failure by governments to privatize the fixed-line segment of the market, and liberalization which left incumbents as natural monopolies, contributed to minimal development of the segment in terms of provision of services at affordable prices. Similarly, privatization of monopoly fixed-line incumbents remained far behind the introduction of competition in the cellular market (Adam and Gillwald, 2007), which partly explains mobile telephone substitution of fixed-line telephone services as found by RIA and PICTURE Africa studies. Further, introduction of a pre-paid service has not had any marked effect, largely because the monthly line rental cost is often a barrier to entry (Gillwald and Stork, 2008).

The PICTURE study showed that fixed-line telephone ownership by households was very low at 1.6 per cent of all the households covered in the countries, only ahead of internet connection (0.8%) (May, 2010). In comparison, 70 per cent and 60 per cent of all the households covered owned a radio or mobile telephone, respectively. Low access to fixed-line telephone services is probably the reason that in all four countries, fixed-line telephony did not feature among the ICTs that have contributed to improvement in people's livelihoods.

Mobile telephony

The growth, development, and expansion of mobile telephony in the four East African countries remains unprecedented, although uneven within and across countries. This has resulted in mobile telephony being the main means of voice communication in the region (Esselaar et al., 2007). In Uganda, the GSM coverage extends to all districts, although some remote rural areas have weak or no network signal (Mulira et al., 2010). Mobile telephone services were provided by the three main providers, MTN Ltd, UTL, and Celtel (Zain now Airtel), until 2005, and other providers have been licensed recently. Mobile telephony was first introduced in 1992 in Kenya under the External Total Access Communications Systems (ETACS) but it has now moved to the second and third generation of GSM. Mobile telephone service providers include Safaricom, established in 1997; Kencell, now Airtel, licensed in 2000; and Telkom Kenya (Orange) and Econet Wireless (Yu), which were assigned GSM mobile network licences in 2007/08. In Tanzania, there are seven active mobile telephone operators: TTCL, Zantel, Vodacom, Zain (now Airtel), Tigo, BoL, and Sasatel, and two new applicants (Behitsa and Diyamett, 2010). MTN Rwandacell is the main private cell phone firm established in 1999. Notable is that these providers offer converged services in each of the countries.

Although subscriber growth was low in the initial years of licensing of GSM operators, the number of subscribers has increased substantially in all four countries. For example, in Kenya, according to the CCK, less than 20,000

mobile handsets were registered in a period of seven years from 1993 to 1999, but mobile subscribers increased rapidly in the last decade or so. Mobile penetration continues to increase (Figure 3.4) although it could be lower than indicated because some subscribers own multiple SIM cards (Gillwald and Stork, 2008).

Increase in mobile penetration has been attributed to the competitive effects resulting from the increased number of mobile operators, increased mobile coverage, customer awareness, availability of pre-paid low denomination airtime vouchers, aggressive promotion of mobile services, availability of low cost handsets, and mobile payment services (Waema et al., 2010; Mulira et al., 2010; Calandro et al., 2010). In Kenya, mobile telephone subscribers began to increase in 2000 when a competing GSM operator was licensed and Vodafone invested in network expansion, which was further enhanced by the Kenyan government's move to exempt VAT on all telephones for cellular and wireless networks in 2009. Creative promotional offers included Warid's *pakalast*, Zain's *kika,* and Uganda Telkom's *endobo* (Obot et al., 2010: 34). Operators in the mobile segment have increased because of higher growth potential and lower incremental investment costs (Esselaar et al., 2007).

It is not yet clear whether number portability, which has been implemented in Tanzania (2008) and Kenya (2011) but not in Rwanda and Uganda, has contributed to the growth and development of mobile telephony (Waema et al., 2010; Mulira et al., 2010; Behitsa and Diyamett, 2010). Two innovations that have fundamentally transformed the development of mobile telephone services in East Africa are the introduction of mobile money transfer services and the 'end or roaming' through 'ONE network' offerings by most mobile operators across borders. Mobile money transfer was pioneered by Safaricom

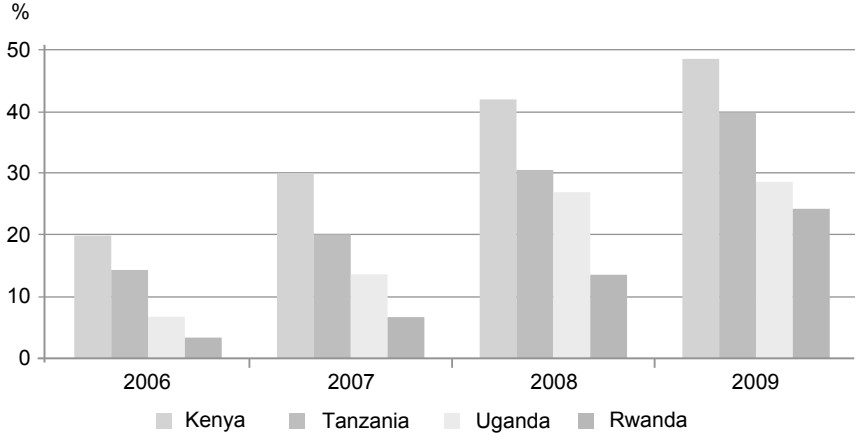

Figure 3.4 Number of mobile phone subscribers as a percentage of the population (2006–09)

Source: ITU statistics

in 2007, a service dubbed M-Pesa. Similar systems have been developed in the East African region by MTN, Zain (now Airtel), Vodacom-Tanzania, and Rwandatel. M-Pesa, considered one of the best global innovations in mobile telephony, has transformed access to financial services by the unbanked population in Kenya (Waema et al., 2010). Mobile banking and money transfer services, facilitated by appropriate policies, have led to cooperation between mobile operators and financial services providers (Calandro et al., 2010). Similarly, in September 2006, in order to take advantage of its licences in Kenya, Tanzania, and Uganda, Celtel, now Airtel, dropped all roaming charges between its networks and created 'One Network' within these countries. In response, the other operators created their own competing seamless services, branded *Kama Kawaida* (as usual), and brought together partner networks in the four countries, namely Safaricom in Kenya, MTN and UTL in Uganda, Vodacom in Tanzania and MTN Rwanda. The end of roaming charges across networks enabled users of mobile phones to make calls, send SMSs, and top up their airtime at local rates (Calandro et al., 2010; Gillwald and Stork, 2008; Esselaar et al., 2007). End of roaming was an outcome of an enabling policy and regulatory environment which allowed operators to integrate separate national networks into cross-border operations (Gillwald and Mureithi, 2010).

The CCK implemented the EU recommendations of 2009 of enforcing cost-based termination rate caps based on pure long-run average incremental cost (LRIC) in 2010, which resulted in a decline in interconnection and call termination rates. As a result, Kenya had the lowest mobile termination rates at KSh 2.21 (2.7 US cents) compared to 8.2 US cents in Uganda, 7.0 US cents in Rwanda, and 7.5 US cents in Tanzania (Calandro et al., 2010: 12). The termination rate reductions in Kenya resulted in lower retail prices. However, interconnection determinations in Tanzania and Uganda have not translated into lower retail pricing. In Uganda, interconnection and uncompetitive practices are largely driven by the incumbents; the UCC was to adopt a cost-based price control of call termination in November 2009 (Mulira et al., 2010).

As with the findings of the RIA survey (Gillwald and Stork, 2008), the PICTURE Africa study found that households in rural areas have less access to all ICTs – mobile and fixed line telephone, internet, radio, and television, compared to households in urban areas (May et al., 2011). Thus, just as in Uganda, Tanzania, and Rwanda 'In Kenya, the liberalisation of the communications sector has not changed the situation with respect to access to ICT in the rural areas' (Waema, 2007: 36).

What does this mobile phone market structure portend for the livelihoods of households and individuals in the countries covered? The contribution of mobile phones to people's livelihoods can be understood from the point of view that a mobile phone is the second most owned ICT after radio in all four countries (May et al., 2011). In turn, despite challenges, people's access to and use of mobile phones in their day-to-day socio-economic and political activities was easier, cheaper, and more convenient, which contributed to improvement in their livelihoods.

From an economic perspective, mobile phones facilitated faster, more convenient, and cheaper money transfer services and conducting of financial transactions. For example, a farmer could make calls to find customers to purchase farm produce and receive money through the mobile phone before delivering the produce (Waema and Okinda, 2011).

Further, use of mobile phones resulted in monetary savings through reduced cost of travel because people do not have to travel at all or only travel for short distances to receive information or conduct financial transactions (Mascarenhas et al., 2009; Waema and Okinda, 2011; Obot et al., 2010; Bizimana et al., 2010). Other examples include parents who access their children's examination results via mobile phone, and business owners who used mobile phone to follow up debtors and coordinate their business activities by making orders and exchanging valuable information (Mascarenhas et al., 2009; Obot et al., 2010; Waema and Okinda, 2011).

Elsewhere, through sale of airtime vouchers and mobile phone handsets, mobile telephony generated income as a business (Mascarenhas et al., 2009), which resulted in an increase in household income through self-employment (Bizimana et al., 2010).

Regarding the social dimensions of people's livelihoods, mobile phones enhanced people's ability to cushion themselves from shocks. People sought assistance from the police or friends and relatives during emergencies (Mascarenhas et al., 2009) and reported health problems to authorities as well as using hotlines to report to the authorities when they were mistreated by health personnel or denied access to health facilities (Waema and Okinda, 2011). For example, during situations that need money, people made phone calls to their friends and relatives who sent them money to solve the problem through the mobile phone. In Rwanda, households made calls to an ambulance service known as *Imbangukira Gutabara* (the quick rescuer) during a health emergency (Bizimana et al., 2010), while in Kenya, a respondent made a mobile phone call to a veterinary doctor who rushed and assisted a cow during calving (Waema and Okinda, 2011).

Mobile phones also strengthened and enhanced people's participation in groups and social networks, thereby enhancing social capital. Mobile phones enabled people to keep in touch with family and friends, and to organize and coordinate community or group events like fundraising, funerals, and weddings (Obot et al., 2010; Mascarenhas et al., 2009). Some groups used ICTs to send or receive money from the treasurer, as in the case of a *chama* (otherwise known as rotating and savings credit associations or ROSCAs), when late or unable to attend group meetings, thereby avoiding a fine for late payment (Waema and Okinda, 2011).

Radio

Noteworthy is that most recent studies have not looked at radio and its contribution to people's livelihoods. Clearly, changes in ICT policy and regulations

also include radio broadcasting. Due to reforms in the broadcasting segment, especially in the 1990s, there has been a proliferation of FM radio stations in all the countries. Many of the radio stations broadcast in indigenous languages, and one of the remarkable changes in the segment is the introduction of phone-in programmes, where listeners contribute their opinions to issues being discussed, mainly through mobile phone calls to radio stations. As illustrated in Figure 3.5, the PICTURE Africa study found that radio was the most commonly owned ICT among the matched households covered during the two waves of data collection (May et al., 2011).

The PICTURE Africa study found that as a result of easy access to radio, radio listenership had contributed to improvement in people's livelihoods. Radio increased awareness of what was going on and connection to the outside world (enhanced social inclusion). Some respondents relied on radio to know school and university opening dates as well as knowledge of government policies. For instance, the announcements on the radio increased the number of people who participate in the monthly voluntary community labour (*umuganda*) in Kigali (Bizimana et al., 2010). Through many radio programmes that focus on good husbandry practices, listening to radio led to improvement in farming practices like use of appropriate fertilizers and effective use of pesticides. For example, after listening to '*ukulima bora*' (appropriate farming), a radio programme promoting good farming practices, a farmer contacted the local agricultural office and an agricultural extension officer assisted him to establish a zero grazing unit on his farm. Another farmer had learned that use of a particular salt lick as a supplement would increase milk output, which she now enjoys after adopting feed supplements (Waema and Okinda, 2011).

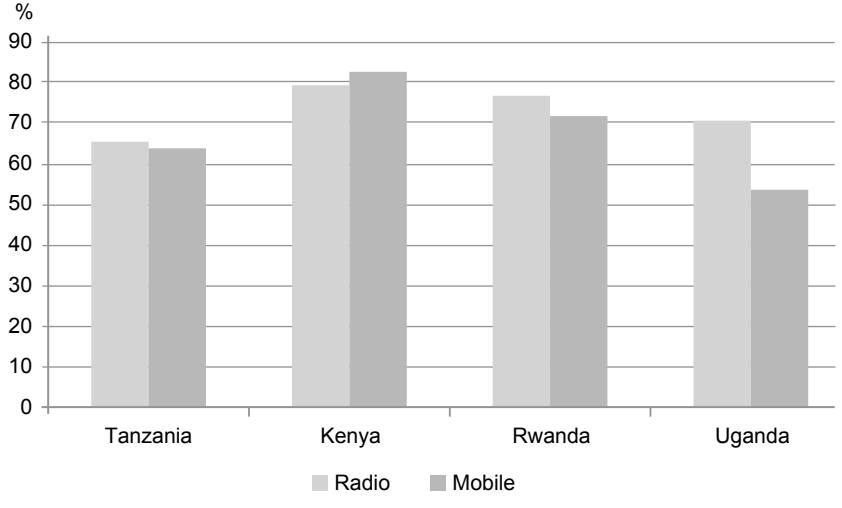

Figure 3.5 Ownership of mobile phones and radio

Source: May et al., 2011: 25

Listening to radio increased people's political knowledge and awareness through civic education programmes. Radio phone-in programmes offered people the opportunity to articulate and express their opinions regarding key political events. As a result, many people know and are willing to seek or fight for their rights and promote harmony (Waema and Okinda, 2011).

Through radio, people know what health services are available and where. Radio provided information about free medical camps and immunization campaigns where people can seek health services. A respondent visited a health centre after listening to a radio programme that discussed the importance of reproductive health, especially family planning. She is now on a family planning programme and listens to a weekly programme on family planning by a local radio station, to keep abreast of the latest developments (Waema and Okinda, 2011). Similarly, in Rwanda, some women heard about the importance of family planning on the radio, and then went to health centres to consult about the best method for them (Bizimana et al., 2010). In addition, radio programmes promoting behaviour change and attitudes have resulted in increased knowledge and reduction of the stigma associated with some diseases, for example, HIV/AIDS. The youth knew about using condoms to prevent HIV/AIDS infection, while people in the eastern province of Rwanda became convinced about the relevance of educating both girls and boys (Bizimana et al., 2010). Others came to recognize the importance of washing hands to prevent communicable diseases, the use of insecticide-treated bed nets, and good hygiene and nutritional practices (Waema and Okinda, 2011)

Some radio programmes were associated with knowledge and skills for saving money (Obot et al., 2010). Elsewhere, some respondents joined *Umurenge* SACCO (a government microfinance institution) and started saving their money, after listening to a radio programme that promoted the initiative (Bizimana et al., 2010).

In addition, secondary school students taking subjects such as business studies have radio programmes that teach certain topics. By listening to these programmes, students were able to cover the syllabus whether they were in school or not (Waema and Okinda, 2011).

The internet

The RIA survey showed very low levels of household ownership of computers and internet connections (Figure 3.6), which made the internet of limited value as a communication strategy (Gillwald and Stork, 2008).

Similarly, PICTURE Africa found that internet connectivity was very low across sampled households. Access to an email address was highest in Rwanda (18%), followed by Kenya (10%), and Uganda (2%), and lowest in Tanzania (1%) (May et al., 2011: 27). Further, it appears that Rwanda has a better penetration of newer forms of ICT due to the more pro-active role of the state in promoting these forms (May et al., 2011: 25). The RIA household survey (2007) established that most users obtain access through their place

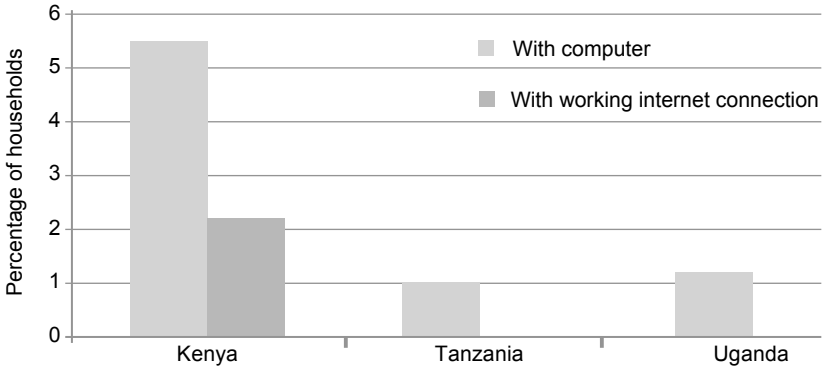

Figure 3.6 Computer ownership and internet connection at home

Source: Gillwald and Stork, 2008: 23

of work, training institutions, or internet cafes (Gillwald and Stork, 2008). Low internet penetration has been attributed to the low levels of education and skills in using computer-based ICT (Calandro et al., 2010; May et al., 2011: 25), lack of infrastructure due to reliance on satellite links and limited reach of the traditional fixed-line network, the limited relevant local content, and limited PC ownership (Calandro et al., 2010; Waema et al., 2010; Behitsa and Diyamett, 2010). Calandro et al. (2010) argue that this is a result of policies on the protection of monopolies and their ineffective regulation.

However, the landing and operationalization of undersea fibre optic cables on the East African coast, and building of terrestrial fibre networks and a national fibre backbone, are likely to improve internet connectivity in the region. TEAMS and SEACOM landed at the Kenyan coast in mid-2009, EASSy landed in 2010, while Lion2 landed in 2012. With the landing of the undersea cables and the use of the unified licence, the mobile operators have become the largest internet service providers (ISPs) (Waema et al., 2010:18). Notable is also the entry of electricity transmission companies into the communication market in Kenya and Uganda to provide fibre connectivity (Waema et al., 2010; Mulira et al., 2010). As a result of these infrastructural developments, the capacity and quality of internet provision has improved, but reduction in the cost of the retail (consumer-level) internet service remains elusive (Waema et al., 2010). Generally, increased competition has led to a reduction in the cost of international bandwidth over the years (Gillwald, 2010).

Perhaps because of low internet connectivity and ownership of computers among sampled households, internet did not feature among the ICTs that largely contributed to people's livelihoods. From the PICTURE Africa findings, household members at different levels in the formal school system

accessed educational information through the internet in cyber cafes. This is essential in doing school assignments and obtaining learning resources. Further, students interact with their supervisors through email and obtain feedback about their assignments, regardless of their location. In addition, use of computers in schools has made it possible for learners to access learning resources that they could not have accessed previously (Waema and Okinda, 2011). It can therefore be argued that use of the internet contributed to improvement in human capital.

Conclusions and recommendations

By arguing that ICT policy and regulations are outcomes of political processes, the central point of this chapter is that policies and regulations shape market structures (entry into markets, how many players, kind of players allowed in the market, and the kind of competition), which influences ICTs' contribution to people's livelihoods through access and use. Stork and Gillwald (2006), for example, point out that market structure affects both access to and use of ICTs through services and products availed, where they are availed, and at what price. While the proposition that ICT policy and regulations shape ICT market structure, which in turn influences people's livelihoods through ICTs, should not be taken to mean causality, there is evidence of such linkages. Therefore, to understand how ICTs contribute to people's livelihoods, it is important to look at how ICT policies and regulations influence ICT market structure.

Of the different ICTs, mobile phones and radio were found to have contributed to improvement in people's social and economic livelihoods much more than internet and fixed-line telephone. This is partly due to policies and regulations that resulted in a market structure that enabled wide access to and use of mobile phones by households and individuals. It is this wide access to mobile phones that led Esselaar et al. (2007) to think that mobile operators are the drivers of converged services. This is likely, because mobile phone operators have already been issued with converged licences after reforms in ICT policies and regulations to cope with the realities of the market. Regarding one of the innovations in mobile telephony, money transfer services, Adam and Gillwald (2007) note that after the establishment of M-Pesa, regulations that were introduced to allow telecommunication agents to act as deposit takers ensured its success. Access to other ICTs like the internet is compounded by lack of electric power or unreliable electric power, lack of computers to access networks, low ICT literacy, and low purchasing power (Behitsa and Diyamett, 2010; Esselaar et al., 2007; Bizimana et al., 2010). Overall, people's disposable income matters in terms of access and use of different ICTs (Gillwald and Stork, 2008).

Because of the likelihood of more poverty alleviation through the application of ICTs in commercial endeavours (Gillwald, 2010), questions remain as to how much government-sponsored, supply-driven initiatives like digital villages in Kenya can achieve poverty alleviation objectives. ICT applications

like mobile money transfer services, hailed as transformative in terms of money transfer and access to services, are commercial innovations backed up by appropriate policies, regulations, and infrastructure.

More research should be conducted to understand the linkages between ICT policy and regulation, resultant market structures, and how these influence people's livelihoods through *converged* ICTs. This is because access to and use of ICTs is partly undermined by government's policies and practices, market structures, and institutional arrangements (Gillwald and Stork, 2008: 31). Understanding such linkages would go a long way in formulating interventions that improve people's livelihoods at policy, regulation, or strategy levels.

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CHAPTER 4

Livelihood and ICTs in East Africa

Aileen Agüero, Roxana Barrantes, and Timothy M. Waema

This chapter draws on quantitative data showing the incidence of ICT usage for livelihoods. Specifically, we examine PICTURE Africa's survey data for individuals with the following benefits: travel time and costs reduction, information about the latest news, socialization, job and running individual businesses, and security in case of emergencies. Also, models are run to study those factors that determine the perception that mobile phone use makes lives easier. Quantitative evidence is complemented with qualitative narratives in which respondents described the advantages and disadvantages brought about by ICT access and use for travel time and costs reduction, information about the latest news, socialization, job and running individual businesses, and security in emergencies. At the end of the chapter, conclusions are drawn about the characteristics of those who perceived the greatest benefits.

Keywords: East Africa, information and communication technologies, ICT use, ICT appropriation, ICT benefits, livelihood

Information and communication technology (ICT) can improve the activities undertaken by individuals and households in order to generate a livelihood. This is especially relevant when considering the poorest sectors of the population. In these sectors, characterized by low literacy rates and low income levels, cost-reduction strategies are often used for different purposes such as transportation, communications, and job-seeking.

The literature on ICT, especially mobile phones as an information channel, shows evidence of its role to reduce transaction and search costs in, for example, fisheries and grain markets. In addition, the payment, consumption, and saving channel is also well-documented, including cases such as M-Pesa, the most widely used mobile remittance service in the world, that was first implemented in Kenya.

The important factors that determine the success of people's strategies include the portfolio of assets, the use to which these are put, the context in which these activities take place, and the returns that are achieved. ICTs have the potential to be a new asset, a channel through which information can be obtained and transactions undertaken, and a means for payment,

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consumption, and saving. This chapter draws on quantitative data showing the incidence of ICT usage for livelihoods, and the returns that follow, as well as qualitative narratives in which respondents described the advantages and disadvantages brought about by ICT access.

The quantitative analysis is at the individual level, based on the individuals that were randomly selected from each household to complete the section on mobile phone use of the PICTURE Africa questionnaire. Particular attention is paid to those who mention that they perceive benefits derived from the use of a mobile phone. The benefit categories that are taken into account are the following: travel time and costs reduction, information about the latest news, socialization, job and running individual businesses, and security in emergencies. We also use regression analysis to study those factors that determine the perception that mobile phone use makes lives easier.

In the next section, we review the literature on how mobile phones have helped to improve livelihoods in general and in the African context in particular. In the third section we focus on the evidence in East Africa, using PICTURE Africa's 2010 dataset. This section looks at the benefit categories described above and also at the determinants of the perception that mobile phone use makes lives easier. The final section offers conclusions.

Experiences of improvement in livelihoods

General experiences

Recently, the extent to which ICTs in general and mobile phones in particular contribute to livelihoods has been widely studied. It is common to assume that mobile phones are part of everyday lives and that they represent a need among other needs in modern societies (Ureta, 2005). In addition, there is an underlying hope related to the contribution of mobile phones to livelihoods and well-being, especially in settings with constrained resources (Donner, 2007); mobile phones are also described as complex and powerful devices that alter and reflect the complex social ties that are the base of societies.

Ideas such as these are supported by quantitative and qualitative research. Regarding the former, one of the most known and influential studies is Jensen's (2007), which shows the impact of mobile phone use at micro-level in the fishing sector in Kerala (India). In this context, the use of mobile phones by fishermen and wholesalers led to a strong reduction in price dispersion, the complete elimination of waste, and near-perfect adherence to the law of one price, benefiting both consumer and producer in terms of welfare.

There is also evidence for the case of transport cost reduction (Bhavani et al., 2008). For itinerant workers in China, the use of a mobile phone can help save 6 per cent of time. In a different setting, de Silva et al. (2008) find that in the different stages of the agricultural value chain in rural Sri Lanka, there are high information search costs (transaction costs); if farmers had used mobile phones to obtain information, their information search costs would

have reduced significantly, leading to creation of incentives to commercialize their agricultural production.

Also in a rural context, Barrantes et al. (2011) estimate the effect of mobile phone use in households' welfare, in Puno, Peru. With an increase of 0.1 in the probability of being a mobile phone user, there is a 7 per cent increase in welfare (measured as per capita monthly expenditure). Also, if a household member has been using a mobile phone for more than two years, welfare, measured by household expenditure, increases by 37.7 per cent.[1]

Through a vast review of the literature on mobiles and micro and small enterprises (MSEs) in developing countries, Donner and Escobari (2010) conclude that mobile phone use helps many MSEs become more productive, and the main contribution is found in improvements in sales and marketing and procurement processes. In addition, there is currently more evidence for the benefits mobile phones bring to already existing MSEs instead of new MSEs, amplifying existing conditions and information flows rather than transforming them.

From a macro perspective, studies on the impact of both internet and mobile phones have been conducted. Khalil et al. (2009) find that these ICTs boost growth and the effect is higher in developing countries than in developed ones: an increase of 10 percentage points in mobile phone adoption increases growth in GDP by 0.8 percentage points in a developing country, while the effect is 0.6 percentage points in a developed one. Waverman et al. (2005) finds that in a typical developing country, 10 more mobile phones per 100 people could increase GDP growth by 0.6 percentage points.

Experiences in Africa

A lot of attention has been paid to African countries to study the contribution of mobile phones. For example, in the South African context, Samuel et al. (2005) find that for 56 per cent of SMEs, in rural or urban areas, the most important contribution of mobile phones is on the reduction of the number of trips. Similarly, Esselaar et al. (2007) show that ICTs are considered highly productive inputs by SMEs in a set of 13 African countries; ICTs help reduce transaction costs and facilitate market access in formal and informal sectors.

Aker (2008), in a well-known study in the field, examines mobile phone use impact in grain markets in Niger. The main finding is that mobile phones help to reduce price dispersion, and that the reduction is higher in markets that are farther away and with more difficult access. Moreover, this study suggests that mobile phones improve both consumers' and traders' welfare.

From a qualitative perspective, Myhr and Nordström (2006) find that the use of mobile phones empowers Tanzanian fishermen, through an increase in both bargaining power and control over external events. Mobile phones, in this sense, help with more information about market opportunities and the possibility to work more efficiently.

Muto and Yamano (2009), focusing on 30 regions in South Uganda, estimate the impact of mobile phones on agricultural markets. Using a panel dataset from 2003 to 2005, they find that the market share of farmers of perishable goods (bananas) increased from 50 per cent to 69 per cent in communities more than 20 miles away from district centres after the expansion of mobile phone coverage.[2] This contrasts with the results for less perishable crops (such as maize), where no effect on market share was found. The main conclusion is that mobile phone coverage expansion, or the access to more information, has a stronger effect on market participation of farmers who live in remote areas and produce perishable crops.

Boateng (2010) studied the impact of mobile phones on the micro-trading activities of women traders in Ghana. Three different effects are identified: incremental effects, which increase the number of activities they did before using a mobile phone; transformational effects, that change the way in which the business was run; and production effects, expressed in new business ideas and opportunities for income-generating activities. The results indicate that the main effects of mobile phone use are at the beginning and the end of transactions, and it helps to improve information management and empowerment of women in business.[3,4]

Aker and Mbiti (2010) identify five mechanisms through which mobile phones can produce economic benefits to consumers and producers in sub-Saharan Africa. The first includes the improvement of access to and use of information, which will reduce transaction costs and lead to more market efficiency. Second, the availability of more information will increase firms' productive efficiency by allowing them to manage their supply chains in a better way. Third, due to the increasing demand for mobile-related services, mobile phones help create new jobs. Fourth, mobile phones make communications easier among social networks in the case of shocks, which reduces households' exposure to risks. Finally, mobile applications can be effectively used to deliver financial, agricultural, health, and educational services. After reviewing the relevant literature for the five described mechanisms, the main conclusion is that mobile phones do have the potential to increase consumer and producer welfare, and perhaps broader economic development, in sub-Saharan Africa.

Evidence in East Africa

Using data from the second wave of the PICTURE Africa project described in the previous chapters, we look at those individuals who declared they perceived benefits from the use of a mobile phone.

In general, using a mobile phone can make lives easier. In particular, in PICTURE Africa's questionnaire, there are at least five categories in which the benefits are classified:

1. Reduction of travel time and costs. This is the most commonly found benefit associated with mobile phone use, since it involves a

reduction in transaction costs which in turn increases benefits from market participation.

2. Information about the latest news. This category, coupled with the next one, reflects people's need to be connected.
3. Socialization. Interpreted as a means to strengthen social ties and capital, the mobile phone reduces connection costs, improving the frequency of contacts.
4. Jobs/businesses. This is associated with the ease in doing business and a reduction in the transaction cost of obtaining information about job opportunities or keeping in touch with clients.
5. Security in emergencies. The sense of well-being increases when people trust that they can be in touch with loved ones when facing an unexpected event.

The distribution among these categories is shown in Figure 4.1.

It is important to remember that the analysis considers individuals that either *used* a mobile phone or a SIM card and individuals that *have* a mobile phone or a SIM card (504 in total). From this group, we found that 79 per cent thought that using a mobile phone made their lives easier in general terms. Also, more than half of the respondents perceived benefits related to socialization, information, and travel time and costs savings. In the remainder of the benefit categories (jobs/businesses and security in emergencies), the percentages were close to 50 per cent (Figure 4.1).

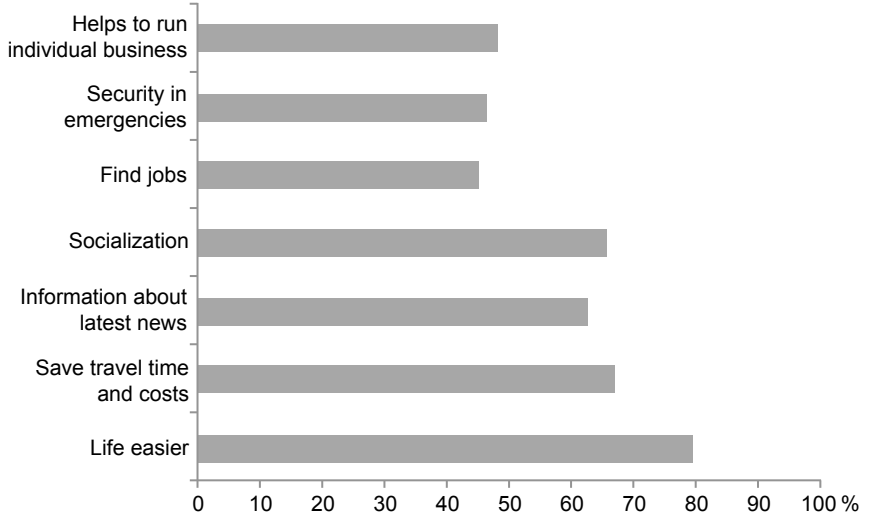

Figure 4.1 Individuals who perceive different benefits from a mobile phone

Who have perceived benefits?

What are the characteristics of those respondents that perceived benefits from using a mobile phone? Is there anything in particular about them? This section tries to answer these questions according to the categories we previously mentioned and the following variables: gender, country, possession of mobile phone or SIM card, education, location (urban/rural), use of public phones, age, and household size.

Save travel time and costs

When we look at the whole group of people who perceived benefits in this category, we find that 68 per cent of them are females. However, the differences between male and female respondents who perceived this kind of benefit are not statistically significant.

Regarding countries, the evidence is mixed: the percentages of respondents perceiving benefits in this category ranged between 34 per cent (Tanzania) and 96 per cent (Kenya). Uganda was closer to Tanzania with 40 per cent, and Rwanda to Kenya with 81 per cent. The highest percentage of people in the group were from Kenya (31%), followed by Rwanda (28%), Tanzania (21%), and Uganda (21%). The relatively high percentage for Kenya could be because of the high penetration of mobile phones as shown in Table 1.2 in May et al. (2014) and the extensive use of mobile money transfer, especially M-Pesa. With money transfer, people save time and huge costs of travel to send money, especially for people who work in urban areas sending money to relatives and friends in rural areas.

If people own a mobile phone or a SIM card, it is more likely that they will perceive benefits from its use. Considering this, we found that 68 per cent of owners thought that mobile phones helped reduce travel time and costs. Also, among all those who perceived this as a benefit, 97 per cent owned a mobile phone or a SIM card. These differences are statistically significant.

Qualitative studies in all four countries confirmed the realization of benefits of using mobile phones to save travel time and costs. In Kenya, people no longer needed to travel long distances to access some services that were not available locally – they could access them through the phone. One of the respondents remarked: 'Use of a mobile phone has really changed life. I can now talk to my children in Nairobi when I want even right from my bedroom. I do not need to travel merely to send a message to them.' For a hairdresser in one of the East African countries studied (an informal settlement), the use of a mobile phone meant that clients could call her to agree when to meet and where to meet for her services, which saves time and money. Similarly, a part-time student at a local university working on her project paper could consult with university supervisors over the phone and through emails, which also saved travel time and costs.

In Rwanda, a young woman, remarked: 'My business is about selling clothes and before I got my mobile phone, I used to go to Kigali to purchase them, but now I just call when I'm in need and my suppliers send them through SOTRA, which is a transport company.' In another case, a young woman explained: 'I used to spend much money on travelling to see my mother who lives far, but since I have a cell phone, she calls whenever she needs me and I am able to send her money through a transport company without having to pay also for a ticket and spend time travelling.'

In Tanzania, women in Dar es Salaam said: 'Mobile telephones have empowered women – businesses have expanded; women do not need to go to Tabora, Tanga, or Mombasa, etc.' Mobile phones had also generally reduced the cost of travel, with Dar es Salaam residents stating that the number of trips had been halved.

Another variable that is part of this analysis is education, specifically the maximum education level that has been achieved by a member of the household of the respondent. From respondent households with primary education as the maximum level, 56 per cent perceived benefits in terms of travel time and cost reduction; for those with secondary and tertiary education, the corresponding figures were 67 per cent and 84 per cent. Of all those who declared that a mobile phone helped them save travelling time and cost, 54 per cent had secondary school as the maximum education level.

It is interesting to analyse whether the use of other ICTs influences or not the perception of benefits derived from the use of mobile phones. In this case, we looked at the use of public phones during the three months previous to the interview. From the group of respondents that considered there was a reduction in travel time and costs, only 11 per cent had used a public phone. From respondents who had used a public phone, only 52 per cent perceived benefits in terms of travel time and costs, while from the group of respondents that had not used a public phone, 70 per cent indicated mobile phones helped them save travel time and costs. These differences are statistically significant.

The variable 'location' was also part of the study. We found that in the group of respondents that thought a mobile phone helped them save travel time and costs, 52 per cent were in rural areas. On the other hand, among respondents in rural areas, 70 per cent perceived benefits from using a mobile phone in terms of travel time and costs reduction, although these differences are not statistically significant.

Figure 4.2 shows the distribution among age groups of all the respondents benefiting from travel time and costs reduction. Two of the youngest groups, 21–25 and 26–30, include the greatest percentage of respondents (18% and 17% respectively).

Information about the latest news

In terms of gender, 65 per cent of the group of women, and 59 per cent of the group of men, asked about the benefits of information about the latest

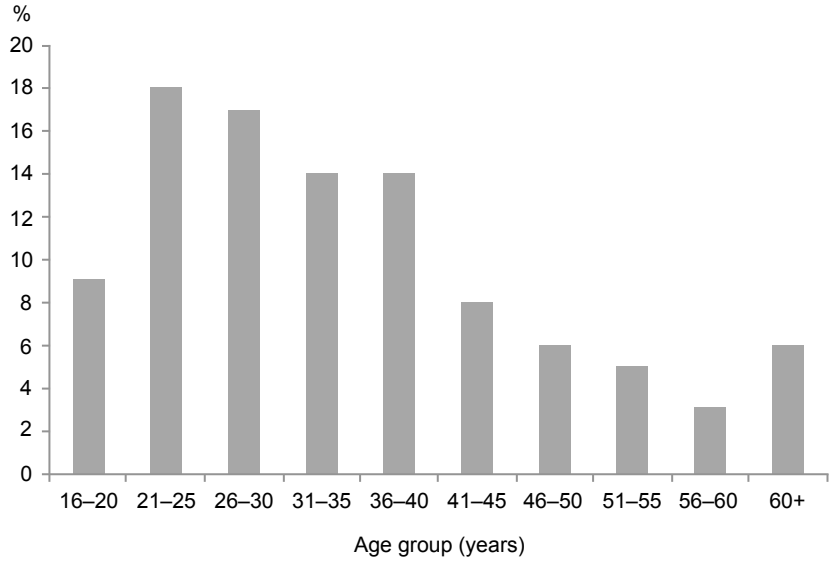

Figure 4.2 Respondents in different age groups benefiting from reduced travel time and costs

news through a mobile phone, perceived this kind of benefit. However, these differences are not statistically significant. Of the whole group that perceived benefits, 63 per cent were women.

In Kenya, 88 per cent of the respondents considered that they had benefited from information about the latest news, in Tanzania 34 per cent, in Uganda 47 per cent, and in Rwanda 68 per cent. Of those who thought they had benefited 43 per cent were from Kenya, 30 per cent from Rwanda, 16 per cent from Uganda, and 11 per cent from Tanzania. Again, the relatively high figure for Kenya could be due to the high penetration of mobile phones. It could also be attributed to the high usage of mobile phones to access the internet, including news.

Regarding possession, we found that among mobile phone or SIM card owners, 63 per cent thought there were benefits in terms of information. In addition, a high percentage (96%) among those who felt they had more access to information about the latest news owned a mobile phone or a SIM card.

Qualitative studies in all countries also showed evidence of benefiting from the use of mobile phones to access the latest news, especially information on jobs. In Kenya, for example, different groups (social, educational, etc.) used mobile phones to inform each other, especially when an urgent meeting needed to take place. In Rwanda, people listened to FM radios from their cell phones; they got to know about something like job announcements and directly called the number provided. In Uganda, some people used the mobile phone to receive information on job opportunities from their friends. Some women entrepreneurs used mobile phones to access the latest information

about commodity demand and supply trends and prices, thereby improving the performance of various women's businesses.

The maximum education level achieved by a member of the household of the respondent was also taken into account. In the group in which primary education was the highest level that a household member had achieved, 54 per cent thought mobile phones helped with information about the latest news, while the figures for secondary and tertiary education were 62 per cent and 76 per cent respectively. Among the group that thought mobile phones helped them in this benefit category, the majority (53%) had secondary school as the maximum education level.

As in the previous benefit category, public phones were part of the analysis. We found that from those who had not used a public phone in the last three months, 64 per cent considered mobile phones were useful for information about the latest news. In the group of public phone users, 53 per cent perceived this kind of benefit. Among those that thought there were information benefits from using a mobile phone, only 12 per cent were public phone users.

In terms of location, 52 per cent of the group of respondents that benefited from information about the latest news were in rural areas. From the group of respondents located in rural areas, 65 per cent perceived benefits in this category, while among those in urban areas, it was 60 per cent.

Figure 4.3 shows the distribution among age groups of respondents benefiting from information about the latest news. As in the case of travel time and costs reduction, two of the youngest groups, 21–25 and 26–30, had the greatest percentage of respondents (17% and 18%). The age group with the lowest percentage was that of respondents from 56 to 60 years old.

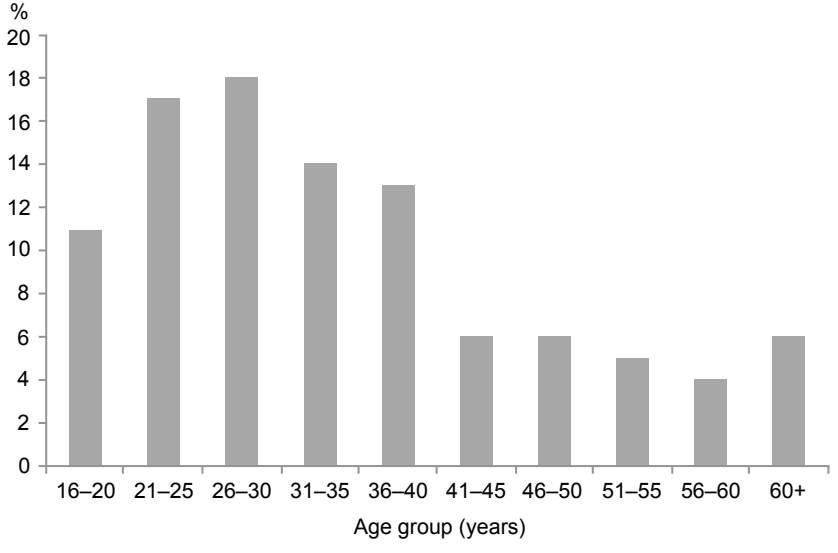

Figure 4.3 Respondents in different age groups benefiting from news information

Socialization

It is known that ICT in general and mobile phones in particular are valuable not only for job opportunities, information, cost reductions, and productivity, but also for socialization. In this part we look at this issue relative to the variables previously listed.

Among females, 69 per cent, and among males 60 per cent, perceived benefits related to socialization from using a mobile phone. This is a statistically significant difference. Of the group of people who perceived benefits, 69 per cent were females. Kenya had the most respondents who thought there were benefits related to socialization (90%), the corresponding figures in Rwanda, Uganda, and Tanzania were 76, 48 and 33 per cent respectively. Of those who thought they had benefited, 42 per cent were from Kenya, followed by Rwanda (32%), Uganda (15%), and Tanzania (11%). Again, the relatively high figures for Kenya could be due to the high penetration of mobile phones.

As in previous categories, qualitative studies in all the countries showed evidence of household members benefiting from the use of mobile phones for socialization. In Kenya, for example, mobile telephones were found to facilitate easier and faster communication through calls and text messages. The nature of the information and messages exchanged varied from people updating their relatives or friends on knowing how they were doing, to being informed when a job was available in a different location.

In Kigali (Rwanda), some households reported that they had used mobile phones to socialize and to keep communication links within their families, while others had strengthened their social networks due to the use of cell phones from many telecommunication companies. For example, a young man said: 'As far as I'm concerned, I have gained 10 friends through TIGO connection; they are my classmates and we communicate every day and in this way, I improved my relationship with others.' The households interviewed in the Southern Province also said that their social networks and their personal relationships had changed due to the availability of cheap cell phones, lower calling costs, and internet. A female participant explained: 'The telephone is really useful for me because since I have it every time there is a meeting I have to attend like for cooperative meeting or any other, they call me at any time and I am able to get more involved in the community matters.'

In Tanzania, mobile phones were used to keep in touch with family and friends, communicating during funerals and weddings, and greetings. In Uganda, mobile phones were used to chat with friends. An interesting observation was that mobile phones enabled people to talk/socialize with people they could not tolerate talking to face-to-face, like political opponents, members of different political parties, estranged spouses, and debtors.

However, some respondents in Uganda cautioned that the use of mobile phones for socialization can have negative effects. For example, lengthy gossiping and excessive loading of airtime can lead to increased impoverishment. This was echoed by another head of a household when he said: 'You load

airtime of 5,000 and you talk for a short time and it gets finished. Yet 5,000 shillings could have bought you a kilo of meat and sugar for the family.' There was therefore a widespread feeling in Uganda that the cost of airtime is high. It is believed that this is due to the high tax Uganda levies on airtime. The high cost of charging the phone where power is not available was also a common source of complaint. Another negative socialization effect of mobile phones was acknowledged as the ability to reduce physical interpersonal (one-on-one or face-to-face) interaction between individuals – a factor that has the potential to increase social isolation of poor and vulnerable individuals.

A high percentage of mobile phone or SIM card owners thought there were socialization benefits from using a mobile phone (66%); and 97 per cent of the group that perceived this kind of benefit had a mobile phone or a SIM card.

In terms of education, 80 per cent of the respondents in the group in which tertiary education was the maximum education level achieved by a household member perceived benefits in socialization, and 65 per cent and 57 per cent for secondary and primary education respectively.

Among public phone users, 55 per cent considered there were benefits in socialization from using a mobile phone. In contrast, among those who had not used a public phone in the last three months, 68 per cent perceived socialization benefits.

Among the group of urban respondents, 64 per cent thought there were benefits in socialization; in the rural group the percentage was slightly higher (67%). Of all those who found benefits in this category, 51 per cent lived in rural areas.

The distribution among age groups of the respondents benefiting in socialization from the use of a mobile phone is shown in Figure 4.4. Again the highest percentages were in the 21–25 and 26–30 age groups, and the lowest in the 56–60 age group.

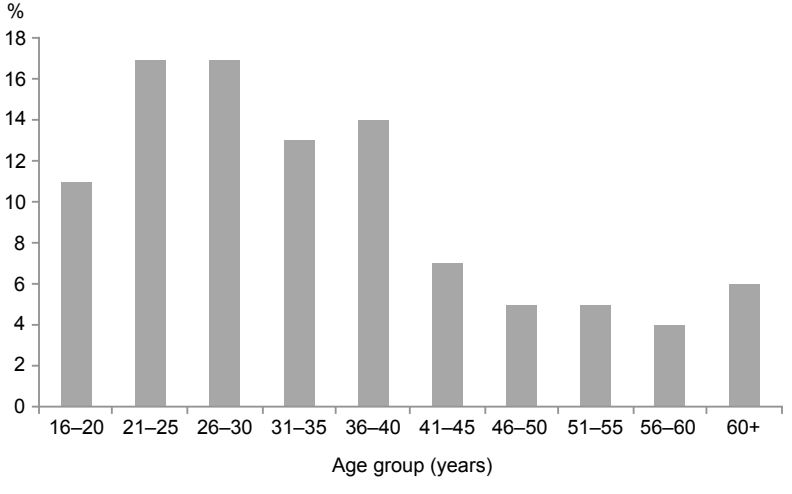

Figure 4.4 Respondents in different age groups benefiting from socialization

Jobs and running individual business

One of the most common areas in which research has been conducted is the way mobile phones help in job-related issues. This area was also covered by PICTURE Africa's questionnaire and the analysis is developed in this section, considering two categories: help to find jobs and help to run individual businesses.

In gender terms, 47 per cent of females perceived benefits in this category, and 45 per cent of males. Among the group of people who perceived benefits in this category, 67 per cent were females.

In Uganda, only 28 per cent of the respondents considered there were benefits in terms of jobs and/or running individual businesses; the percentage was similar in Tanzania. In Kenya, 75 per cent of respondents felt there were benefits in this category, and in Rwanda, 42 per cent. Of those who perceived benefits in this category, 49 per cent were from Kenya, followed by Rwanda (25%), Tanzania (14%), and Uganda (12%). Again, the relatively high figures for Kenya could be due to the high penetration of mobile phones.

A high percentage of mobile phone or SIM card owners perceived benefits in terms of help to find jobs and/or running individual businesses (68%). Even those who were not owners (75%) thought they benefited from the use of a mobile phone in job/business-related issues. Of those who found benefits in this category, 96 per cent were mobile phone or SIM card owners.

Qualitative studies in the four countries found evidence of the benefits of using mobile phones for jobs and/or running individual businesses. In Kenya, it was common for business people to transfer money to make payment for goods or receive payment for goods sold. For example, buyers who had established contact with farmers sent money to them through M-Pesa, after which they delivered produce, especially vegetables, bananas, and milk, at the roadside for collection by a buyer's agent. The mobile money transfer service (largely M-Pesa), also facilitated group contributions like revolving credit and savings schemes contributions. In one of the enumeration areas (EAs) studied, farmers did not have to walk for long distances to seek veterinary services for their livestock. When in need, they called a veterinary officer who came to their farms to treat livestock. This was crucial in enhancing chances of livestock surviving, as a veterinary officer was more likely to come in time. The time saved was used for other farm activities.

In Rwanda, a businessman said he was using his mobile phone in his business of trading and that it helped him to know changes in prices in different areas. In this case, he knew when and how to sell his products and regulate his prices. In addition, farmers no longer moved long distances to go and look for clients who can buy their food after harvesting; they just called and advertised their goods and prices to customers. A female respondent said: 'Since I bought my phone, it is easy to get clients for making hair braids. Before they had to come at home to see whether I was available or not, but now they have got my number and they call me for an appointment before coming.' There

was also evidence that businessmen used their phone to communicate with their clients and suppliers, and get what they needed at the right time and the right place. With it, they could be informed about the prices of items they needed that were at markets located in other parts of the district and the province at large. Businessmen could also communicate with their service providers and product suppliers without going to the marketplace, or even when they went there, they at least got some information first.

There were also some negative outcomes. For example, some household members reported losing opportunities for jobs because they could not be contacted. An example was a photographer, head of a household, who was losing business after he lost his mobile phone because his clients could no longer call him. Many households also complained they had seen increased household expenditure on mobile phone credit.

In Tanzania, the use of mobile phones had increased the number of clients for micro-entrepreneurs, with one person stating that his customers had increased from 6 to 16. However, some of the groups felt that mobile phones were impoverishing the poor who were not business persons as illustrated by the following quote from poor people in Dar es Salaam: 'Mobile phones can reduce poverty but applies mostly for business people (men, women, traders). For ordinary income earners there is wastage of resources. The handset exploits us and does not help us. Money is taken out of the country; does not help the local economy.' A similar sentiment was echoed by a group of professionals in Moshi when they said: 'There are benefits of mobile and internet services to poverty reduction, but they exploit people who do not set their priorities (phones become an addiction to some people).'

In Uganda, a woman, who is an entrepreneur, commented: 'Inquiries about the availability of merchandise, prices, transport, costs were made before physical travel and incurring of transport costs.' Mobile phones were also used to achieve better prices – which were negotiated after confirming the prevailing prices in the markets. As one young woman said 'Even if one was unemployed, if a neighbour has work like typing, he/she just brings it or calls you to collect it and you complete that task and get paid while at home.' Other business uses of mobile phones included

- selling airtime credit cards,
- coordinating several retail businesses, and
- sending money to relatives in rural areas via the recent mobile money remittance facility offered by many service providers.

In terms of education, in the group with tertiary education as the highest education level, 63 per cent considered there were benefits in the job/business category, with values of 42 per cent and 44 per cent for primary and secondary education respectively. The majority of respondents who had benefited in this category had secondary education as the highest level achieved (54%); with 27 and 18 per cent for primary and secondary education respectively.

Of public phone users, only 30 per cent thought there were benefits from using a mobile phone in jobs and/or running individual businesses. In contrast, half of the respondents who were not public phone users perceived benefits in this category. Of those who thought there were benefits in this category, 86 per cent were not public phone users.

Among urban respondents, 43 per cent thought they benefited from using a mobile phone in jobs and/or running individual business; among rural respondents the percentage was slightly higher (50%). Among the whole group of respondents that found benefits in this category, 54 per cent lived in rural areas.

Figure 4.5 shows the distribution among age groups of all the respondents that thought mobile phones helped to find a job and/or to run individual businesses. The same pattern is observed; two of the youngest groups (21–25 and 26–30) had the greatest number of respondents (18% and 17%).

Security in emergencies

Mobile phones are also seen as devices to be used in emergencies.[5] Some research has been conducted in this respect, especially in Asia after the tsunami experience in 2004.

In East Africa, 46 per cent of females believed mobile phones provided them with a sense of security in emergencies; and 48 per cent of males. Among those who perceived benefits in this category, 65 per cent were female.

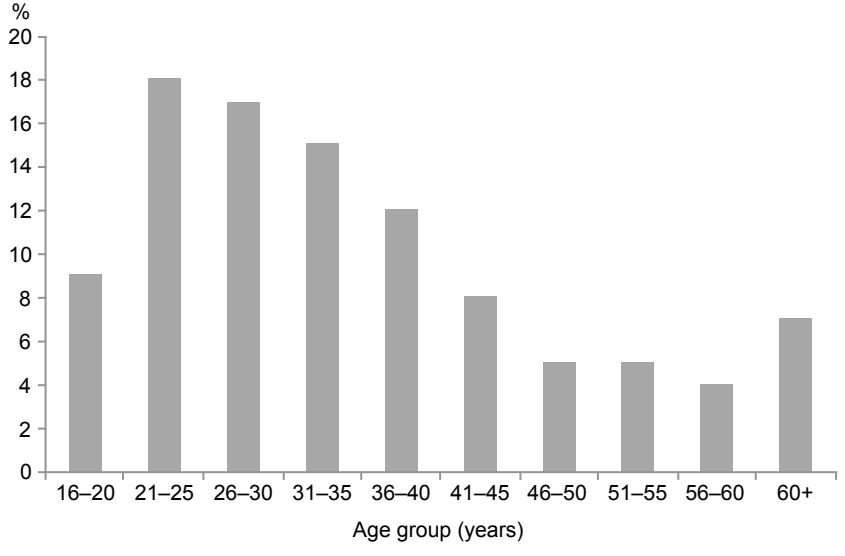

Figure 4.5 Respondents in different age groups benefiting from help to find jobs and/or run businesses

In Kenya, 85 per cent of the respondents thought mobile phones provided them with a sense of security in emergencies. In Rwanda, Tanzania, and Uganda the percentages were considerably smaller (37%, 26% and 24% respectively). Of the group of respondents who believed there were benefits in terms of security in emergencies, 56 per cent were from Kenya, followed by Rwanda (22%), Tanzania (12%), and Uganda (11%). Again, the relatively high figures for Kenya could be due to the high penetration of mobile phones.

The qualitative studies in the four countries found overwhelming evidence of the use of mobile phones to deal with security in the case of emergencies. In Kenya, it was found that security had been enhanced by using mobile phones to warn people of impending danger. In situations where money was needed, people made phone calls to their friends and relatives who sent them money to solve the problem through the mobile phone. One example was where a respondent collapsed and found herself in hospital. When she regained her senses, she called her husband who came to pay her medical bills and took her home. People also made calls to the police or relatives for help during emergencies. In one of the EAs studied, the assistant chief had an elaborate network of individuals to report criminal activities through mobile telephone calls or text messages. He confirmed that this had helped improve security in the area.

In addition, during the violence that followed a disputed national election in 2007, characterized by running battles between people and police officers, and damage and destruction of property by hooligans and thieves taking advantage of the lapse in security, among other acts of lawlessness, people followed the development through mobile phones and radio. Mobile phone calls and text messages were also used to find out the location of relatives and friends and their safety, and to alert friends and relatives of any impending danger to enable them to move to safer locations. After the violence, mobile phones helped to promote safety, including sending airtime and money to relatives and friends in distress.

It was also found that people suffering from HIV/AIDS used mobile phones to call for help when they were unable to assist themselves, to obtain information from support groups, and to talk to relatives who lived outside the village. In another case, one household made a call to an organization that helps people infested with jiggers,[6] who came and helped the household. Through these means, mobile phones had been instrumental in handling situations of vulnerability.

In Rwanda, an old woman said that one time she got a tumour and she borrowed a cell phone and called her daughter to come and take her to the hospital. In another account, an old widowed lady living with three young children explained: 'One night, about midnight, our house collapsed while we were inside. We managed to get out of it but we could not rescue everything that was inside. I immediately went to a neighbour who had a mobile phone. She lent me her phone and I called the coordinator of our village and other people, they came and managed to get everything out of the house.'

In addition, the mobile phone had been used in the following incidents:

- In Western Province in Rwanda, mobile phones were used a lot to save the lives of people during an earthquake catastrophe.
- People no longer carried their sick on traditional stretchers to the hospital – they called ambulances when they had a sick person at home.
- People could contact the police using cell phones, which contributed to a reduction in violence and other insecurities among the youth.
- One man was in hospital for six months and none of his family members could be available all the time – whenever he needed them for help, he used to flash his relatives using the nurse's cell phone, and the relatives could call him immediately and bring money for food and/or hospital fees.

In Tanzania, mobile phones were used to get assistance during emergencies and to rescue relatives held by the police. In Uganda, mobile phones were used for rapid dissemination of information to relatives and friends in times of stress, illness, robbery, and bereavement via direct calls, SMS, or flashing. Mobile phones were also used to inform internally displaced persons (IDPs) about insecurity and to advise them to move to safe areas. The participants also pointed out that increasingly burials and other social functions like weddings, family gatherings, and parties were being arranged using mobile phones.

In terms of ownership, 47 per cent of the group of respondents with a mobile phone (or a SIM card) benefited from a sense of security in emergencies. Of the respondents who perceived this kind of benefit, 97 per cent owned a mobile phone or a SIM card.

In terms of maximum education level achieved by a member of the respondent's household, 66 per cent of those with tertiary education as the highest education level, thought using a mobile phone provided them with a sense of security in emergencies, the corresponding values for secondary and primary education were 46 per cent and 34 per cent respectively. The majority of respondents who perceived benefits in this category (54%) had secondary education as the maximum education level, followed by tertiary (25%), and primary education (20%).

Among public phone users, only 33 per cent benefited with a sense of security in the case of emergencies through the use of mobile phones. The figure was much higher for respondents that did not use public phones (49%). Of those who thought there were benefits in this category, 90 per cent were not public phone users.

In terms of location, 42 per cent of the group of urban respondents considered that the use of a mobile phone provided them with a sense of security in emergencies, and 51 per cent of rural correspondents. Of the whole group of respondents that found benefits in this category, 55 per cent lived in rural areas.

The distribution among age groups of all the respondents that thought mobile phone use provided them with a sense of security in emergencies is shown in Figure 4.6. The same pattern was found, with the greatest number (18% and 16%) found in two of the youngest groups (21–25 and 26–30).

Factors determining the perception that mobile phone use makes life easier

Individuals in the PICTURE Africa project were asked if they thought that mobile phone use made their lives easier, in a broad sense. We considered this question and studied the factors that determine this perception. A logit model (Cameron and Trivedi, 2005) was used considering variables such as gender, age, average age of the household, average education years of the household, public phone use, location, affordability perception, mobile phone ownership, country dummies, and the use of radio, TV, and the internet.

In this case, we are working at the individual level, considering all the respondents except for those that indicated they do not use mobile phones.[7] The results are shown in Table 4.1. The dependent variable takes the value 1 if the respondent thinks mobile phone use makes his or her life easier, and zero otherwise.

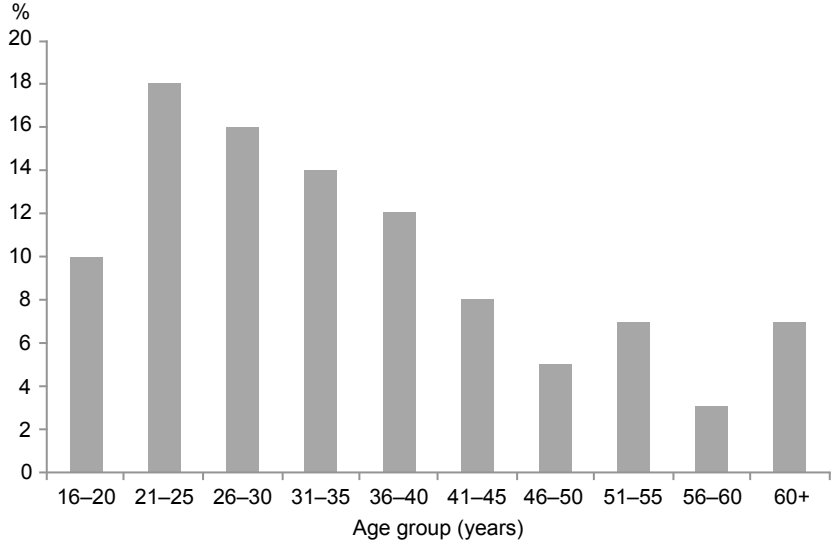

Figure 4.6 Respondents in different age groups with a sense of security from mobile phones in emergencies

Table 4.1 Logit results – factors determining the perception that mobile phone use makes life easier

	Model 1		*Model 2*	
Variable	*Coefficient*	*Marginal effect*	*Coefficient*	*Marginal effect*
Female	–0.2483	–0.0180	0.2774	0.0209
	(0.297)	(0.022)	(0.385)	(0.029)
Age	–0.0115	–0.0009	-0.0114	–0.0008
	(0.011)	(0.001)	(0.011)	(0.001)
Education mean	–0.1886***	–0.0141***	–0.1994***	–0.0144***
	(0.052)	(0.004)	(0.053)	(0.004)
Mean age hh	0.0349**	0.0026**	0.0350**	0.0025**
	(0.017)	(0.001)	(0.017)	(0.001)
Public phone use	–0.6405*	–0.0584*	–0.6294*	–0.0555
	(0.396)	(0.044)	(0.400)	(0.042)
Rural	–0.1545	–0.0116	0.5417	0.0394
	(0.321)	(0.024)	(0.456)	(0.033)
Tanzania	–2.8791***	–0.4146***	–2.9108***	–0.4134***
	(0.479)	(0.092)	(0.484)	(0.093)
Kenya	1.5573*	0.0960*	1.6776*	0.0993**
	(0.879)	(0.042)	(0.483)	(0.040)
Uganda	–2.2146***	–0.2883***	–2.2028***	–0.2795**
	(0.549)	(0.103)	(0.884)	(0.102)
Listen radio	–0.7147**	–0.0444**	–0.7347**	–0.0440*
	(0.345)	(0.020)	(0.545)	(0.019)
Internet user	0.7302	0.0439	0.8361	0.0473
	(0.526)	(0.026)	(0.344)	(0.025)
Watch TV	0.2736	0.0204	0.2993	0.0216
	(0.299)	(0.023)	(0.543)	(0.022)
Mobile owner	0.3330	0.0283	0.2852	0.0231
	(0.583)	(0.056)	(0.301)	(0.051)
Thinks calls are expensive	0.2003	0.0154	0.2428	0.0182
	(0.332)	(0.026)	(0.561)	(0.026)
Rural female			–1.1182*	–0.0987*
			(0.582)	(0.062)
Constant	3.9754		3.7093	
	(1.009)		(0.977)	

Pseudo R^2		0.3231	0.3306
Classification table	Yes	97.24%	96.68%
	No	44.28%	45.99%
	Total	75.56%	77.25%
Hosmer–Lemeshow Test		7.76 (p-value: 0.4571)	4.72 (p-value: 0.7868)
Chi-squared Test of global significance		78.46 (p-value: 0.000)	75.71 (p-value: 0.0000)

Note: Dependent variable = 1 if the respondent thinks mobile phone use makes his/her life easier
Number of observations after performing the influential observations analysis: 488
* Significance level: 0.1
** Significance level: 0.05
*** Significance level: 0.01

Variables such as 'being a female', 'age', and 'living in a rural area' have a negative but not significant impact on the probability of perceiving that mobile phones make lives easier.

Average education years and average age of the household have a significant impact on the probability under analysis. The former has a negative impact, which means that the more educated the household (on average), the less the probability of perceiving that mobile phones make lives easier. In contrast, the higher the average age of household members, the higher the probability of thinking that mobile phones make lives easier.

The effect of other media use such as public phones and radio is also significant, but negative. The fact of being a public phone user or a radio listener decreases the probability of perceiving mobile phones as making lives easier.

In terms of countries, there were negative and significant effects on the probability in Tanzania and Uganda (relative to the omitted country, Rwanda), whereas the effect on Kenya was positive and significant (relative to Rwanda).

Conclusion

Using the database generated during the course of the PICTURE Africa study in Eastern Africa, we characterized the benefits perceived from the use of mobile phones by respondents. Quantitative evidence was given content by the qualitative component, through which important narratives were gathered to illustrate the different benefits that people obtain from using mobile phones.

Of particular interest to us was that there is a different scope of perceived benefits according to certain respondent characteristics. For instance, gender differences make statistical sense for those perceiving benefits in socialization, with more females than males. Owners of SIM cards or phone terminals were more likely to declare that their mobile phone brings benefits in saving travel time and costs, and in getting jobs and running businesses.

There seems to be a clear substitution effect for mobile phone users with respect to public phone use: those not using a public phone perceived benefits from their mobile phone in all categories. Finally, rural mobile phone users only showed statistically significant differences with respect to urban ones for security in emergencies.

The widespread use of mobile phones by poor and marginalized communities in Africa poses new questions for research: are mobile phones an effective means to include women into government social programmes and economic growth benefits? Or are these benefits mainly accruing to males? Is the rural/urban divide as to perceived benefits really eliminated, and what does this mean for development? How effective is the mobile phone to circulate information relevant for taking up job opportunities? What are smartphones doing to all the possible answers to these questions? These are just a few of the questions we can share.

Notes

1 For more on mobile phone effects in Latin American countries, see Fernández-Ardèvol, Galperin, and Castells (2011).
2 In 2003, mobile coverage included 41 communities, while 87 communities were covered by 2005.
3 Interestingly, mobile use depends on previous knowledge (formal education and social networks).
4 The impact of better information management is an incremental effect, while empowerment constitutes a transformational effect.
5 See Samarajiva (2005) as an example in Asia.
6 Jiggers are small parasitic insects that look like fleas found in dusty and unhygienic dwellings in most tropical and sub-tropical climates. They are the cause of a disease that causes parts of the body to rot.
7 After performing the influential observations analysis and considering all the individuals for whom the information was complete, the sample was reduced to 488 observations.

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CHAPTER 5

Access and use of ICT and its contribution to poverty reduction in Kenya

Timothy M. Waema and Obadia Okinda Miroro

This chapter investigates the relationship between ICTs and poverty reduction in Kenya using data gathered in December 2007 and March 2008 through quantitative and qualitative methods. Drawing on the sustainable livelihoods approach, analysis shows that mobile phones are emerging as a new banking paradigm due to innovative ways that people use mobile money transfer and the services provided, which have become 'mobile money for the unbanked'. ICTs contributed to an increase in people's income due to efficiency and cost savings in commercial transactions. Through ICTs, people made real-time decisions during negative shocks, which ensured safety of household members and the assets essential in their livelihoods. ICTs had also enhanced people's knowledge and awareness of their environment, which resulted in adoption of innovative agricultural practices. The contribution of ICTs to poverty reduction varied by context in terms of the ICT used and the challenges households faced.

Keywords: contribution to poverty reduction, information and communication technologies, Kenya, mobile phones, money transfer

ICTs and poverty reduction in Kenya

The unprecedented expansion of information communications technologies (ICTs) in Kenya has led to a sharp focus on the role that they play in development generally and poverty reduction especially. This is a backdrop behind the increase in the number of poor people, despite fluctuations in poverty incidence over time. The number of poor people increased from 3.7 million (31%) in 1972/73, to 11.5 million (40%) in 1994, and 13.3 million (52%) in 1997 (GoK, 2000). In 2005/06, the number of poor people was estimated at 16.6 million, or 46 per cent of the population (KNBS and MPND, 2007). The changing nature of poverty incidence in Kenya is shown in Figure 5.1.

In response, the Kenyan government has over time initiated policy, programme, and project interventions aimed at poverty reduction, often with some successes as well as failures. For example, after a decline in economic growth in the 1990s, implementation of the Economic Recovery Strategy for

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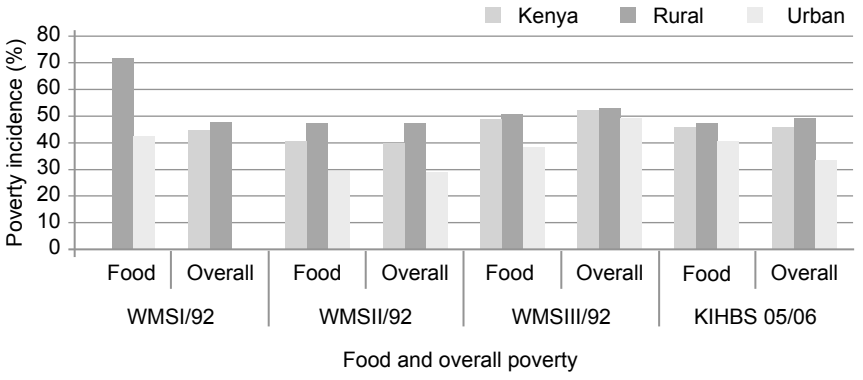

Figure 5.1 Changing food poverty and overall poverty incidence in Kenya

Source: Welfare Monitoring Surveys I and II; KNBS and MPND, 2007

Wealth and Employment Creation (ERSWEC) 2003–07 led to an increase in economic growth rate from 0.6 per cent in 2002 to 7.1 per cent in 2007 (GoK, 2009; KIPPRA, 2009). The ERSWEC is also said to have contributed to a reduction in poverty incidence from 56 per cent in 2000 to 46 per cent in 2005/06 (KNBS and MPND, 2007). Some of these gains were reversed in early 2008 due to the events following the disputed presidential elections and an unfavourable international economic environment. Despite these challenges, the Kenya Vision 2030, the current economic development blueprint, details policy and institutional reforms and programmes necessary to attain key development objectives including poverty reduction and become a successful middle-income country within the next two decades.

In the last decade or so, ICTs have featured prominently in the Kenyan government's development policies, as evident in the Poverty Reduction Strategy Paper (2001–04), the ERSWEC (2003–07), and the Kenya Vision 2030. Within Vision 2030, the ICT sector is one of the areas intended to contribute to economic growth and job creation through business process offshoring (BPO) flagship projects (GoK, 2007: 14-15). Overall, the government views ICTs as tools to promote efficiency in delivery of public services, as a productive sector, and as an enabler of development of all sectors, in order to meet the challenges of the 21st century. To optimize the sector's contribution to the development of the entire economy, the government is currently offering investment opportunities to the private sector, and has formulated policies to enhance competition in the sector.

Within the unprecedented growth of ICTs, which refer to any artefact, technique or knowledge used to create, store, manage, or disseminate information (Gerster and Zimmermann, 2003: 7), mobile telephony is especially widely acknowledged in Kenya. The increased penetration of ICTs such as mobile phones, radio, internet, and television, has the effect of these technologies

reaching a greater proportion of the population, including the poor. This has been achieved through, among others, implementation of a national fibre backbone, connected to undersea fibre, and expansion of ICT infrastructure by private providers, like mobile phone service firms. However, this expansion of ICT supply has not been accompanied by studies that examine its contribution to poverty reduction, one of the challenges to attaining human development. It appears that the focus is more on the supply side of ICTs and their potential to improve people's lives (see Tiwari, 2008). Furthermore, research on ICTs proceeds from the actions of states and their agencies, few of which address usage patterns at the individual level, even though this is fundamental to an understanding of the interface between technology and users (Akpan-Opong, 2010: 181). Inadequate understanding of the relationship between ICTs and poverty reduction from the demand side, especially at a micro-level, may lead to development of policies that are inappropriate for the needs and interests of ICT users, especially the poor. As policy makers are being urged to invest national budgets on ICT infrastructure, evidence, particularly of how such investments would contribute to people's livelihoods, is imperative. This research was conducted to enhance the understanding of the link between ICT access and use and poverty reduction, especially at the micro-level, which remains under-researched in Kenya. This chapter is about how ICTs contribute to poverty reduction. It addresses the question 'How has access to and use of ICTs contributed to poverty reduction at the household level in Kenya?'.

Overview of the status of ICTs in the country

The supply side of ICTs has increased substantially in Kenya. For example, the number of mobile phone subscribers has more than tripled over the past five years, while FM radio stations have proliferated all over the country. There has been a lot of enthusiasm on internet usage with the landing of three undersea fibre optic cables in Mombasa and their subsequent operationalization. Masts of mobile phone service providers and communication equipment now dot both the rural and urban landscapes, and advertisements for some form of ICTs are common on billboards along major highways and roads.

Although mobile phones were first introduced in Kenya in 1992, based on extended total access communications systems (ETACS) technology, development has seen a shift to the second and third generation of global mobile systems (GSM). Mobile phone subscriber growth did not take off immediately because of high costs of mobile phone handsets. Indeed mobile subscriber growth was marginal, totalling less than 20,000 for a period of seven years (1993–99). Subscriber growth increased substantially after the enactment of the Kenya Communications Act (KCA) 1998, which introduced competition in the industry due to licensing of a competing GSM operator and the investment in network expansion. Safaricom was Kenya's first GSM operator and began offering services in 1997. Kencell, the predecessor of Celtel and Zain,

now Airtel, was the first licensed mobile operator and became the second GSM operator in January 2000. There are four mobile operators: Safaricom Ltd, Airtel Kenya Ltd, Telkom Orange Kenya Ltd, and Essar Telecom Kenya Ltd, formally Econet Wireless Ltd. Safaricom has the highest market share (67.7%) by subscriptions; there were 26.4 million mobile subscriptions in the country by September 2011 (CCK, 2011).

There are three fixed-line operators; Telkom Orange Kenya Ltd, Flashcom, and Popote Wireless. The last two provide fixed wireless telephone services, while Orange provides both fixed terrestrial lines and fixed wireless telephone line services. Orange still remains the dominant operator in this segment, with the others slowly gaining market share. Unlike mobile communications services, which have recorded exponential growth, fixed-line communication services seem to have stagnated over time (Figure 5.2).

Payphones, including community payphones that were introduced by the operators between 2002 and 2003, increased during the first four years of their roll-out. This subsequently declined, from 29,888 in 2006 to 20,822 in 2007, which could be attributed to cheaper mobile handsets in the market, evidenced by the 56% increase in the number of mobile subscribers during the same period (CCK, 2008).

Thus, despite 'the monopoly' enjoyed by the incumbent in the nationwide provision of fixed-line services, the sub-sector has continued to experience a 6.1 per cent annual decline in the number of subscribers. The introduction of fixed wireless technology using code division multiple access (CDMA) in 2006 has, however, increased the total subscriber base. The operation in the fixed wireless network registered 10,685 subscribers in 2006, which increased to about 193,064 subscribers by the end of 2007. Generally, the number of

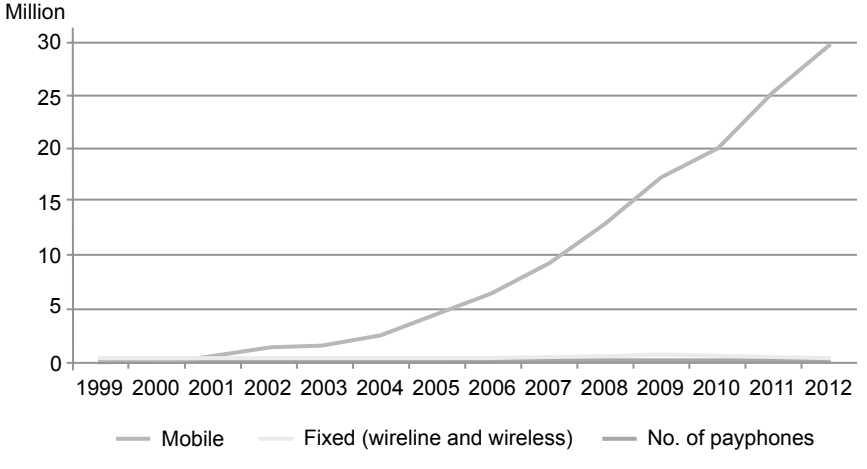

Figure 5.2 Mobile subscribers, fixed wire line subscribers, and payphones in Kenya

Source: CCK database

fixed-lines (terrestrial lines and fixed wireless) has experienced a declining trend. Most recently, fixed line (terrestrial lines and fixed wireless) subscriptions decreased to 355,493 from 374,942, between July and September 2011. Further, the majority (about 90%) of fixed network subscribers are urban customers (CCK, 2008). Figure 5.3 shows the variation in mobile phone penetration, fixed teledensity, and internet users.

The decline in fixed-line phones has been attributed to substitution for mobile and continued vandalism of copper cables. As a result, a report by the CCK (2011) shows that although the total teledensity was estimated at 68.1 per cent, 67.2 per cent of this is mobile penetration. The same CCK report further reveals that mobile money transfer subscriptions are related to the high mobile penetration, they stand at 18.4 million or 69.5 per cent of the total mobile subscriptions (CCK, 2011).

The internet first became available in Kenya during 1993 and full internet access was established in 1995. Initially, ISPs would lease analogue or digital data lines from Kenya to the US to access the internet backbone. When the telecommunications sector was liberalized in 1999, ISPs were licensed to operate formally and the incumbent was given the monopoly to operate the internet backbone as well as the provision of access circuits (leased lines, VSAT, etc) for five years until July 2004. Though Telkom Kenya developed and expanded a national backbone, the coverage area was limited to the main urban centres and the availability, reliability, and quality of the services provided was poor. Recently, the landing and operationalization of the four undersea fibre optic cables (The East Africa Marine Systems (TEAMS), SEACOM, East Africa Submarine System (EASSy), and The Lower Indian Ocean Network (Lion2)) on the Kenyan coast, building of terrestrial fibre networks and national fibre backbone, have led to improvement in internet connectivity. Thus, the capacity and quality of internet provision has improved and the cost

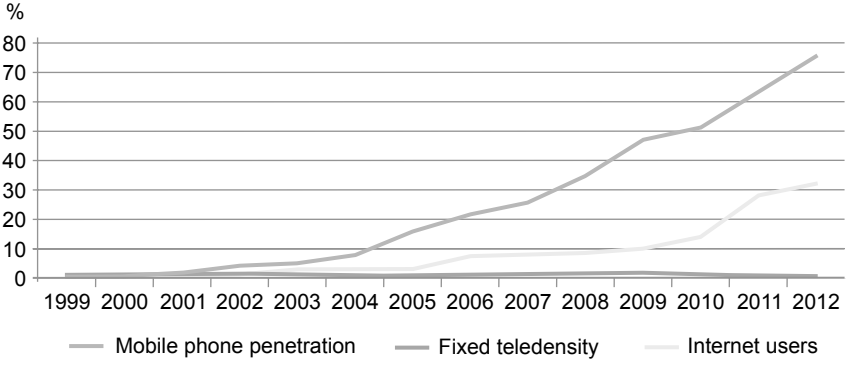

Figure 5.3 Mobile phone penetration, fixed teledensity, and internet users in Kenya

Source: CCK database

of international bandwidth has gone down over the years (Gillwald, 2010). With the use of the unified licence, the mobile operators have become the largest ISPs (Waema et al., 2010: 18). Many retail users are now using the wireless data services provided by these operators for internet access. By the end of September 2011, there were 5.42 million internet subscriptions and internet users were estimated at 14.3 million (CCK, 2011).

Expansion of the ICTs considered 'traditional' has also been on the increase. Radio is by far the most common ICT accessed and used in Kenya. A national survey by the Kenya National Bureau of Statistics (KNBS) in 2010 found that radio had the widest reach at 79.5 per cent of the Kenyan population. Further, the same KNBS survey revealed that 39.7 per cent of Kenyans had access to television while those who had access to pay TV stood at 4.3 per cent (KNBS, 2011: 22). According to Synovate, in Kenya, radio stations increased tenfold from 10 in 1999 to 107 in 2010, while TV stations quadrupled from 4 to 15 over the same period (Synovate, nd). In addition to radio stations that broadcast in English and/or Swahili, the number of vernacular radio stations has risen considerably since the first station, Kameme, was set up in 2000 (Media Council of Kenya, 2012: 3).

The ICT policy and regulatory framework

The country's ICT sector has been undergoing a series of policy reforms over time (Waema, 2005). These reforms have largely been geared towards liberalization and privatization of the sector to make ICTs competitive, accessible, and affordable. The most influential document regarding ICT legislation and regulation in Kenya is the Kenya Communications Act of 1998 (KCA, 1998). The KCA 1998 steered the liberalization and introduction of competition in the sector. This was because the Act unbundled Kenya Post and Telecommunication into five separate entities, including Telkom, the fixed-line operator; the Postal Corporation of Kenya (Posta); the regulator, the CCK, as the sector regulator; and the National Communications Secretariat (NCS), to advise the government on the adoption of a communications policy (GoK, 1998). It also created an appeals tribunal for the purposes of arbitration in cases where disputes arise between parties under the KCA 1998.

In March 2006, a policy document that recognized the inadequacy of previous Acts in dealing with issues of convergence, electronic commerce, and e-governance was published through a special issue of the Kenya Government Gazette. The document further acknowledged the need for a comprehensive policy, legal, and regulatory framework to, among others, support ICT development, investment, and application; and ensure affordability and access to ICT nationally (GoK, 2006). There is also the ICT sector Medium Term Plan (MTP) for the Kenya Vision 2030 that runs from 2008/09 to 2011/12 with a vision that 'Kenya becomes an information and knowledge-based society' (GoK, 2008a). The priorities are to reduce costs of access to ICT through infrastructure development, and affordable

hardware and software; enhance economic productivity by lowering transaction costs; encourage entrepreneurship innovation and create more jobs; and enable universal access to technology and information to build a knowledge-based economy (GoK, 2008a). The enactment of the Kenya Communications (Amendment) Bill, 2008, which amended the KCA 1998, was signed into law in January 2009. It replaced the section on information technology with a section named Electronic Transactions under Part VIA (GoK, 2008b). The Kenya Communications (Amendment) Act (2009) made CCK the converged regulator. This was in recognition of the rapid changes and developments resulting in convergence of information and communications technologies.

In 2010, the CCK introduced new regulations to deal with dispute resolution; tariff regulations; compliance monitoring, inspections, and enforcement; fair competition and equality of treatment; and interconnection and provision of fixed links, access, and facilities. For example, the CCK implemented the EU recommendations of 2009 of enforcing cost-based termination rate caps based on pure long-run average incremental cost (LRIC) in 2010, which resulted in a decline in interconnection and call termination rates. As a result, Kenya had the lowest mobile termination rates at KSh 2.21 (2.7 US cents) compared to 8.2 US cents in Uganda, 7.0 US cents in Rwanda and 7.5 US cents in Tanzania (Calandro et al., 2010: 12). The termination rate reductions in Kenya resulted in lower retail prices. Similarly, the CCK introduced an open market-based licensing regime which licenses potential operators on a first come first served basis if they meet the requirements (Waema et al., 2010).

The country has also adopted universal access principles. Universal access was to be achieved through roll-out obligations and through a Universal Service Fund (USF) from operators. The objective of the fund is to facilitate the rapid achievement of national policy goals for universal access to ICTs, by focusing on under-served areas (GoK, 2008b). A USF, managed and administered by the CCK, was established in 2009, but has yet to be implemented (Waema et al., 2010). Mobile phone operators (Safaricom and Celtel, now Airtel) have resisted the USF because of their view that they have attained their roll-out obligations while Telkom Kenya Ltd failed to meet the minimum targets stipulated in the licence (Calandro et al., 2010).

Generally, Kenya's approach towards the formulation and implementation of ICT policy and regulations has been incremental, unlike other countries like Rwanda which followed an elaborate framework and implementation plan (Adam and Gillwald, 2007). Overall, the regulatory framework in the country has changed to allow for a technology-neutral and horizontal licensing (converged) framework. Kenya migrated to a unified licensing regime (ULF) in 2007 (Waema et al., 2010). In addition, a review of ICT policies shows that ICT responsibilities are distributed in different arms of the government, with little coordination. Further, CCK does not have a formal relationship with the Monopolies and Prices Commission, and mechanisms to regulate

competition in the industry have had setbacks (Waema et al., 2010). This is evident in the inability to bring about competition in the fixed network and interference by the Kenyan government in the regulatory process (Esselaar et al., 2007). As an example, the CCK suspended implementation of the new tariff regulations due to protest by a leading mobile service provider despite the new regulations having been gazetted by government (Waema et al., 2010; Calandro et al., 2010).

Literature review on ICTs and poverty reduction

The role that ICTs play in poverty reduction is contested in the human development discourse. Not all the literature sees a direct relationship between ICT and poverty reduction. For instance, Akpan-Obong (2010) contends that recent studies on the adoption and implementation of ICTs on development and poverty reduction reveal mixed results. This debate could not have come at a better time in Kenya, where poverty reduction remains a challenge despite numerous interventions, and ICTs now feature in key development policy documents, unlike in the 1970s, 1980s, and 1990s. Because there is no general agreement on the view that ICTs bring about socio-economic and political change, the two sections that follow present arguments to support the role of ICTs in economic development and poverty reduction and a critique of this perspective. The subsequent section looks at the conceptual framework on which the analysis of the relationship between ICTs and poverty reduction is anchored.

The primacy of ICTs in economic development and poverty reduction

Proponents of ICTs take an optimistic view and highlight the positive effects of different ICTs in creating new economic, social, and political opportunities for developing countries and the poor (Tiwari, 2008). They argue that ICTs can contribute to economic development as a sector of economic activity or can enable productivity of other sectors of the economy (see Chacko, 2005; McNamara, 2003). Based on this optimistic view, many development agencies and organizations tend to suppose that ICTs have the capacity to bring about positive change (Akpan-Obong, 2010) or transform the socio-economic and political processes of a country when appropriately deployed, especially under an enabling environment (McNamara, 2003). This is because challenges that arise from poverty have an information, communication, or knowledge component.

One of the arguments is that ICTs can enhance the productivity of other sectors of an economy. From this perspective, ICTs can play a significant role in poverty reduction interventions by governments and other development agencies (Sreekumar and Rivera-Sánchez, 2008); they can stimulate the development of other sectors and expand economic growth (Chacko, 2005); or improve the efficiency of governments in providing services that contribute

to poverty reduction (Kenny, 2002). ICTs can also enhance the productivity of the manufacturing processes and industries and as a result lead to a reduction in production and transaction costs (Chacko, 2005). As a consequence, a reduction in costs can generate employment opportunities (Tiwari, 2008). In support of this view, a study by Cecchini and Scott (2003) in India found that use of personal digital assistants (PDAs) by auxiliary nurse midwives led to efficiency in the provision of their services because it reduced paperwork and data entry. The same study found that use of smart cards with an embedded microchip containing information on clients' credit histories helped reduce the transaction costs of a microfinance institution that operated in Andhra Pradesh.

Use of ICTs can enhance poor people's opportunities and strengthen their voice. This is attained when poor people access relevant information and knowledge that can broaden their choices to improve their livelihoods (Chacko, 2005; Cecchini and Scott, 2003; McNamara, 2003). Information obtained through ICTs is important when people have to make quick decisions in a dynamic environment characterized by changing socio-economic and political conditions. A study by Cecchini and Scott (2003) found that farmers obtained information about crop prices in regional wholesale markets in telekiosks, which enabled them to negotiate for better terms. It is further pointed out that ICTs contribute to social inclusion when incorporated in the design of empowerment interventions (Tiwari, 2008; Sreekumar and Rivera-Sánchez, 2008).

ICTs have the potential to promote governance and transparency of institutions. This is because they enhance communication and facilitate interaction between people and those in positions of authority (Chacko, 2005). An evaluative research by Cecchini and Scott (2003) in India, focusing on Gyandoot, a government-owned computer network, found that the initiative had improved people's access to government services through a reduction in the time and money people spent to communicate with the government. The initiative also provided immediate transparent access to local government data and documentation. This same study found that introduction of computerized milk collection centres increased transparency and the speed of processing milk delivery and payment, which led to fair prices for farmers.

In dealing with environmental risks and extremes of weather conditions, ICTs act as an early warning system. Arunachalam (2004), studying a micro-level ICT project focusing on knowledge centres in a cluster of ten villages in southern India, found that the information obtained enabled fishermen in the coastal area to know when it was safe to venture into the sea. This prevented deaths or loss of boats at sea.

Although the foregoing discussion suggests that use of ICTs can contribute to economic development, some proponents of this view caution that focusing on ICTs alone would not contribute to economic development and poverty reduction (McNamara, 2003). They also note that the contribution of ICTs to economic development and poverty reduction depends on

other factors like an enabling environment. This implies that they recognize the role that the context plays within the ICT development debate. Other scholars are more critical of the role that ICTs play in development and poverty reduction.

Fault lines in the contribution of ICTs to development and poverty reduction

One of the key arguments is that there is little empirical evidence of the impact and role of ICTs in economic development and poverty reduction. It is argued that the proponents of ICTs tend to overestimate the role that ICTs play in development and poverty reduction and emphasize the supply of ICTs (Sreekumar and Rivera-Sánchez, 2008; Tiwari, 2008). Others are of the view that a positive relationship between ICT and human development is either weak or does not come out clearly (Chacko, 2005; Adeya, 2002). For instance, there are no analytical studies on the labour absorption capabilities of rural ICT (Sreekumar and Rivera-Sánchez, 2008) or evidence that the relative benefits of investment in ICT infrastructure would compare with the benefits from investments in education, health, roads, dams, and industrial parks (Leye, 2009). It is further argued that evidence from ICT projects is problematic, especially when it comes to scaling up interventions (Wade, 2000), and that cases of success in ICT projects are isolated or anecdotal, while performance of ICT experiments has been dismal (Sreekumar and Rivera-Sánchez, 2008). Thus, huge investments in ICTs do not necessarily mean that the relationship between ICTs and poverty reduction is unproblematic (Leye, 2009).

ICTs may favour privileged people or groups in society. In this way, ICTs could exacerbate the gap between rich and poor and widen the income gap. This is because access to and use of ICTs is not just about connectivity but also about people's capability to acquire and use the tools and content in ways that improve their lives (Leye, 2009). The result is that those who lack these prerequisites (capabilities) are excluded from the benefits (Leye, 2009). This could be made worse by the idea that not all ICTs are easily delivered or assimilated to the poor due to technical and operational reasons. Thus, the primary focus should not be on connectivity, because such a focus wrongly assumes that the digital divide is a major obstacle to development (Leye, 2009). Sreekumar and Rivera-Sánchez (2008) point out from their study that although farmers accessed market prices of agricultural commodities, the information was useful to farmers who had storage facilities and those who were financially able to buy inputs and agricultural implements and could harvest large quantities. Similarly, Soriano (2007) found that making telecentres available in rural communities did not give the poor access to them or the ability to use the information to improve their livelihoods. Soriano notes that the telecentres did not enable poorer farmers to market their own produce due to their inability to produce in large quantities, lack of transportation facilities, and huge expenses to market the goods on their own.

These studies imply that information about market conditions or prices for crops does not of itself change the agency of poor farmers. In support of this view, a study by Tiwari (2008) found that people with higher levels of income, literacy, and land ownership accessed ICT services more than those with lower literacy, incomes, and land ownership. These findings question the assumption that ICT can reduce the digital divide and enable market participation of poor farmers.

The outcome of ICT access and usage is influenced by the context, an issue that is not clearly highlighted while documenting the benefits of ICTs (Wade, 2000; Chacko, 2005; Tiwari, 2008; Akpan-Obong, 2010). It is further noted that the digital divide is a reflection of broader socio-economic inequalities (Arunachalam, 2004; Leye, 2009). This means that the expectation that ICTs can solve a variety of development challenges ignores the power relations, social structures, and agency of actors, which influence ICT access and usage in a country or region (Sreekumar and Rivera-Sánchez, 2008). This is because ICTs are not neutral tools but commodities deployed in a neo-liberal context (Leye, 2009). Proponents of ICTs focus on awareness building, conscious design, and incorporation of gender concerns, rather than the power relations that characterize ICTs and commodities (Sreekumar and Rivera-Sánchez, 2008). Soriano (2007) found that telecentres were established on the dominant relationships and power structures, which weakened their ability to empower poor people. It is therefore thought that other conditions are necessary before farmers can utilize information on market conditions to make production decisions that improve their livelihoods (Soriano, 2007).

The view that ICTs enable developing countries to skip industrialization and leapfrog into the information age remains problematic. ICTs are unrealistically considered as inherently enabling and able to bypass all institutional and infrastructural obstacles (Wade, 2000), which tends to imply that there is only one valid model of development (Leye, 2009). This is a bias that tends to privilege civil society-based initiatives with private partnerships, over state-centric models of technology transfer and diffusion (Sreekumar and Rivera-Sánchez, 2008). By focusing on the supply side of ICTs, they do not show how ICTs can address inequalities and human development challenges at all levels (Chacko, 2005; Wade, 2000).

What emerges from both the theoretical and empirical literature outlined above is that a positive relationship between ICTs and poverty reduction remains contested. While others argue that ICTs have provided global dividends that have trickled down to the poor, some argue that the poor cannot benefit from ICTs because of lack of means with which to access ICTs, lack of skills to use ICTs, and inadequate information about the usefulness of ICTs. This paper contributes to this debate by looking at how ICTs contribute to poverty reduction at a micro-level.

Analytical framework

To analyse the relationship between ICTs and poverty reduction, this paper draws on the sustainable livelihoods approach (SLA), a framework used in understanding multidimensional aspects of poverty and poverty reduction. The SLA illustrates the different linkages between livelihood assets, vulnerability context, institutions and policies, and people's livelihood outcomes (Messer and Townsley, 2003). The approach emphasizes the importance of the capitals or assets that people have access to or draw on, and the context within which they devise strategies to improve their lives. Due to its flexibility in understanding people's livelihood outcomes and poverty reduction, the SLA has been extended and used to analyse ICT applications for poverty reduction (see Duncombe, 2007). The framework illustrated in Figure 5.4 shows linkages of how livelihood strategies are mediated within a given context and the resultant livelihood outcomes.

According to this framework, households and individuals draw on certain assets or capitals in pursuit of their livelihood strategies, mediated by context. Policies, regulations, and institutions, as well as the ICT system, influence people's livelihoods strategies (Messer and Townsley, 2003). Policies and institutions may make it easy or difficult for people to achieve their livelihood objectives by controlling access to those assets, or by influencing how, where, when, and by whom they are used (Messer and Townsley, 2003;

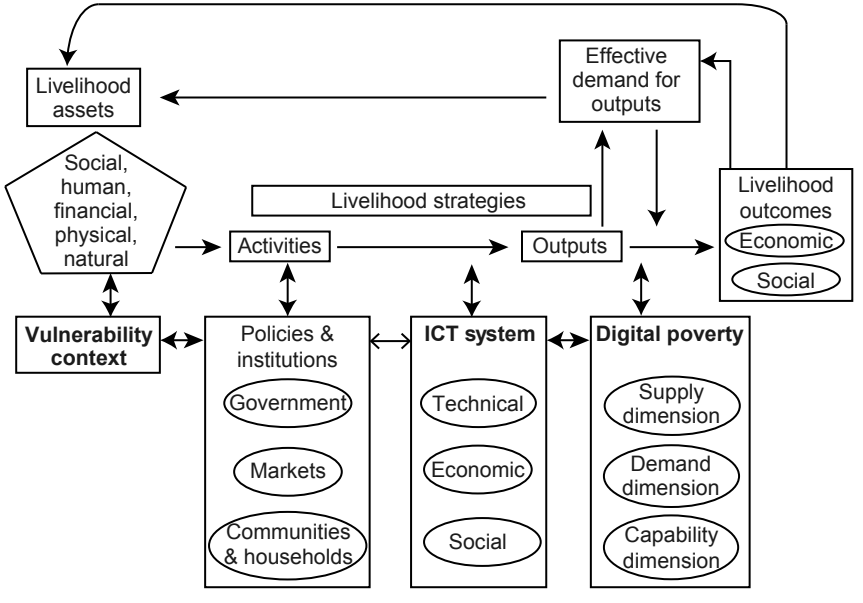

Figure 5.4 The livelihoods analysis framework

Source: adapted from Duncombe, 2007

Duncombe, 2007). Therefore, livelihood outcomes, either social or economic, result from the combination of livelihood assets at the disposal of households or individuals, the vulnerability context in which they operate, and the policies, institutions and processes including the ICT system around them. Livelihood outcomes can be adequate or inadequate for individuals or households. In this regard 'Poverty can be thought of as an "inadequate livelihood outcome"' (Messer and Townsley, 2003: 8), while poverty reduction is viewed as a favourable livelihood outcome in terms of improvement in people's material or non-material lives.

In this chapter, poverty reduction is conceived as multidimensional and includes increase in income; participation in governance and enhanced voice; increased access to public goods and services; acquisition of education in terms of knowledge and skills; reduced vulnerability or increase in risk preparedness; and increased capacity to cope with, or prepare for and adapt to, natural or economic shocks (Harris, 2004). Therefore, poverty reduction incorporates economic and social aspects of people's lives and entails different kinds of change that affect social, economic, and political aspects. This is because there is no universally applicable way to add up the reduction of poverty affecting different people in different circumstances in different places over time (Barder, 2009: 1). By looking at ICTs as the complete range of communication, media, and information flows in a community with technical, economic, and social dimensions, this chapter looks at what people are able to do with ICTs to improve their lives. ICTs are seen as tools that mediate social and economic livelihood outcomes of households and individuals.

Methods

Sample selection

This chapter is based on a study that utilized quantitative and qualitative methods. The quantitative component involved a survey of 400 households selected from urban and rural areas in Kenya. The quantitative data were gathered in December 2007 and March 2008, and the qualitative data were gathered in March 2008. The sample for the survey was drawn from the Research ICT Africa (RIA) (a study that investigated access and use of ICT in Kenya) sample of July 2007, which was based on the NASSEP IV sampling frame of the KNBS. Sampling entailed categorizing the RIA sampled districts into rural and major urban areas. Thereafter, each of the major urban and rural areas was stratified into poor and non-poor followed by categorizing the poor into several strata, based on the Kenya Integrated Household Budget Survey (KIHBS) classification. The RIA sample comprising major urban was grouped into five socio-economic categorizations, namely upper, upper lower, middle, lower middle, and lower. According to the KNBS, the last two categories, i.e. lower middle and lower, comprise the poor. The RIA sample of major urban consisted of 38 enumeration areas (EAs), out of which 16 were classified as

poor and form the focus of this study. Further, three municipalities, namely Nairobi, Kisumu, and Nakuru, were purposively sampled from a list of six under the RIA sample. Thus, six EAs were purposively sampled from the 16 that comprised the poor under urban based on several facts, including available resources. Further, of these six EAs, two EAs were selected from each of the selected three municipalities, one each from lower middle poor (category 4) and lower poor (category 5). However, due to post-election disturbances at the beginning of the year 2008, the two EAs sampled in Nakuru Municipality, were replaced with two EAs of similar socio-economic category in Nairobi. The RIA sample classified as rural, other urban, was categorized into poor and non-poor, 56 districts fell under poor from the possible list of the then 72 districts in the country. The selected 56 districts were categorized further into four poverty quartiles. A total of 14 EAs comprising 70 per cent of the sample size were randomly sampled from the above districts. An attempt was made to draw the rural sample from two contrasting provinces, namely: Nyanza and Central. Nyanza province had the widest range of categories of the poor while Central had only two categories of the poor. In total, therefore, 20 EAs were sampled, 6 from urban and 14 from rural areas. Twenty households were systematically selected from each of the 20 EAs using the lists of households developed by KNBS, making a total sample size of 400 households.

The qualitative component was sampled from within a sub-sample of the households covered by the survey. Three EAs were purposively selected from each of the three provinces covered by the survey for in-depth interviews. These three EAs were selected based on the diversity of ICT access and usage themes sought by this study. In Nairobi province, an EA in an informal settlement was selected because it is prone to political and social conflict and the study sought to investigate use of ICTs during social and political conflicts. In Nyanza, an EA was selected because it has been largely affected by shocks, especially HIV and AIDS. Lastly, in Central province, an EA was selected because most people in the area engage in intensive smallholder faming. Therefore, these three EAs offered an opportunity to understand how access and use of ICTs contributed to poverty reduction in different contexts.

Data collection and analysis

Sampled households were identified using EA maps in urban areas with the assistance of the KNBS staff, and village elders in rural areas. Selected households that did not wish to be interviewed, those that were vacant or demolished, or those whose occupants were not available were systematically replaced. The survey involved face-to-face interviews with heads of households, the principal respondents. However, in households where the head was not available, the next most senior member of the household who was knowledgeable in household expenditure and ICT access and usage by household members was interviewed. In addition, another individual, randomly selected from among household members and visitors that were to stay at a

household that night and were 16 years or over, was interviewed for purposes of their ICT access and usage.

The survey was conducted in December 2007 and between March and April 2008. Data were collected using PDAs. The questionnaire had a fixed design and almost all responses were pre-coded, respondents were interviewed face to face and responses were directly captured onto PDAs. Household data on socio-economic and demographic characteristics, and ownership, access, and usage of ICTs, were gathered. Data saved in PDAs were regularly transferred to the laptop computer by synchronization, exported, and saved into a statistical package for social sciences (SPSS) database. Analysis of survey data involved generation of frequency distributions, measures of central tendency, and measures of dispersion, critical in assessing distribution of responses. Cross-tabulations were used to examine the relationship between various ICT access and use variables and respondent characteristics.

In assessing the relationships, Pearson's chi square test significance values were calculated using SPSS and the p-values obtained from the tests were analysed at the 0.05 level of significance. The 400 households covered were categorized into poor and non-poor groups using the cost of basic needs (CBN) approach. To arrive at this, consumption aggregates in the form of monthly expenditure per adult equivalent were calculated based on the survey data collected from households for both total food consumption and total non-food consumption. The demographic data were used to calculate the household size and the corresponding adult equivalence in each household based on the Anzagi and Bernard equivalence scale, the scale usually adopted in household surveys of well-being in Kenya by the KNBS (KNBS and MPND, 2007). An external basket (KNBS basket developed using KIHBS dataset), and costing the basket using the national consumer price index (CPI) prices corresponding to the months that data were collected, was used. The overall poverty lines in monthly adult equivalent terms were computed as follows: KSh 2,173.1, KSh 2,398.9, and KSh 2,503.1 for December 2007, March 2008, and April 2008, respectively. The poverty category was cross-tabulated with other variables to establish the relationship between ICT access and usage and poverty. It should, however, be noted that due to the small size of the sample, the findings are not representative of the country but aim to shed light on how ICTs contribute to poverty reduction, particularly among poor households in urban and rural areas in the country.

Qualitative data were collected through focus group discussions by use of interview schedules. In each of the three EAs sampled, three focus groups targeting youth, women, and men were conducted separately. Members that made up the groups were purposively selected from each of the three EAs. Each focus group discussion was facilitated by a moderator and a note-taker. Discussions were aimed at obtaining information about ICTs and how they contribute to poverty reduction, and factors that limit household's access and use of ICTs. Qualitative data analysis was an iterative process. The first step involved transcription of interviews for each of the focus groups; the

second step involved reading the transcripts and coding the data by identifying themes in relation to key ICTs and how they contribute to poverty reduction. The codes were described and their reliability tested. Further analysis involved generation of analytic codes used in establishing relationships between the ICT access and usage themes and poverty reduction based on the conceptual framework. This was useful in explaining processes evident in the raw data.

ICT access and use by socio-economic profile

The households interviewed had a total of 1,737 members, 51 per cent of whom were female. The mean age of household members was 24 years and the most common age was 20 years. The oldest household member was 90 years. About half of the household members were 19 years and below, while 60 per cent were 24 years and below. The distribution of these household members in different age categories based on sex is illustrated in Figure 5.5.

This structure shows a wide base that sharply narrows with increasing age of household members, which characterizes a youthful population and a lower life expectancy. It compares well with the KIBHS 2005/06 which found the proportion of the population 14 years and below to be 41.9 per cent (KNBS and MPND, 2007). It further shows a high dependency ratio, because fewer economically active household members support the majority who are below working age or in school. This is made worse by high unemployment levels within the economically active population in the country.

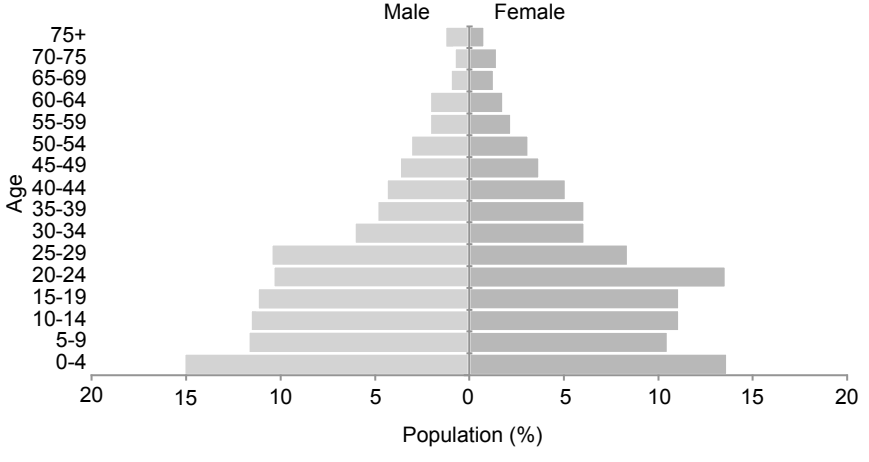

Figure 5.5 Age–sex distribution of household members

Source: field data, 2007/08

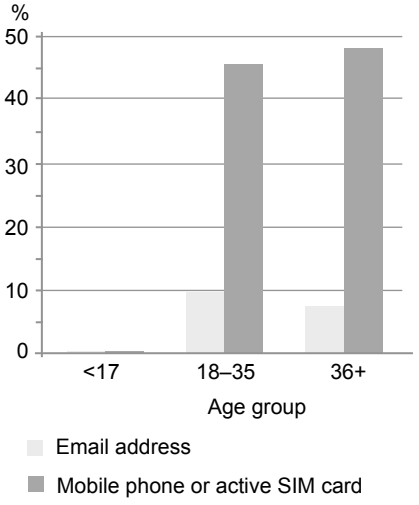

Figure 5.6 ICT access by age group, Kenya

Source: field data, Kenya, 2007/08

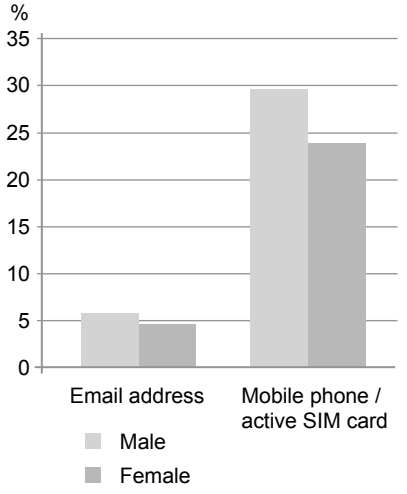

Figure 5.7 ICT access by gender, Kenya

Source: field data, Kenya, 2007/08

In terms of access to ICTs, 5.2 per cent of household members had an email address, while about a quarter (26.6%) had a mobile phone or an active SIM card. Figure 5.6 shows ICT access by age groups. The figure shows that household members of all ages use the two ICTs, although internet use is more a youthful phenomenon (18–35), while mobile phone access is more for older members of households (36 years and over). These relationships were found to be significant through chi square tests ($p<0.005$) for both email address, and mobile phone or active SIM card, respectively.

Figure 5.7 shows ICT access by gender. A higher proportion of male household members have access to email and mobile phone/active SIM card compared to female members. However, this was not significant ($p>0.005$) for either email address and mobile phone or active SIM card.

In terms of marital status, slightly more than half (51%) of household members above the age of 16 years were married. The rest were single (38%), widowed (7%), or cohabitating, divorced, or separated (4%). Access to ICTs by marital status of household members is shown in Figure 5.8. It appears that a higher proportion of single household members have access to email, while a higher proportion of married/cohabiting household members have access to mobile phone, compared to members of other marital status. Both of these relationships are significant ($p<0.005$). This implies that single household members are more likely to use email compared to household members of other marital status, while married household members are more likely to use a mobile phone compared to household members who are single or divorced/separated/widowed.

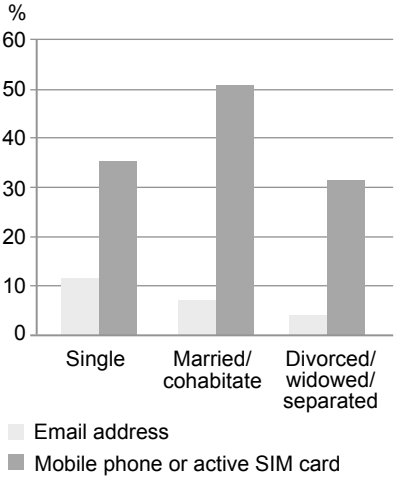

Figure 5.8 ICT access by marital status, Kenya

Source: field data, Kenya, 2007/08

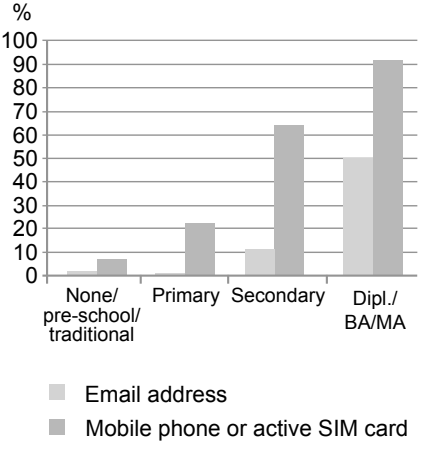

Figure 5.9 ICT access by highest level of education attained, Kenya

Source: field data, Kenya, 2007/08

With regard to education, a third of household members had attained primary school level (34%), 20 per cent had no education, 21 per cent had pre-school education, 19 per cent had secondary education, and 4 per cent had tertiary education. Generally, only a few household members had vocational/remedial or tertiary (BSc, Master's, or PhD) education. Figure 5.9 shows access to ICTs by highest level of education attained. Not entirely unexpectedly, a higher percentage of household members with higher levels of education accessed email or had a mobile phone/active SIM card, compared to those with lower levels of education. This relationship was found to be significant ($p<0.005$) for both access to email and mobile phone/active SIM card.

The main activity of household members more than five years old shows that about half were employed (48%) and 38 per cent were full-time students. The rest were either in unpaid work/housewives (7.1%) or unemployed (7.7%). Figure 5.10 shows the variation in ICT access by main activity, categorized into three groups. Household members in formal employment were more likely to use ICTs compared to those in informal employment or unemployed. The relationship was significant ($p<0.005$) for both access to ICT and mobile phone.

Households were categorized into poor and non-poor using per adult equivalent household expenditure. Out of 398 households, 94 (24%) were

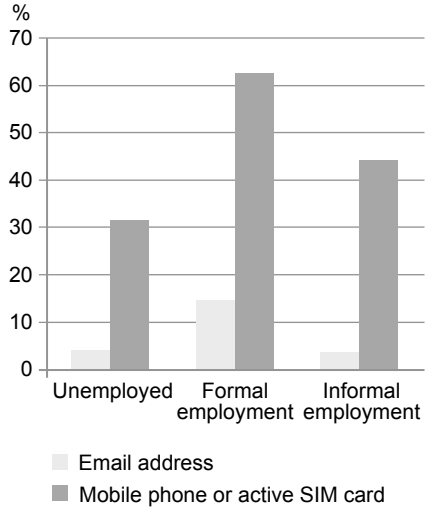

Figure 5.10 ICT access by main activity of household members, Kenya

Source: field data, Kenya, 2007/08

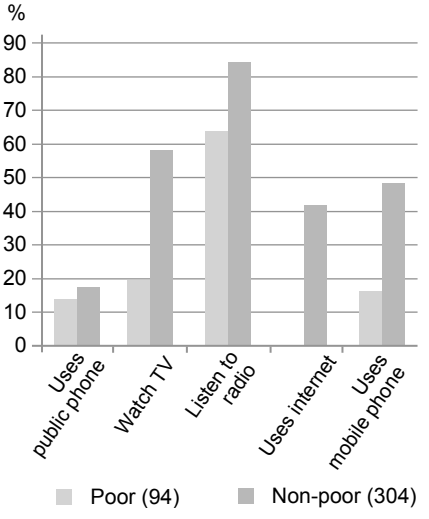

Figure 5.11 ICT use by poverty category, Kenya

Source: field data, Kenya, 2007/08

classified as poor and 304 (76%) as non-poor. Use of ICTs by poverty category among the sub-sample of individuals from households showed that radio, television, and mobile phone (79%, 49%, and 41% respectively) were the most commonly used ICTs. Figure 5.11 shows the use of selected ICTs by poverty category. As might be expected, a higher proportion of individuals from non-poor households used all four ICTs (public phone, television, radio, and internet) compared to those from poor households. This relationship was significant for television, radio, and mobile ($p<0.005$), but not for use of internet and public phone ($p>0.005$). This implies that individuals from non-poor households were more likely to use television, radio, and mobile phone compared to those from poor households, while use of internet and public phone did not vary by poverty category.

Almost two thirds (66%) of household dwellings were in a sound structural condition, about a third (29%) needed major repairs, while only about 5 per cent were seriously dilapidated. The relationship between the structural condition of the main dwelling and use of radio and television is shown in Figure 5.12. Although households of different structural condition owned radio and television, use of the two ICTs was highest for those households with sound structure. Of these two ICTs, the ownership of television was significantly different among households of different structural condition ($p<0.005$), while ownership of radio was not ($p>0.005$).

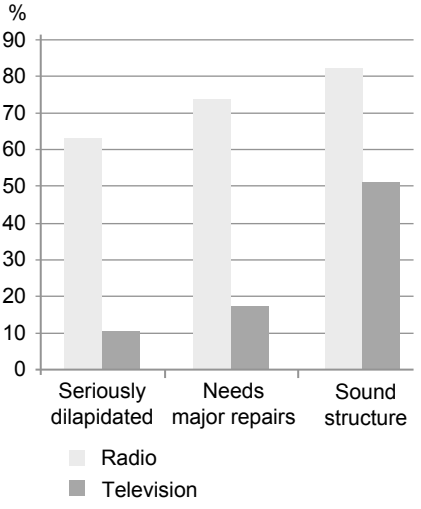

Figure 5.12 ICT access by structural condition of household dwelling, Kenya

Source: field data, Kenya, 2007/08

With regard to participation in groups and social networks, the greatest proportion of individuals belonged to a religious group (48%), followed by savings clubs and microfinance groups (23%). This study examined the relationship between ICTs and participation in decision-making in groups (see Figure 5.13). Although a higher percentage of individuals who used mobile phone, public phone, or internet made decisions in groups or social networks compared to those who did not, the association between use of these ICTs and decision-making in social networks was not significant ($p>0.005$).

How ICTs contribute to poverty reduction

The question of how ICTs contribute to poverty reduction revolves around issues of access to and use of different ICTs. The survey found that of the different ICTs, radio is the most commonly accessed by households (79.3%) followed by television (39%). Further, about a quarter of household members (26.7%) access mobile phone while only 5.3 per cent of them have an email address. Notably, mobile phone usage is higher than ownership because of sharing. Indeed, 57 per cent of those who own handsets allowed their friends and relatives to use them. In addition, only three households had an internet connection while two households had a fixed wire line phone connection.

As already discussed under the analytical framework, poverty reduction involves improvement in people's material and non-material lives. To discuss how ICTs contribute to poverty reduction, analysis in this paper draws on arguments that view ICTs as tools that enable people's activities in order to improve their lives (Gigler, 2011). In this sense, to reiterate Sen's perspective

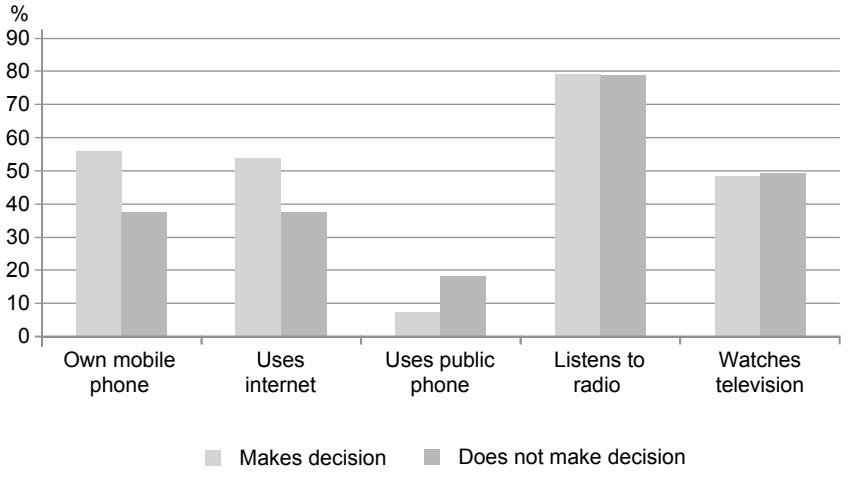

Figure 5.13 Decision-making in groups using ICTs, Kenya

Source: field data, Kenya, 2007/08

(Sen, 1985), it is not just access to ICTs but what people are able to do with them that is useful in looking at how they contribute to poverty reduction. Using the qualitative data on which this discussion is based, the study found that contribution of ICTs to poverty reduction varied depending on the ICT used and the specific challenges the community faced. The key themes of how ICTs contribute to poverty reduction are discussed below.

Use of ICTs enabled youths to engage in economic activities to earn a living. Findings show that television and radio stimulated and motivated people's interest and increased their awareness of economic activities that they can undertake. Through television and radio, youth in Silanga had developed interest in and were now playing soccer. This came about by watching players in other leagues like the English Premier League who earn a living through soccer. As a result, soccer clubs had been established in the area, players were paid, and some of those who were highly talented had transferred to play for higher divisions in the Kenyan football league. Another way was that by watching television shows that featured dancing competitions, youth were motivated to form dancing and theatre groups to enable them to participate in competitions aired on local television channels. This enabled them to acquire dancing skills and knowledge that was useful in the formation and management of the groups. They also sought opportunities to perform at various venues for a fee. As a result, some theatre and dance groups were commonplace and they had a keen interest in radio and television to know about upcoming competitions and public events where they could perform.

ICTs, particularly mobile phones, ensure that one is able to obtain information about jobs. One of the ways is that with a mobile phone, one may be

informed of when and where a job is available. In another case, a respondent said, 'I rely entirely on mobile phone to know when to go to work. For those of us in casual work in industrial area, you are not sure of when work is available. It would have been impossible to travel to industrial every everyday just to confirm when there is work'. This may be interpreted to mean that information on when and where jobs are available through mobile phones enables individuals to plan their days in terms of the economic activities they can engage in to earn a living. It also implies that they do not have to incur travel time and expenses only to establish whether work is available or not.

Through ICTs, people have participated in governance which has enhanced their voice. The study found that through radio phone-in programmes, people obtained knowledge and became aware of how to make constructive contributions during *barazas* (public meetings). They also got to know about economic, political, and social issues of the time, as a result of which they would question issues that they thought were contrary to policies by government or nongovernmental agencies. This was evident in Siwinga, where youths held a peaceful demonstration to the assistant chief's office for clarification about the *kazi kwa vijana* (jobs for the youth) initiative, a government economic stimulus intervention to create jobs for the youth. After discussions with the assistant chief and other administrators, they agreed on how they would be involved in the initiative, unlike before when its operations were obscure. The youths had listened to debates over the initiative on radio. In so doing, ICTs have offered people a forum to air their views and to participate in affairs that affect them.

Travel time and transportation costs had reduced due to use of ICTs. Through ICTs, people had saved on the cost of transport and the pain of walking long distances or spending a lot of time in public transport. This was because people could access some services by use of mobile phones or through the internet, which meant that they did not need to travel to seek such services. In Kaimiri, a respondent remarked, 'A mobile phone is important because it makes it possible to make a call to obtain information from someone instead of travelling sometimes for a long distance merely to obtain information. This saves time and money'. Another added: 'I called a government office to confirm whether the letter that I was waiting for was ready. Previously, we used to travel to government offices and wait in a long queue only to be disappointed when what you went to seek was not ready'. Related to this is that people were able to transfer money through their mobile phones by use of mobile service provider's agents who were closer to their homes. Therefore, use of mobile phone has reduced the transport burden through calls made to obtain information and transfer of money.

There has been a reduction in the stigma associated with HIV/AIDS and formation of support groups due to use of ICTs. In Siwinga, the effects of HIV/AIDS were evident in many households headed by minors and homesteads that had since been abandoned. Initially, and for a long time, people could not talk about HIV/AIDS, and those who were thought to be suffering

from it were stigmatized in the village. People were scared of visiting the local dispensary to know their HIV status, despite the many deaths from the disease. However, through numerous campaigns and several educational programmes on radio regarding the disease, the stigma associated with it had significantly reduced. People in the village seemed to accept and talk to those infected among them and many people were able to speak openly about it. In addition, the number of people taking the initiative to know their status had increased. Through counselling programmes on radio, those people living with HIV/AIDS in the village knew how to live positively with the disease with regard to diet, drugs, behaviour change, and support available for those suffering from the disease in the district. As a result, people were able to work and support themselves and one another. A youth remarked, 'Discussions on radio have encouraged those people living with HIV/AIDS to seek counselling and many more people speak openly about it and some even make jokes about the once dreaded disease'. Thus, through radio, people benefited from education programmes focusing on HIV/AIDS prevention and management, including formation of support groups, diet, and anti-retroviral therapy. This in turn led to a reduction in the stigma associated with HIV/AIDS because people also learnt from the experience of others based on the news and information exchanged. Moreover, people used mobile phones to seek assistance when they were unable to assist themselves, find out information from support groups and talk to their relatives who live outside the village.

Use of ICTs resulted in a reduction in vulnerability through preparedness to respond, cope with, and adapt to risks and insecurity. Through radio programmes, residents in Silanga had learnt the danger of petrol tankers through the publicity of the Sachangwan[1] fire tragedy, and residents of Kaimiri had learnt the dangers of deforestation.[2] During the post-election violence, mobile phone calls and text messages were used to find out the location of relatives and friends for safety. Mobile phones were also used to alert friends and relatives of any impending danger to enable them to move to safer locations. A youth in Silanga said, 'Mobile phones were important in ensuring personal safety during the post-election violence. One could find out safe areas to move to or dangerous areas to avoid and even send airtime to relatives in distress'. Another added, 'We obtained information about our residential location through radio and television, we knew whether to proceed, or to wait until a disastrous situation was calm, in order to avoid being hurt'. Another respondent recounted, 'It was very dangerous for women during that time. If you did not have a mobile phone you were dead, because you would not know where danger lurks and walk straight into a trap. One needs to be constantly in touch with on-going here because of the unpredictable nature of occurrences lest you are caught unawares'. In this way, ICTs played a role in reduction of vulnerability especially in volatile areas, and enhanced preparedness to risks as an early warning system, thus alleviating the sense of helplessness.

Moreover, during emergencies, people sought help from the police or relatives through phone calls. Elsewhere, use of mobile phones was associated with improvement in security. In Siwinga, an assistant chief had an elaborate network of individuals to report criminal activities through mobile phone calls or text messages, which had helped improve security in the area. However, during a focus group discussion in Silanga, some participants were of the view that use of mobile phones facilitated coordination of criminal activities. This was because criminals could alert their colleagues of a potential target identified or could warn them of approaching security personnel.

Through ICTs, people acquired skills and knowledge on improved crop and animal husbandry. Because of radio programmes that encourage and teach good agricultural practices, some farmers in Kaimiri used farmyard manure to improve yields on their farms rather than expensive commercial fertilizers. The farmers also got to know about appropriate agricultural inputs, while others began to experiment with organic growing of vegetables. To underscore this, a respondent in Kaimiri stressed, 'Listening to radio has made a difference in farming in terms of the type of seeds to use in this area depending on the season. Otherwise, if you buy seeds from the shop without knowing the type you need, the shopkeeper will sell to you anything. They are after your money'. In the same area, a farmer reported, 'When I need a veterinary to attend to my livestock, I just call him through my mobile phone. This is crucial in enhancing chances of livestock surviving because a veterinary officer is more likely to come in time that when you go to look for him'. Thus, use of ICTs, especially mobile phone, had made it easier for farmers to access veterinary services.

Due to mobile money transfer, farmers received advance payment for produce and safely kept cash in their mobile phone accounts. In Kaimiri, a respondent said, 'I have established contacts with buyers in Nairobi who send money to my mobile phone after which I deliver produce, especially vegetables, bananas, and milk, to the buyer's agent in the local market. I do not have to meet buyers or incur transport costs to deliver produce to the market in Nairobi and although the prices I receive are slightly lower than the price I would receive in Nairobi, I do not incur transport costs or waste my time to Nairobi'. In this way, use of mobile phones ensured faster transactions, and saved time and transportation costs. In addition, mobile money transfer facilitated group contributions like revolving credit and saving schemes contributions.[3] A case in point is a women's group in Kaimiri; a member of the group recounted: 'We use mobile phones to organize meetings for our *chama* (an informal income-generating self-help group common among women in Kenya) and make contributions before, during, or even after meetings'. This study found that people were using mobile phone accounts as a deposit account. The major difference the service had made is that people received or sent money instantly as a text message on their phones and could collect the money at any of the mobile service providers' agents.

ICTs enabled students to access additional educational information. Students benefited from school programmes through radio broadcasts even when they were not at school. For youths in Kaimiri, book club programmes on radio and specific programmes tailor-made for schools, like those that discuss English and Kiswahili literature set books for secondary schools, had enhanced their knowledge and analytical skills. The students occasionally participated in book club programmes aired on a national radio station. However, some youths in the group thought that ICTs facilitate leakage and cheating in national examinations.

Thus through the various ways discussed above, ICTs contributed to poverty reduction. In terms of human capital, ICTs contributed to acquisition of educational information, agricultural knowledge, and skills that people utilized in activities that improved their lives. From an economic perspective, use of ICTs contributed to initiation of income generation activities and also increased people's income. Further, with regard to empowerment, ICTs enabled people to participate in governance by having their voice heard, which alleviated helplessness because they knew that they could raise their concern to the rightful authorities and bring about change. Reduction of vulnerability to risks and improvement in safety also resulted from use of ICTs as an early warning system, to seek help during emergencies, or to adapt to and recover from shocks.

However, the contribution of ICTs to poverty reduction was limited by several challenges. Some of the challenges were the high cost of initial purchase, and use and maintenance of ICT equipment. According to the survey, a majority of those who did not own a handset (83%) cited high cost of handsets as the prohibitive factor. This is similar to the literature that cites affordability as one of the biggest challenges in accessing and using ICTs (Waema et al., 2007). In addition, when ICTs malfunctioned, the cost of repair was high because repair was usually done in larger markets or urban centres which were a long way off. This resonates with Otieno, a 68-year-old man in Siwinga, who pointed out that: 'I own a radio which I bought during my youth but it is now damaged. There is no one in the village who can repair it and I have to take it to Ukwala, which requires money. At my age I do not have that kind of money and I opt to receive news during village *barazas* that I sometimes attend or from neighbours'. The other factors that limited contribution of ICTs to poverty reduction are lack of requisite knowledge and skills to use some ICTs, and lack of infrastructure to support use of some ICTs. For example, lack of electricity supply discouraged ownership and use of television. People travelled for some distance to charge their mobile phones because it was done occasionally.

Summary and conclusions

Summary

Most households are composed of young people (below 30 years). This has implications on household well-being due to high levels of dependency. This remains a challenge in Kenya and is made worse by high levels of unemployment, especially among the youth.

In terms of access and use, radio is by far the most commonly owned and used ICT. This was evident in the high percentage of households that owned a radio (79%) or television (39%). Mobile phone ownership has rapidly increased although some people still use payphones, while fixed-line telephones had become unpopular – only two households had a fixed-line connection. Further, knowledge and penetration of internet remains low with an equally low ownership of personal computers (1.8%) and households with internet connection. Ownership of email addresses is equally low (5.3% of household members). Internet penetration remains low, especially in rural areas, due to lack of appropriate infrastructure and requisite knowledge among the people. Television remains largely pervasive in urban areas. Finally, the study found that usage of ICTs was higher than ownership for all types of key ICTs.

Access and use of some ICTs vary by demographic characteristics of household as well as their well-being. In terms of age, internet access/use is more a youthful phenomenon (between 17 and 35 years), while access to mobile phone is more for older household members (36 years and over). In terms of marital status, single household members were more likely to use email, while married household members were more likely to use mobile phones. Further, the level of education and formal employment of household members positively influenced ICT access and use. Therefore, the use of these technologies varies between poor and non-poor groups, by gender, and between rural and urban areas. It is also evident that some forms of ICT are more widely owned and used than others.

There is ample evidence that use of ICTs contributed to poverty reduction by improving people's socio-economic and political lives in both urban and rural areas in Kenya. The contribution of ICTs to poverty reduction varied depending on the ICT used and their contextual social and economic conditions. Use of ICTs contributed to poverty reduction by enabling them to cope with vulnerability, enhanced access to education for students through targeted radio programmes, mobilization of people for community meetings through text messages, and improvement of security through warning people of impending dangers. ICTs also contributed to improvement of governance, for example, by providing information and knowledge that enables people to participate more in the way they are governed. ICTs also led to income generation through initiation of economic activities. For example, people transferred money easily through mobile phones, and mobile phones facilitated easier and faster communication, which enabled business people to obtain income-generating opportunities at a lower cost and to make quicker decisions. In particular,

use of different ICTs had led to an increase in people's income due to efficiency and cost savings in commercial transactions. By enabling people to make real-time decisions, ICTs had enabled people to cope with negative surprises. This in turn ensured security of household members as well as the household assets essential in their well-being. ICTs had also enhanced people's knowledge and awareness of their environment. This had, for example, resulted in adoption of innovative agricultural practices as people conserved their environment. However, the contribution of ICTs to poverty reduction varied by context in terms of the ICT used and the specific challenges the community faced.

The key factors that limited the contribution of ICTs to poverty reduction were the cost of initial purchase and maintenance, the lack of commercial electric power supply, and the low levels of income among poor households.

Conclusions

ICTs play a very critical role in poverty reduction in both urban and rural areas in Kenya. All people, including those from households classified as poor, access and use ICTs, although the extent of use varies. For example, while ownership of radio and television was higher in non-poor households, there was no variation in use of public phone and internet among individuals from these households. This is evidence of the willingness and ability to use ICTs, which might be interpreted to mean that they find ICTs useful in their day-to-day socio-economic and political livelihood strategies. It also means that ICTs are no longer the preserve of a certain social or economic group. Despite this, disparities in access and use of ICTs remain prevalent between the poor and non-poor, whereby the poor are worse off in terms of access and use of most ICTs.

Although there has been a lot of investment to promote 'modern ICTs' like internet and mobile phones, use of the 'traditional ICTs', like radio and television, remains widespread. This implies that in terms of ICTs and poverty reduction, appropriateness of an ICT in terms of the people's context is crucial, although it is also evident that people combine different forms of ICTs. It is not simply about traditional or modern ICTs, but the appropriateness in terms of what they mean to people, which influences which ICT or combination of ICTs they use. This is probably the reason that although internet has been touted to contribute to people's lives, in the areas covered, it did not feature as contributing to people's lives. This is unlike mobile phones, which have evolved and become pervasive as evident in their diverse uses. Mobile phones are no longer simply a tool for voice calls or text messages, but are increasingly being used as a sort of bank to deposit cash, a security gadget, a tool for mobilizing group members, and so on. With the decrease in the price of smartphones, it is likely that mobile phones have become essential in people's day-to-day social, economic, and political lives. This offers application developers an opportunity to come up with applications relevant to people's socio-economic and political needs.

Poverty reduction is multidimensional, and ICTs contribute to poverty reduction in terms of enhancing people's ability to undertake activities important in improving their lives and by these activities actually leading to improvement of their lives. Specifically, use of ICTs contributed to improvement of people's lives through enhanced human capital in terms of valuable knowledge and skills, increase in income, reduction in vulnerability, and having a voice in how they are governed.

Notes

1 Sachangwan is a place where a petrol tanker overturned and residents started helping themselves to free petrol and the tanker caught fire, killing and injuring many people.
2 Residents of Kaimiri had over time listened to many radio programmes about environmental conservation and had as a result planted trees on their small parcels of land to avoid the dangers of deforestation.
3 In most parts of rural Kenya, people in a community come together in self-help groups and contribute money to help each other.

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CHAPTER 6

Impact of enhanced access to ICTs on small and microenterprises in Tanzania

Ophelia Mascarenhas

This chapter is based on the findings of a study that was carried out among two groups of urban micro and small enterprises using a quasi-experimental methodology in which the benefit group received ICT interventions while the other group was kept as a control. The findings revealed statistically significant changes in the use of mobiles and the internet within the benefit group. The increased use of ICTs resulted in a statistically significant reduction in economic poverty levels among the benefit group. However, the positive impact of ICTs tended to be evident only for the money-related indicators rather than for formal education or access to economic assets, due probably to the short time lag between the introduction of the interventions and the assessment of the impact. Some policy implications about enhancing the use of mobiles and the internet by MSEs are identified.

Keywords: ICT access, ICT research, information and communication technologies, microenterprises, mobile phones, internet, ICT/poverty nexus, quasi-experiment, Tanzania

There is an increasing awareness of the importance of micro, small, and medium enterprises (MSMEs) for socio-economic growth in the developing economies (Duncombe and Heeks, 2005; URT, 2003; Bothelho and da Silva Alves, 2007; Kotelnikov, 2007; Ilavarasan and Levy, 2010). For instance, Duncombe and Heeks (2005) argue that MSMEs have the potential to contribute most directly to poverty reduction in three main ways: 1) income generation and diversified livelihood opportunities; 2) more secure employment opportunities for the poor of developing countries; 3) provision of other social benefits to the poor – for example, enhancement of skills, increased self-confidence, increased participation of women, empowerment, and security against income loss. With the explosive growth of ICTs, especially of mobile telephony, in the last two decades in all regions of the world, there is a corresponding increasing interest in the role of information and communication technology (ICTs) in enhancing the potential of MSMEs.

The literature on this discussion can be divided into two main categories: 1) the use of ICTs by MSMEs and the benefits and constraints experienced

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in the use; and 2) the link of such use with growth in the business and corresponding poverty reduction in the households of the MSME users of the ICTs. A number of studies have been carried out on the use of ICTs by MSMEs Heeks (2002) and Kotelnikov (2007) for Asia Pacific; Botelho and da Silva Alves (2007) for Latin America; Nielinger (2003) and Souter et al. (2005) for India, Mozambique, and Tanzania; Molony (2005) for Tanzania; Munyua (2009) for Kenya; and Lal (2002) for India, to give just a few examples. These studies found that telephony, especially mobile phones, is particularly popular among these enterprises and can have positive results. For instance, Heeks (2002) argues that information technology has the potential to be an enabler of organizational changes among MSMEs that can lead to additional productivity gains. A study of women entrepreneurs in Nairobi found that the use of mobile phones had indeed enhanced the effectiveness and efficiency of female-owned businesses (Munyua, 2009).

However, these studies have found that the benefits are not automatic and that the role of ICTs in growth and poverty reduction among MSMEs is not clear. Kotelnikov (2007), focusing on Southeast Asia, found that while ICT can benefit small and medium enterprises (SMEs) in multiple ways, SMEs have been slow to adopt ICT as they face major constraints. A growing area of concern in some of the literature is the de-linking of the use of ICTs by micro and small enterprises with growth and poverty reduction (Flor, 2001; McNamara, 2003, Arunachalam, 2004; Chaco and Harris, 2007), particularly the wider definition of poverty which goes beyond absence of money and encompasses aspects such as vulnerability, exclusion, gender discrimination, lack of equitable access to essential assets, and opportunities. As Mathison (2003) states, impact analysis is crucial. Unless an initiative can demonstrate positive impact, there is little point in allocating resources to expand or replicate it. There are, however, very few studies that have used rigorous methods to assess impact. Most evaluations have studied communities after the enhancement of the use of ICTs and have made assumptions about the impact based on what was reported to them by the users.

The conclusion from this brief review of the literature is that while there are opportunities for ICTs to enhance micro, small, and medium enterprises and improve livelihoods, there are still gaps in the understanding as to how the adoption of ICTs by MSMEs in developing countries contributes to the sustainable development of the enterprises as well as to the livelihoods of the households of the owners of these enterprises.

It is against this background that a study was carried out between 2008 and 2010 among micro and small enterprises in two urban locations in Tanzania: Njombe and Makambako in Iringa region in Southern Tanzania. The research was funded by the International Development Research Centre (IDRC) as part of the PICTURE Africa project and implemented by the Commission for Science and Technology (COSTECH). Although a part of the PICTURE Africa project, a different methodology was used involving benefit and control groups. This methodology was considered for the overall four country study

but was not adopted because it was felt that the undertaking was not feasible for a four-country research project. It was funded in one country more as an experiment and is aptly referred to as the 'experiment study' among the PICTURE Africa research teams.

The main objective of the research was to answer the question: To what extent does an increase in the access to and use of ICTs result in improved business output and reduction of poverty among micro and small enterprises (MSEs)? In order to answer the question, the study selected a quasi-experimental research approach.[1] This chapter is based on the findings of that study and hopes to make a contribution towards the current discussion on the impact of ICTs on micro and small enterprises (MSEs) and draw conclusions for the general debate on the impact of ICTs on poverty.

The analytical framework

Based on the main objective, the conceptual framework focuses on the interaction between changes in access to and use of ICTs by owners of micro and small businesses in their business operations, and the resulting changes in their businesses output and the socio-economic status of their households, where socio-economic status is measured in terms of the poverty levels of the households of the MSE owners. It is recognized that the households of MSEs have different levels of poverty and can therefore be affected differently by interaction with any external impetus such as an enabling technology, in this case ICTs. Thus the main components of the framework are: 1) the poverty levels of the households of owners of micro and small enterprises (MSEs); 2) changes in access to ICTs; 3) resultant changes in ICT use; and 4) changes in business outcomes and their impact on poverty levels of the households of the MSE (see Figure 6.1 below and the descriptions of these components).

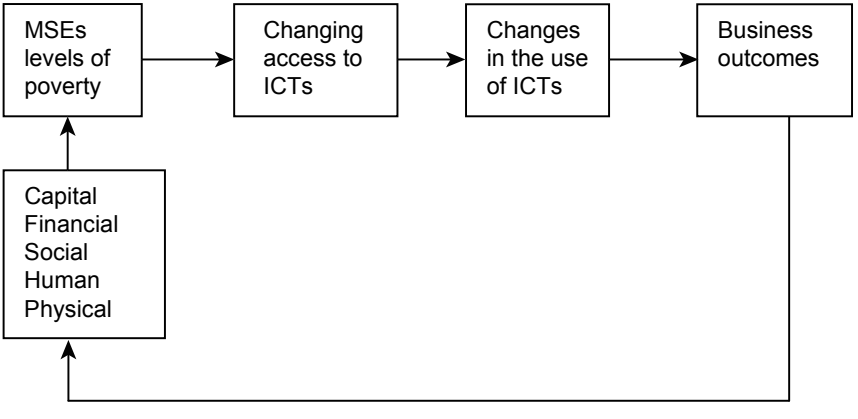

Figure 6.1 Analytical framework for assessing the impact of ICTs on growth/poverty reduction among MSEs

The components of the analytical framework

MSE levels of poverty

Poverty is increasingly being recognized as being multi-dimensional and encompassing other aspects than the presence or absence of money. Thus, while recognizing that the money indicator is the most widely used indicator of poverty in terms of per capita income and expenditure, the study uses a multi-dimensional approach to poverty based on the sustainable livelihoods (SL) framework formulated by DFID (1999). Conventionally, the SL framework recognizes that the poor have access to five sets of capital: social, human, physical, financial, and natural. These assets constitute the means with which the poor develop livelihood strategies to reduce poverty.

This study uses only four of the five capitals: namely, financial, physical, human, and social. *Financial* considers the flow of money in the business and how this is reflected in the business turnover, which in turn determines the household income and expenditure and acquisition of movable assets such as a vehicle, refrigerator, cooker, water storage tank; *physical* considers access to social services such as water, electricity, and quality of housing, *human* considers the educational level of the household members; *social* considers the two aspects of vulnerability and exclusion. Poverty increases vulnerability by making the MSEs less able to cope with business and personal losses and risks, while exclusion, whether commercial, political, or social, reduces the capability of the MSEs to make use of networks and groups to increase their businesses. In order to operationalize this framework for assessing poverty, the study utilizes a set of proxies, as shown in Table 6.1.

Table 6.1 Measuring the impact of ICTs on poverty

Poverty dimension	*Impact resulting from enhanced access to and use of ICTs*	*Proxy variable to measure impact/ relationship*
Financial poverty	Increased financial resources	Per capita hh expenditure and income Business turnover Movable assets (refrigerator, bicycle, motor vehicle, cookers, ICTs)
Physical poverty: inadequate access to basic social services	Increased access to social services	Access to basic services (water, energy source, waste disposal, sanitary facilities) and quality of housing
Human poverty: poor capability to use new skills	Increased capability to use ICTs	Mean years of education of household members
Social poverty vulnerability and exclusion	Decreased vulnerability; decreased exclusion	Perception of level of vulnerability Number of groups that MSEs belong to

Access to the ICT system

As with poverty, ICTs have also been defined in many ways and include digital and non-digital information communication technologies (Heeks, 1999). This study focuses on mobiles and the internet. Access in this study is defined as ownership and use. Access to these technologies depends on the technical infrastructure, especially the distribution of mobile networks and internet service providers. While the ownership of a mobile is mostly personal, the use of the internet for the majority of users is through public facilities – at the workplace or via internet cafes. Access to ICTs is also affected by the cost of using them (economic), hence the level of financial poverty is a major factor affecting access. This constraint can be reduced if the MSE owner has other ways of accessing ICTs such as some external agency providing the necessary economic support.

Changes in use

This component looks into changes in the use of ICTs between two selected time periods, 2008 and 2010, for the mobiles and the internet/email for business purposes. Changes in usage will consider three aspects: purpose of use, frequency of use, and amount of money spent per month on usage.

Business outcome

The primary outcome here is increase in business turnover, which will feed back into the selected capitals of the households of the MSE owners – financial, physical, human, and social. The changes in the selected capitals measured through the selected proxy indicators (Table 6.1) are used to assess changes in the poverty levels of the households of the MSEs.

The research approach

The main methodology for carrying out the study was quasi-experiment where the primary focus is an assessment of change over a selected period among two similar groups: a *benefit* group that is deliberately targeted with interventions designed to improve its current situation to meet a certain specified impact (in this case poverty reduction), and a *control* group that is not targeted with any interventions. The basic hypothesis is that in a post-intervention assessment, the group with the interventions will *do better* than the group without the interventions, thus proving that the interventions do have a pre-stated positive impact. In line with this methodology, the first task was to select two groups of micro and small enterprises in two locations that were similar in livelihood patterns, socio-economic status, and potential to access ICT.

Two groups of micro and small enterprises were selected from two urban locations in Tanzania: the Njombe and Makambako urban areas in Iringa region in Southern Tanzania. The former group was designated the benefit group and targeted for ICT interventions, while the group in Makambako was designated the control group. Both areas are along the major highway that links Dar es Salaam with countries in Southern Africa, directly with Zambia and via Zambia to Zimbabwe and Botswana and South Africa, and therefore have similar economic and commercial opportunities. The two locations also have similar access to the major mobile networks, and radio and television stations in the country, in addition to having a community radio. Both locations had access to public internet services, although in this respect Njombe with more than one such service was better off than Makambako with only one. The research was carried out in phases as shown in Table 6.2.

Table 6.2 Phases and activities in the research methodology

Phase	*Sub-activity*	*Date*
Baseline study	Stakeholders' workshop	13 June 2008
	Carrying out the baseline	July/August 2008
	Completion of the first draft of the report	February 2009
	Completion of final draft	August 2010
Interventions	Training needs assessment	November 2008
	Training in business provided to both groups by Small Industries Organization (SIDO)	July 2009 (the arrangement took longer than anticipated)
	Training in ICTs to benefit group	September 2009
	Giving ICT interventions to benefit group	January 2010
	Monitoring visits to assess use of interventions	March/April 2010
Second survey of both groups and report writing	Fieldwork	June 2010
	Analysis	July/September 2010
	Preparation of final report	October 2010

Only those business owners who had a permanent location were selected, so that the same enterprise owners could be followed up in the various phases of the study. For the initial baseline, carried out in 2008, 150 micro and small enterprises were randomly selected from each location. Following the baseline survey, there was a substantial attrition rate among the households. By the time of the ICT training, we could only get 100 households of the benefit group in Njombe, and by the time of the second survey in 2010 we could only get 93 of these in Njombe, and 95 of the households from Makambako, the control group, who had participated in the baseline (Table 6.3).

Table 6.3 Sample size in 2008 and 2010 (number of hh)

Survey periods	*Njombe (benefit group)*	*Makambako (control group)*	*Total*
2008	150 (48%)	160 (52%)	310 (100%)
2010	93 (49%)	95 (51%)	188 (61% of original sample)

Assessment of the changes in the ownership and use of ICTs, and business turnover and poverty are based only on those households that could be surveyed in both surveys.[2]

Characteristics of the sampled MSEs

Of the MSEs that could be surveyed in both 2008 and 2010, females constituted about 16 per cent in Njombe and 12 per cent in Makambako. The largest proportion of the owners of these enterprises was in the age groups of 25 to 44 for males, with a mean age of 36.3 years in 2008 and 39.7 years in 2010. Average household size was around 5 persons for both locations in both years, with the households in Njombe being slightly larger than those in Makambako. The majority of the enterprise owners (about 70% for Njombe and 80% for Makambako) had primary education, but there were differences by gender with females being more disadvantaged in both locations at higher levels of education. More than 90 per cent had a start-up capital of less than 5 million Tanzanian shillings, which put them in the category of microenterprises, and of these nearly 80 per cent had less than 1 million shillings. The MSMEs were thus at the lower end of the small enterprises.[3]

About three quarters of the sampled micro and small entrepreneurs owned one business, but a fifth owned two and the rest even three or more. The enterprises involved a range of businesses which have been broadly divided into the following: permanent stands or shops categorized as *produce,* selling fresh produce; retail shops categorized as *shops,* selling a variety of manufactured goods; businesses providing services, categorized as *salons*, *crafts*, *transporters;* and finally a miscellaneous group categorized as *other.* Although the numbers that were interviewed in 2010 were far less than those that were interviewed in 2008, the overall distribution pattern by type of businesses remained the same.

The premises ranged from shops with one or more rooms to a permanent stand in the market. The majority had a one-room shop and most were renting their premises. Both groups owned a range of ICTs, which included radio, television, mobiles, computers, fax machines, and email addresses. In 2008, the ownership of ICTs was far higher than the national figures as found by the Household Budget Survey (HBS), undertaken in 2007. For

instance, ownership of mobiles was 94 per cent and 92 per cent for Njombe and Makambako, respectively, compared with 42.5 per cent found by the HBS in 2007 for other similar urban areas. The main constraint to the use of ICTs was the cost, with the poor paying a higher proportion (20%) of their mean expenditure compared to the non-poor (11%) (Mascarenhas, 2010).

Targeted interventions

In March 2009, both groups were provided with simple business skills which included how to raise capital; marketing; general business skills; skills in keeping stores; and book-keeping. This was done in order to ensure that both groups started with an equal capacity in business skills before the ICT interventions were given to the benefit group in order to reduce any inherent differences in conducting business.

In September 2009, the benefit group was provided with ICT training in preparation for receiving the targeted intervention. The training consisted of seven modules and provided basic skills in the following: computer basics and handling skills; use of the computer keyboard and mouse; the internet and online information sources; searching for information on the internet; sending and receiving emails; use of mobiles for business (calculator, means of communication, storage device, marketing tool, money transactions – M-Pesa, etc.); and the use of ICTs in banking. A training manual in English and Kiswahili was compiled and provided to all participants (PICTURE Africa, 2009).

The training was followed by a set of ICT interventions aimed to enhance the access to and use of ICTs. This was provided to the benefit group in January 2010 and consisted of 1) a mobile handset; 2) airtime amounting to 30,000 Tanzanian shillings equivalent to approximately US$20 per month per enterprise owner for five months (January to May, 2010), and 3) paid-up access to the internet/email of one hour per week at a designated internet cafe for the same five months. The enterprise owners in the benefit group had high levels of access to mobile phones, but we had to give them a mobile in order to have a centralized form of providing the airtime which was credited directly to mobiles that were provided at subsidized prices by the Airtel mobile company. This avoided providing the benefit group with cash which could be diverted to other uses. Since all the mobile sets were purchased from Airtel, we could request Airtel to lock the airtime so that it could not be transferred to another phone, another safeguard to ensure that the airtime was used only by the selected enterprise owner. The airtime was provided because during the baseline study carried out in 2008, the main constraint to a greater use of mobile phones was stated to be the high cost of the airtime.

Although the focus was the enterprise, the unit of analysis was the household because it was felt that poverty reduction was best assessed at the level of the household of the enterprise owner rather than the enterprise itself, which was the source of the livelihood of the household. Admittedly this does have

some challenges since the level of poverty of the household can be affected by other income-generating activities of the household and by contributions of members of the household who are not the owners of the enterprise. This was mitigated by two considerations: 1) since the main occupation for the majority was the business, it was felt that changes in the business would be the most important contributor to changes in poverty at the household level, and 2) although income was one of the indicators of poverty, the poverty levels were based mainly on per capita expenditure at the household level. As head of the household, the household expenditure would be affected mainly by the contributions of the enterprise owner.

Ethical issues

Before the study was initiated, a workshop was held with major stakeholders from the ICT and business sectors from academic institutions, the government, and the private sector, to discuss the conceptual framework and methodology. Ethical issues arising from providing one group with interventions while not doing the same for the second group were discussed. It was agreed that the objective of the study was to measure impact, which was best done by comparing two groups with different levels of access to and use of ICTs and where the difference could be controlled by providing interventions meant to contribute to this difference. Nevertheless, it was also agreed that both groups should get some common beneficial intervention. In this case it was the training in the basic management skills that was provided to both groups.

Limitations of the study

There was a major limitation to the planned period allocated to the research. It was envisaged that the ICT interventions would be provided for six months, but due to unforeseen delays in implementing the interventions, the period had to be reduced to five months. The delays also resulted in the post-intervention survey being conducted soon after the period of interventions ended instead of the planned lapse of one year. This affected the analysis of the impact of ICTs on poverty indicators such as human capital (proxied by mean years of education of members of the MSE households), which requires at least one calendar year to assess changes.

Changes in ICTs between 2008 and 2010

The focus of the quasi-experiment is on the changes that took place within the benefit group in Njombe and the control group in Makambako within the period between the baseline that was carried out in 2008 and the post-intervention survey carried out in July 2010. The analysis begins with changes in the access to ICTs and use of ICTs, especially those that were provided as part of the interventions.

Changes in access to ICTs

The MSEs in both groups owned a range of ICTs, but the emphasis here is on the access to mobile phones and the internet, the foci of this study. Access was defined as ownership of at least one mobile per household. For email, access was defined as to whether the MSE owner had an email address and/or used the email at least once a week as provided by the intervention. In 2010, access to mobile phones among the control group in Makambako was almost the same as that for the benefit group in Njombe (98% compared with 100%) despite the fact that the MSME owners in Njombe were given a mobile phone each. This was the result of the way that access was defined. The respondent (the MSE owner) was asked if he/she had a mobile phone/email address. The response was a positive or negative answer and did not take into account if the respondent had one or more mobile phones. Changes in access to the mobile phone and the internet between 2008 and 2010 for the selected MSEs in Njombe and Makambako are described below (see Table 6.4).

Table 6.4 Changes in access to mobile phones and the internet (by MSE owner)

Enhanced ICT	*Njombe*				*Makambako*			
	2008 %	*2010 %*	*Change %*	*Sig.*	*2008 %*	*2010 %*	*Change %*	*Sig.*
Mobile phone	94	100	+6	0.000**	92	98	+6	0.000**
Email address	5	54	+980**	0.000**	0.01	0.01	0	0.657

Njombe: N=93; Makambako: N=95
**Statistically significant at 0.01 level

There was no change in the access to email via computers in the internet cafes among the enterprise owners in Makambako, but some significant changes in Njombe. Out of the 95 enterprise owners in Njombe who had been provided with training in the use of the internet/email and were eligible to using the internet free of cost for at least one hour per week for about 20 weeks, 51 (54.3%) had email addresses and 40 were using it at least once every time they came for the weekly one hour access time during the five months of the interventions. The higher access to email/internet in Njombe than in Makambako was definitely due to the interventions involving the training and facilitation of use that was provided to the benefit group in Njombe. However, it was noticeable that not everyone used the intervention to its full capacity even though it was free.

During the monitoring of the use of the interventions it was noticed that nearly half of those who had received the training were not using the free internet access at the designated internet cafe, Althek. The owner of the internet cafe was as disturbed as the researchers. One problem identified by the owner was that a large proportion of those that were trained were still not able to cope with using the keyboard and the internet searches. A refresher

course was provided to those who wanted such a course. There was a slight improvement but the overall result was still disappointing: only 40 per cent of the sampled MSEs in Njombe had email addresses and only 7 per cent were using it for business.

In discussions with the potential users, the following reasons were given: the availability of the internet facilities among the partners that the SMEs were dealing with, and the need for instant response. The level of internet access in Tanzania is very low at around 11 per cent, according to a survey by the Tanzania Communications Regulatory Authority (TCRA) conducted in 2010 (TCRA, 2010). However, this estimate is based on some questionable assumptions. The figure of 1.1 per cent for internet subscribers is probably a more representative figure and corresponds to the figure given by ITU for Tanzania for 2007. Therefore, even if the MSEs in Njombe had access to email through the interventions, it is likely that most of their business partners would not have access.

The relatively lower use of the internet/email for business was also due to the characteristics of the businesses. Most of the MSEs involved in the study were microenterprises, and characterized by informal business relations where person to person contact and instant response were major ways of conducting business. The person to person contact was replaced to some degree by the mobile phone, but instant response was still the major concern. It cut down the uncertainties of getting the required commodities, and if travel was involved the trip could be planned to take advantage of new consignments at the depot of the supplier. It is for this reason that most of the respondents in the study preferred calling to using the cheaper SMS. In 2008, 80.3 per cent of males and 77.5 per cent of females used the mobile for calling, compared with 7.1 per cent and 2.8 per cent for males and females, respectively, for sending an SMS (Mascarenhas, 2010). This pattern had not changed much in 2010. Calling cuts down the uncertainties. In many ways email is similar to SMS – the response is not instantaneous, especially where the email has to be accessed via an internet cafe. This might explain why about 40 per cent had email addresses but only 7 per cent were using the email for business.

Finally, even the owner of the internet cafe pointed out that there are gaps in the internet with respect to the information that is currently needed by the MSEs. Development of local-level business information (content) is still highly undeveloped in Tanzania. Even those institutions that have websites are struggling to keep them up-to-date. In 2010, TCRA carried out a survey of the supply of internet facilities, but not of the demand side. There is no comprehensive survey of the information needs of the users, especially of MSEs. The same is true for training for MSEs. This should ideally be done by the Small Industries Development Organisation (SIDO) which is mandated to facilitate the development of micro and small industries and has a widespread decentralized organization. However, in 2010 SIDO had not begun to include training in the use of computers, email, and the internet in its regular business training programmes.[4] These three factors limit the use of the internet among the MSEs.

Nevertheless, the provision of free access to email had resulted in some changes to access to email by gender, marital status, and education among the benefit group in Njombe, but none were statistically significant. For gender, the change was upward for both males and females, but Pearson's correlations found the change in access to emails by gender to be positive but insignificant at the level of the MSE owners ($r = 0.109$; $p = 0.300$). Married people constituted 160 (33.0%) of the total of 484 persons, and singles 309 (63.5%), but a higher number of married people had email addresses than singles. However, the pattern was similar to that in 2008 – except that the numbers had increased more sharply for the married.

The most significant change in access to email/internet in Njombe among the benefit group was in relationship to education. The promotion of the email/internet had altered the pattern of access by education. In 2008, ownership of an email addresses in Njombe was highest among those with secondary education, tapering down at the level of vocational education (probably post-primary), and then rising to post-secondary diploma and tertiary levels. This clearly showed that the level of education affected access to the internet/email. In 2010 in Njombe, the proportion of persons having email addresses was highest among those with primary education, with the next highest group being those with secondary education (Figure 6.2).

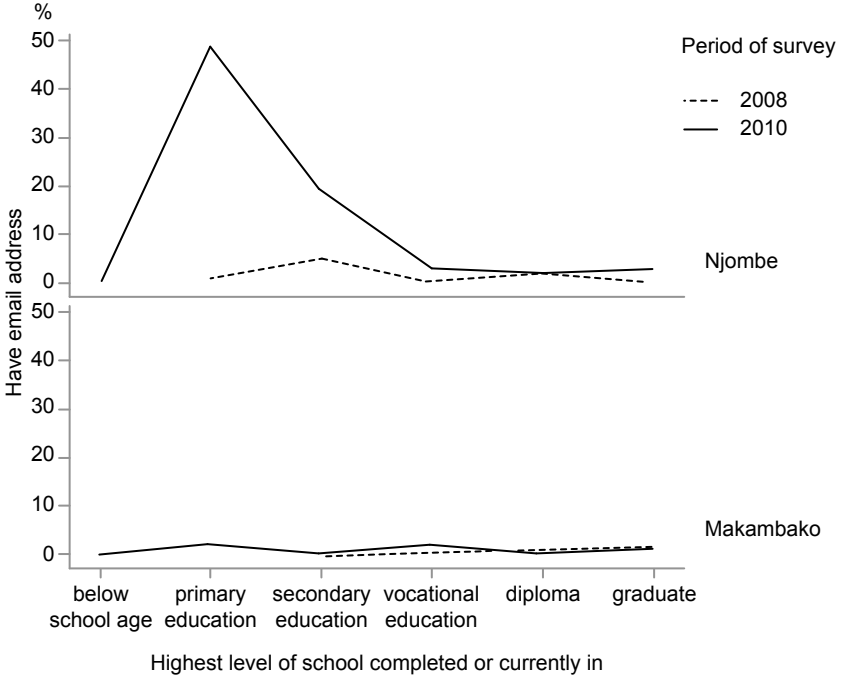

Figure 6.2 Access to email by education in 2008 and 2010

Undoubtedly, the change was affected by the level of education among the selected MSEs. The highest level of education among the enterprise owners was primary education and all were provided with the intervention regardless of their education. However, the results show that even those with primary education will use the email/internet if it is made available accompanied with some training. The use did not depend on the education of the users. Pearson's correlation tests seemed to support this finding since the relationship between the number of email addresses and the level of education in Njombe in 2010 was found to be positive but insignificant (*r=0.112; p=0.288*), whereas in 2008 the correlation was positive and significant (r=.210; p=.000). Two examples are given in Box 6.1 which illustrate how the intervention assisted the MSEs to overcome the initial disadvantage of a low education level which had been a problem in 2008.

Box 6.1 Access to the internet by MSEs with primary education

Case 1: a female tailor

The highest education level that this woman had achieved was primary education. While looking at a Tanzanian website during her training and practice sessions, she came across pictures of local weddings showing the outfits of the bride and the bridesmaids. She made sketches of the dresses of the bridesmaids and used these to design a whole new line of clothes for young girls. The new designs were very popular and her business has grown substantially. Her monthly turnover increased from 150,000/- in 2008 to 240,000/- in 2010. Before she had to woo customers; now she has so much work that she is looking for a good assistant.

Case 2: the micro-entrepreneur

This man made iron gates and window railings out of wrought iron. His highest level of education was also primary but this education took place when English was the medium of teaching in primary schools. He found the internet very useful in getting new designs for his wrought ironwork. He was one of the regulars – according to the records of the Altek Internet Café where the internet was being offered – he had used it for 86% of the free time that was provided as part of the interventions. Between 2008 and 2010 his income increased from Tanzanian 80,000/- per month to 100,000/- per month. He was due to participate in a live television show in Dar es Salaam to share his experiences and opinions about the study, but was unable to do so because he had just been offered a lucrative contract to manufacture security grilles by the owner of a large tea estate located nearby in Njombe District.

These are small beginnings, but show that the intervention which provided free access to the internet/email had the potential to overcome the limitation of education that is often stated as the main constraint for the higher use of email. Without the targeted interventions, the level of education was still the determining factor, as in the case of Makambako where in both years the largest group of users was those with the highest level of education.

It is not intended to argue here that the use of the email/internet is not related to or affected by the level of education of the user. What is presented is the evidence that adequate training can overcome the constraint of low level of education for some functional use of the internet/email. In some ways this learning by doing is similar to the Hole in the Wall initiative which was started in the slum areas of New Delhi in 1999 and which has now spread to other countries including Uganda (<www.hole-in-the-wall.com>). Children who had little education and no experience in using the computer at all were able to use a computer keyboard, access websites, and even network with others, when they were provided with free hands-on access to the computer. This methodology of learning by doing encourages a more flexible approach to the use of the internet for MSME owners who cannot improve their basic level of education.

Changes in the use of ICTs

The overwhelming ICT used for business was the mobile phone in both 2008 and 2010. In both locations, mobile phones were used in business for a variety of reasons, the most important of which was for buying and selling (19% in Njombe and 16% in Makambako), to get information (22%/20%) and to give information (21%/20%), together constituting about 60 per cent of the use.

However, the intensity of use changed. Data on the frequency of use of the mobile phones for business was collected at five levels: not used at all; used less than once a week; once a week; more than once a week; more than once a day. Respondents were requested to choose only one of the levels. In 2008, about 15 per cent of the MSE owners did not use the mobile phone for business at all; in 2010, that was no longer true – all enterprise owners selected for the study in both locations were using this ICT in business. About 98 per cent in Njombe and 77 per cent in Makambako were using the mobile phones for business more than once a day – the highest level of use – compared with about 70 per cent in Njombe and 72 per cent in Makambako in 2008. Thus both groups had accelerated the use of mobile phones for business; the increase was statistically significant at 0.01 levels in both locations but the level of acceleration was higher in Njombe.

In the case of the internet only one household was found to be using the internet regularly for business in Njombe in 2008; in 2010 this had increased to seven, a small number in terms of absolute numbers but a seven-fold increase and significant at 0.05 level with $p = 0.0127$. Hopefully the trend has been set and will spiral upwards (see Table 6.5). The level of use of both mobile phones and the internet was thus much higher in Njombe than in Makambako due to the interventions.

Table 6.5 Changes in intensity of use of mobile phones and the internet for business 2008–10

Location	*ICT*	*2008 (%)*	*2010 (%)*	*Change (%)*	*Significance*
Njombe	Mobile more than once a day	70	98	+ 28	0.0000**
Njombe	Internet	1.1	7.6	+ 6.5	0.0127*
Makambako	Mobile more than once a day	72	77	+ 5	0.344
Makambako	Internet	0.1	0.1	No change	0.3199

* Significant at 0.05 level
** Significant at 0.05 and 0.01 levels

In order to better assess the impact of the interventions on the intensity of use, a proxy indicator, monthly expenditure on ICTs, was used. The changes in expenditure on ICTs between 2008 and 2010 are shown in Table 6.6. Both groups increased their expenditure on ICTs between 2008 and 2010, but Njombe was spending on average about 96,000 Tanzanian shillings per month on ICTs compared with an average of 47,000 Tanzanian shillings in Makambako. The increase in spending between 2008 and 2010 was statistically significant only in Njombe. The airtime worth 30,000 Tanzanian shillings per month that was provided to the benefit group in Njombe certainly contributed towards this increase, because if one discounts the intervention, the group in Njombe was spending only 19,000 Tanzanian shillings more than the group in Makambako. The main conclusion is that the enhanced expenditure on ICTs in Njombe was mainly due to enhanced expenditure on mobile phones. The question is how had this extra injection of funds affected the business turnover and the poverty indicators of the households of the MSEs?

Table 6.6 Changes in mean monthly expenditure on ICTs between 2008 and 2010 (in Tanzanian shillings)

Location	*2008*	*2010*	*Change*	*T value*	*Significance*
Njombe	38,482.61	96,048.39	57,565.78	7,053	0.000**
Makambako	22,141.05	46, 705.26	24,456.42	1.718	0.89

** Statistically significant at 0.01 level

The increased expenditure on ICTs also affected the pattern of travelling for business. In spite of the extended access to ICTs, travelling on business was part of the business strategy of most of the micro and small enterprise owners. In fact the data from 2010 found that the proportion of MSE owners

who travelled on business had not changed very much since the baseline was carried out in 2008, being around 60% in both locations in 2008 and 2010.

Nevertheless, during the monitoring of the interventions, one of the benefits of the greater access to airtime was stated to be reduction in the number of days travelling. The gains in time and money were more in the reduction of the number of days spent rather than the times that the MSME owners travelled per se. The number of travel days had been reduced in both locations, but the reduction was higher in Njombe (20%, significant at 0.05 level) than in Makambako (14%, and not statistically significant). The resultant savings were spent on expanding the business through purchasing more goods and products. In a few cases, the savings were used to improve the household assets such as installing terrazzo floor tiles.

So how have these changes affected the poverty levels of the benefit group in Njombe as compared with those of the control group in Makambako?

Changes in the poverty/welfare indicators between 2008 and 2010

The analysis of the changes in the poverty/welfare levels among the groups between 2008 and 2010 began with an assessment of changes in financial capital, focusing on two proxies: expenditure and business turnover. Expenditure considered monthly expenditure on food, water, and energy, and yearly expenses on health, transport, clothing for self and others, furniture, repairs, and school fees. Expenditure could be stated in terms of monthly expenditure for frequently purchased items, such as food, water, transport, and energy, or yearly expenditure, such as furniture, clothes, repairs, or school fees. Yearly expenditure was averaged out as expenses per month. A per capita expenditure of US$1 per day for a month of 28 days was used to establish a poverty line. This was then used to delineate MSE households into poor, that is, those below the poverty line, and non-poor, those above the poverty line. This method had been used in the baseline and was used again in order to assess the changes. Changes in the exchange rates between 2008 and 2010 were taken into account.

Changes in poverty levels

In 2008, the proportion of poor households in the sampled MSEs in Njombe and Makambako was about the same: 50 out of 93 or 53.8 per cent for Njombe, and 54 out of 95 or 56.8 per cent for Makambako. In 2010, poverty levels in both groups had decreased, but the reduction was much greater in Njombe, dropping to 16.1 per cent, a decrease of 37.7 per cent, compared with 38.9 per cent in Makambako, a decrease of about 17.9 per cent. Both differences were significant, with $t = 19.575$ and $p = 0.000$ (significant at 0.001) for Njombe, and $t = 17.077$ and $p = 0.000$ (significant at 0.001 level) in Makambako. The t value for Njombe was much higher than the t value for Makambako, showing that the change was much greater in Njombe. Looking at the rates of decline, the rate declined by 70 per cent in Njombe compared with 31 per cent in

Makambako.[5] Thus *while both groups had reduced poverty, the group in Njombe had reduced it by a much higher rate.*

Business turnover

The second proxy indicator for financial capital that was assessed was business turnover based on a mean turnover per month – 12 months for 2007 (for the baseline), 12 months for 2009, and 5 months (January to May) for 2010. For 2009 it would be just before the provision of the interventions, while for 2010 it would be just after the interventions had ended. Both locations showed the same overall trend: a sudden decline in 2009 and an increase in 2010 (Figure 6.3). This confirmed that the MSEs in the two areas operated under similar conditions during 2007 (for 2008 data), 2009, and 2010. Whatever affected the turnover in 2009 in Njombe also affected the turnover in Makambako. In 2010 both locations showed a recovery. However, the rise in the mean turnover for Njombe between 2009 and 2010 was much higher than for Makambako for the same period (Figure 6.3). The results of a paired sample test show that the change in turnover was significant only for Njombe, and only for 2009 and 2010, with t = –5.227, p = 0.000. For Makambako, the values were t = –2.716; p = 0.008 (not significant at 0.001 level).

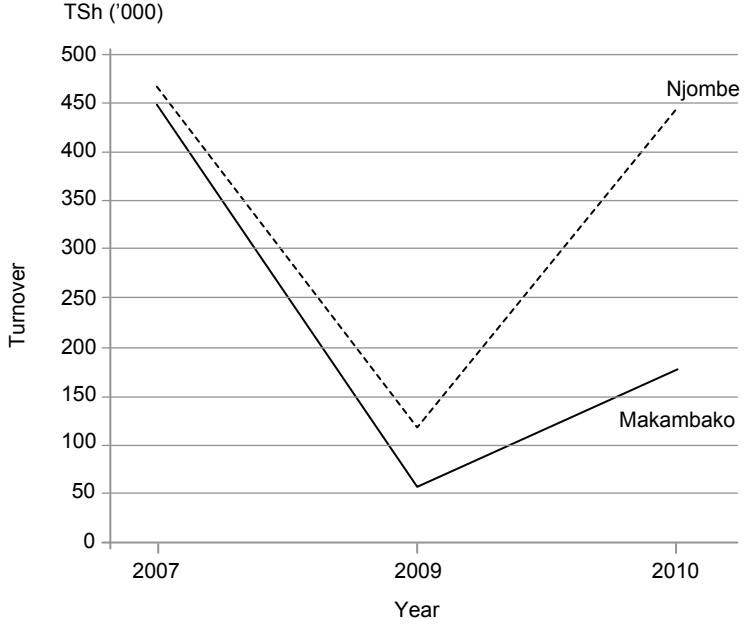

Figure 6.3 Monthly business turnover in Njombe and Makambako in 2008–10

Note: N = 93 for Njombe and 95 for Makambako

Thus turnover at both sites was similar at the start of the project; while midway between the start and end of the project, the MSEs experienced a fall in turnover, perhaps as a consequence of the global economic crisis, but with those in Njombe falling less than those in Makambako. At this stage no interventions had been provided, and the enterprises in both locations were similarly affected by changes in the broader Tanzanian economy and the more local economy within Njombe District, in which both areas were located. After the interventions, the enterprises in Njombe experienced a surge in turnover to reach levels similar to those in 2007, and more than twice those in Makambako.

Changes in other poverty indicators

An analysis of changes for the other poverty indicators – assets (movable household possessions), physical (access to amenities such as water and electricity), and social (perception of vulnerability and belonging to groups) – also supported the evidence that the changes were significantly greater in Njombe than in Makambako (Table 6.7). The only exception was human capital, with its proxy of mean score of years of education of the household members. This was due probably to the fact that the time for the interventions was too short – just five months which would be too short to cause significant changes in the educational levels of the members of the household. There was also no change in one of the proxy indicators for social capital, proxied by belonging to groups. There was no difference between 2008 and 2010 among the MSEs in Njombe, the benefit group, or in Makambako, the control group, probably due to the individualistic nature of conducting business.[6]

Table 6.7 Statistical significance of changes in multi-dimensional poverty indicators in Njombe and Makambako between 2008 and 2010

Poverty indicator	*Njombe*			*Makambako*		
	Change	*T*	*Sig.*	*Change*	*T*	*Sig.*
Per capita income	243,144 TzSh	2.758	0.000**	150,142 TzSh	1.445	0.149
Per capita expenditure	181,160 TzSh	0.482	0.000**	35,319 TzSh	0.94	0.95
Business turnover[1]	329,470 TzSh	5.227	0.000**	121,068 TzSh	2.7167	0.008
Education (mean score for all hh members)	0.48	–410	0.682	0.31	–995	320
Assets	0.41	–19.381	0.000**	1.06	–10.918	0.000**
Physical poverty (decrease)	–0.13	–11.491	0.000**	–0.11	–7167	0.000**

** Highly significant at 0.01 level

1 Comparison between 2009 and 2010 because of the downturn in 2009, with 2010 showing recovery in both locations

The two proxy indicators for social capital were vulnerability and social inclusion. Vulnerability was much lower in Njombe, where about a third (34%) felt less vulnerable in 2010 than in 2009, compared with 24.2% in Makambako.[7] The MSE owners belonged on average to two social groups, but there was no difference in such affiliations between 2008 and 2010 among either the benefit group in Njombe or the control group in Makambako

In summary it can be stated that the data show that there were reductions in poverty levels between 2008 and 2010 in both locations, but the reduction in poverty in Njombe was greater than that in Makambako:

- There were significant positive changes in four of the seven poverty dimensions in Njombe, compared with one out of seven for Makambako.
- The rate of decrease in poverty levels based on per capita expenditure in Njombe was more than twice that in Makambako.
- Vulnerability was high among both groups but much lower in Njombe – 66 per cent in Njombe compared with 76 per cent in Makambako.

Role of ICTs in reducing poverty among the benefit group

This 'quasi-experiment' will need to be done several times before making a definite statement about the role of ICTs in reducing poverty among MSEs. Nevertheless, the greater rate of increase in business turnover following the provision of the ICT interventions resulted in a greater reduction of poverty between 2008 and 2010 in Njombe as compared with Makambako, and coincides with significant increases in access to and use of ICTs in Njombe compared with Makambako. Prior to the interventions, the selected MSEs in both areas had similar levels of poverty and the ups and downs in business turnover were similar for both areas. After the interventions, the trend in the increase in business turnover was significantly higher in Njombe among the group of MSEs that received the intervention. In the absence of any significant development that would explain the reason for the difference, the inference is strong that enhanced use of ICTs in Njombe resulting from the ICT interventions contributed towards a higher decline in poverty in Njombe as compared with Makambako, which did not have the interventions. The ICT interventions that increased access to and use of ICTs in Njombe contributed towards higher business turnover resulting in increased income and expenditure, which in turn led to significantly lower rates of poverty among the benefit group in Njombe than among the control group in Makambako.

In order to further understand the role of ICTs in poverty reduction we decided to compare the changes in the access to and use of ICTs by those that moved from poor to non-poor, and those who remained poor in both years among the benefit group in Njombe, using changes in the number of ICTs between 2008 and 2010 and change in expenditure on ICTs between 2008 and 2010. The results are summarized in Table 6.8.

Table 6.8 Impact of ICTs on movement from poor to non-poor between 2008 and 2010 in Njombe

Category of poverty group	*Change in no. of ICTs*	*Sig.*	*Change in expenditure on ICTs*	*Sig.*
Moved from poor to non-poor	1.24 (3.38 in 2008, 4.62 in 2010)	0.0001**	43,919 TzSh (+160%)	0.0000**
Remained poor	0.61 (3.31 in 2008, 3.92 in 2010	0.8251	6,561 TzSh (+36%)	0.5232

** Significant at 0.01 levels

The rate of change in the ownership of ICTs for those that moved from poor in 2008 to non-poor in 2010 was twice as much as for those who remained poor in both years. Even more important, the expenditure on ICTs by those that moved was far in excess of those that did not move, supporting our argument that it is not the mere access to ICTs that contributes to reduction in poverty but rather the use of it as proxied by expenditure. The ICT intervention provided 30,000 Tanzanian shillings per MSE owner per month. Many of those that remained poor had spent less than the money given resulting in a low mean expenditure in 2010 and indicating that they were not able to absorb the free airtime provided to them to enhance their business. Indeed, the monthly reports from the mobile telephone company that supplied the airtime (Celtel now called Airtel) did show that a number of the beneficiaries did not use up the airtime that they were given. Those that were able to make full use of the extra airtime were able to increase their turnover and thus make the transition from poor to non-poor. Thus ICTs can make a difference, but it depends very much on the ability of the MSE owner to fully utilize the technology. This constitutes a constraint that goes beyond the technology and the supporting infrastructure such as the nature of the business or its low capitalization.

No intervention can have a 100 per cent positive impact, especially over a short time period. Nevertheless the study provides evidence that the majority of the selected MSEs in Njombe were able to improve their business turnover and reduce poverty within their households through greater access to and use of ICTs for their business.

Limitations of the impact of ICTs on some dimensions of poverty among MSEs in Njombe

Although the greater access to and use of ICTs resulted in significant reduction in poverty among the majority of the selected MSEs in Njombe, it was most noticeable for the money-metric indicators, and was less evident for

education, the proxy indicator for human capital, and Makambako did better than Njombe for assets.

Formal education

The analysis found that the enhanced access to and use of ICTs had little impact on education which was a proxy for human resources in the SL framework. Education was measured in terms of the average number of years of formal education of the members of the household. The period of assessment of the impact of the interventions was very short – five months – whereas changes in formal education occur over a year. However, at the informal level some significant changes were taking place as a result of greater access to the internet. About 54 per cent of enterprise owners had email addresses and about 40 of these were regular users of email and the internet during the period of the interventions. These persons had acquired skills in using a computer keyboard, sending and reading emails, and reading information from websites. As several of them reported, it removed the fear of using a computer, and the number of MSEs using the internet for business increased sevenfold. By using the computer, they gained self-confidence and skills, which some used successfully in their livelihood strategies. There were a number of examples where even those with primary-level education had benefited from the enhanced use of the internet and had increased their income. The gains are small, but they are important indicators of how enhanced access to the internet can assist MSEs to increase their human capacity. Thus while there was no statistically significant evidence that the deliberate enhancement of ICTs had a positive impact on the formal indicator of human capital, there was evidence that at least some MSE owners in Njombe had increased their skills in acquiring new knowledge for their business with resulting positive impact on their business turnover and thereby their poverty levels.

Assets

The impact of ICTs on assets, one of the indicators of poverty, was also not clear. Assets constitute a very important indicator of welfare of the household. In times of stress the sale of assets provides much-needed relief. In the baseline, assets showed the strongest relationship with ownership of ICTs ($r = 0.874$; $p = 0.000$). In 2010, both locations had increased their assets and the changes between 2008 and 2010 were statistically significant in both locations (Table 6.7). Nevertheless, the rate of change was higher for Makambako (1.06) than for Njombe (0.41).[8] In other words, the enhanced access to ICTs in Njombe did not lead to a higher rate of positive change in assets compared with Makambako between 2008 and 2010. Therefore enhanced access to and use of ICTs had less of a positive impact on assets than on money-metric indicators such as expenditure, income, and business turnover. As in the case of education, the lack of the expected greater benefit in Njombe in

terms of assets was probably due to the fact that the time period between providing the interventions and the post-intervention survey was too short to enable households to invest in additional assets, which needed a longer term strategy. Changes in assets may not be quickly visible soon after an intervention leading to enhanced access to ICTs. A third survey of the same MSEs might have provided more clarification on this aspect.

Physical poverty

Finally there was a decrease in access to physical resources using basic services and quality of housing as proxies. The ICT interventions did not lead to any positive significant change in Njombe for this indicator. Again this could be explained by the fact that the time factor was too short for changes in access to basic services or improvements in housing. It could also be due to the fact that access to such services is not always the result of the use of individual resources. Water, electricity, and sewerage systems are all dependent on the extent to which the relevant private or local government authorities can supply such basic services. In this case, it appears that the households in both locations suffered a decline, possibly due to systemic problems which could not be overcome by increased individual or household incomes resulting from enhanced use of ICTs. This shows the limitations of the effectiveness of ICTs in improving physical capital, where the basic infrastructure and governance are not in place. This was also the finding of studies in Southeast Asia (Kotelnikov, 2007).

Conclusions

The data show that between 2008 and 2010 access to and use of ICTs, particularly the internet, increased at a much higher rate in Njombe than in Makambako. This was due to the interventions. Significant increases in access to and use of ICTs in Njombe paralleled increased reductions in poverty levels in Njombe compared with Makambako, where the lower access to ICTs paralleled lower rates of poverty reduction. In view of the fact that there were no major circumstances other than the enhanced use of ICTs to explain the differences, the conclusion is that the increased access to ICTs in Njombe provided by the interventions had contributed to a higher rate of poverty reduction in Njombe. However, there are some qualifications to this overall conclusion. The impact of ICTs on poverty was more easily and quickly seen in those poverty indicators that are amenable to changes in the short term, rather than those that are strategic and require a sustained long-term investment, such as education or an optimum level of increase in financial savings such as would be required to acquire assets.

The response to the intervention to facilitate access to the internet was low, and clearly much more needs to be done to enhance the use of the internet by the MSEs. Nevertheless, the findings reveal that education does

not necessarily limit the use of the internet. The experience in Njombe shows that targeted interventions with supportive monitoring and assistance in usage can overcome the limitations of the use of computers, email, and the internet, provided the information obtained is relevant. Given sufficient opportunity and relevant information on the internet, the MSEs will use the internet and overcome the limitations posed by low levels of education. Seven persons were able to make the transition within five months and with very short-term training. This will get easier as the internet becomes available on mobile handsets. These findings in turn have important policy implications.

Although the evidence showed that ICTs, especially the mobile phone, can reduce poverty, it also revealed limitations in the use of ICTs. The fact that some of the poor were using only a fifth of the free airtime that was given to them shows that use of ICTs for enhancing business and reduction of poverty depends very much on the ability of the MSMEs to use the technology to its full capacity. This in turn depends on some underlying factors that constrain the full use of ICTs by MSMEs, such as type of business and low level of business capital.

There are policy implications for expanding MSE access to ICTs, especially mobiles and the internet. For mobiles a major constraint of the MSEs, especially the poor, is the high cost of airtime. Lowering the cost is especially important for reducing the frequency and costs of travelling on business. Government institutions such as TCRA and the Commission of Science and Technology (COSTECH), in partnership with mobile companies, should disseminate products that are especially tailored to the needs of the MSEs such as prices and markets for trade goods.

For the email/internet there has to be a strategy to increase opportunities for micro and small businesses to access and use the internet. This strategy will need to consider the kind of training that is provided by institutions like SIDO and the Vocational Education and Training Authority (VETA) that have been especially set up to enhance the business skills of MSEs, and will also need to have a pro-active policy for improving access to ICTs in the formal education system beginning with secondary level.

Notes

1 The methodology is described fully in the section under research approach.
2 Locating the same households that we first surveyed was a challenge at each phase of the study. Many of the sampled MSEs were operating the businesses themselves; many were also travelling on business or on personal matters at the time of the surveys. In some cases the operator had moved and no one knew where they had gone to. Data collection for the two surveys was carried out using a mainly pre-coded questionnaire.
3 The Tanzania Small and Medium Enterprise Development Policy (URT, 2003) defines enterprises as follows: microenterprises are those with a capital of less than 5 million Tanzanian shillings (US$3000); small enterprises with a capital of more than 5 million Tanzanian shillings up to 200 million shillings (US$3000 to US$125,000); medium enterprises with a capital of

between 200 million and 800 million Tanzanian shillings (US$125,000 to US$500,000) (US$1 = 1600 Tanzanian shillings approx. in 2013).

4 SIDO was used in the study to carry out the general business training that was offered to MSEs in both locations. The aim of involving them was to create awareness within SIDO to include the use of ICTs in their regular training programmes. That had not materialized by 2010.

5 The reduction was more dramatic than we had expected and we tried to find out if there were other interventions which affected Njombe town and not Makambako township. However, we did not find any that would result in such a drop in poverty reduction.

6 When asked about the lack of change, the researchers were informed that the MSEs were not organized in groups or networks for business purposes and also did not have the time to engage themselves in social or political groups.

7 Only qualitative data were available for this indicator.

8 We could not explain the reason behind the higher rate of increase in assets in Makambako between 2008 and 2010 compared with Njombe since the difference was noted only at the time of the analysis of the findings and it was not possible to do a follow-up survey to investigate this fact.

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CHAPTER 7

Mobile phones and the food price crisis in Rwanda

Kathleen Diga, Claude Bizimana, Felix Korbla Akorli, and François Bar

The PICTURE Africa research spanned the 2008/09 period during which East Africa (and much of the world) experienced dramatic increases in food and fuel prices. The food price increase was a result of extreme global changes of weather, amongst other factors, leading to below average agricultural production, which translated into incredible price spikes in global food and fuel costs. This chapter examines how this crisis affected spending amongst households in Rwanda's most disadvantaged areas. The descriptive findings explored the shift in household food and non-food (including ICT) expenditures and poverty levels between 2007 and 2010. While poverty levels increased, the sample households also adopted mobile phones at an increasing rate. Rural and poor households were able to maintain food expenses while having new access to mobile phone technology. Urban households faced a more difficult situation as they experienced substantial drops in non-food expenditures while maintaining access to ICT. Changes of vulnerability and mobile access did not change markedly over time. This could imply that food and fuel crises are only some of many shocks within the lives of the poor. Their spending choices adjusted according to changing values, leading to the adjusted behaviour of mobile phone maintenance for personal and business use, an activity now embedded within their everyday lives.

Keywords: Africa, food crisis, information and communication technologies for development, panel research, poverty, Rwanda

Poverty, the global crisis, and mobile phones

While the global food crisis between 2007 and 2010 resulted in dramatic commodity price increases in Rwanda, it is unclear how this affected spending patterns amongst the country's poorest households. This chapter draws on household surveys conducted by the PICTURE project to observe food and non-food household expenditures and to analyse the extent of household spending change over this crisis period. The economic crisis left 50 million more people in extreme poverty around the world by 2009 (World Bank, 2010). The Food and Agriculture Organization (FAO), which follows the food

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price index each year, found high food prices in 2010, which only declined slightly in 2011 (FAO, 2011). The same pattern of sharp food price spike and drop was also seen between 2007 and 2008.

The global food crisis was a result of the decreased availability of world food commodities, increased petrol and input costs, a growth in the global population (predicted to reach 9 billion by 2050), and the changed food consumption patterns in emerging nation states like China, India, Brazil, and Russia (FAO, 2011). All of these factors have put pressure on the global food demand. The global food crisis in 2007/08 had a distressing impact on the population. The Global Hunger Index found that by 2009, the world counted over one billion hungry people (von Grebmer et al., 2011). Africa had some of the most extreme levels of persistent hunger. African households are still largely dependent on agricultural productivity for their livelihoods in terms of food subsistence and income. Wodon and Zaman (2010) argued that the higher food costs would lead to welfare losses, particularly affecting the already poor, as well as an increase in poverty in Africa. Food insecurity was found to be increasing in East and South African countries alongside global inflation of food prices (Headey, 2011). Childhood under-nutrition can lead to poor physical and mental development, which have detrimental effects in later adult life (Victora et al., 2008). The assurance of adequate food provision during the crisis had become less secure for the poor, who became unable to pay for the higher costs for food.

The inability to meet rising food costs can mean adjusting household budgets and purchasing less food. Regmi et al. (2001, cited in von Braun, 2007: 6) argues that, 'for every 1 per cent increase in the food prices, food consumption expenditure in developing countries decreases by 0.75 per cent'. As households are trying to find ways to cope financially with higher food prices, they are looking for strategies to allocate scarce resources to pay for proliferating ICT, in particular to cover mobile phone costs. Given the phenomenal increased use of mobile phones in the East African region (see Chapter 2, May et al., 2014), we need to understand the role mobile phones play within the crisis. One possible approach is to analyse the strategic use of information and communication technologies, especially when used to leverage changes in household budgets. A review (Ruel et al., 2010) of those most vulnerable during shocks like the food crisis found that the urban poor were most affected. The study also revealed vulnerability, as the re-allocation of resources such as cuts in food costs, health, childcare, and education were part of household members' coping strategies.

These food budget and expenditure choices of African households are occurring in the midst of the continent's growing and ongoing demand for information and communication technologies (ICT). The implementation of Rwanda's National ICT strategy, complemented by increased ICT infrastructure (both broadband and mobile phone operators) as well as partnership initiatives such as the One Laptop per Child (OLPC) (2007 to present), contributed to increased ICT access (Andersson and Norrmalm, 2010). Mobile

subscription jumped from 13.2 per 100 inhabitants in 2008 to 33.4 per 100 inhabitants in 2010 (ITU, 2011). The lower costs and wider penetration of certain ICTs in Africa have allowed even the poor to participate. In Chapter 2, May et al. (2014) reveal that between 2007 and 2010, 30 per cent of the respondents with less than US$2.50 per capita per day had access to ICTs. The willingness to pay for one item over the other, such as mobile phones over food, has not been well researched, although certain studies have begun to document this phenomenon (Diga, 2007; infodev, 2012). The ITU has started measuring mobile-cellular price sub-baskets as a percentage of the GNI per capita, in individual countries. For example, in Rwanda, the mobile sub-basket was 34 per cent of the per capita GNI (ITU, 2012), much higher than in Kenya, Uganda, and Tanzania, with values of 6.8 per cent, 25.1 per cent, and 22.9 per cent respectively (ITU, 2012). The relatively high costs of ICT in Rwanda are part of the balancing act of accessing and having certain essential household items within one's meagre income.

In some cases, mobile phones, despite costs, have improved local capacity to deal with the unpredictable changes in food prices, and thereby helped lower the severity of poverty. For example, farmers have used mobile phones to search and share market prices of produce as well as bargain a fair price for their produce in Niger (Aker, 2008). A further study in Niger investigated the 2005 food crisis and showed that sharing pricing information via mobile phones resulted in lower price dispersion across markets (Aker, 2010). While mobile phones will certainly not be a means of feeding the hungry, they can be useful to access other resources and mitigate the major depletion of a household expenditure budget. The period 2007/08–2010 saw substantial levels of increased global poverty, a food crisis which inflated produce and fuel prices to extreme levels, yet at the same time it saw the great uptake of ICT on the African continent. Within this context, there remains a research gap on how these dramatic changes affect everyday life in East Africa. This study explores Rwanda at the micro-level, particularly examining this mix of changes amongst households located within the country's poorest communities.

East Africa: global economic recession

The East African region was far from sheltered during the global economic recession, which saw rising food and fuel prices in the region. Higher costs for transportation, erratic weather changes, and high-priced agricultural inputs were felt by its citizens, particularly in rural agricultural zones. The PICTURE Africa study was completed during the food crisis in East Africa. This Rwanda study takes the PICTURE data and provides insight to the household expenditure changes amongst the poor as a result of these lower incomes and extreme price levels.

Rwanda is a central African country with a land area of 26,338 km^2, a population of 9 million and a population density of 377 people per square kilometre, one of the highest densities in sub-Saharan Africa. Rwanda had experienced the highest level of vulnerability, or the greatest risk of slipping

into absolute poverty and deprivation. Resettlement after the 1994 genocide involved nearly 3.5 million people, 107,000 were imprisoned, and more than 30 per cent households were headed by women and 85,000 were headed by children (Republic of Rwanda, 2002). The number of vulnerable persons may have gone down since 1994, but remains high with more than 20 per cent of households headed by women and more than 11 per cent of the population landless (Musahara, 2005). The population is dependent on subsistent agricultural production (Huggins, 2009), yet recent changes of land and agricultural reform policy can place uncertainty on land tenure and food security for such farmers (Pritchard, 2013).

During the survey period from 2007–10, Rwanda was not shielded from further shocks like the food crisis. In fact, during this period, fuel prices saw substantial increases, since Rwanda is an oil-importing country and hence dependent on global economic and socio-political circumstances (Republic of Rwanda, 2011). The inflation rate in Rwanda during the PICTURE Africa study started at around 12 per cent in 2007, dropped slightly below 5 per cent by January 2008, rose sharply to approximately 21 per cent in 2009, and dropped to under 5 per cent near the end of the study. Greater inflation rates lower the value of average earnings, making it a challenge for the poor to move out of poverty.

Interestingly, in May 2011, after the PICTURE Africa study was conducted, Kigali was noted as the one East African capital city which had maintained consistent fuel pump prices, while its neighbours in Nairobi and Kampala were experiencing a crisis of short supply. The Rwandan government had prepared itself by holding oil reserves and monitoring fuel prices in order to mitigate substantial price changes. For example, in January 2011, Rwanda had a fuel price of 887 FRw (US$ 1.47), which rose to 1,015 FRw (US$ 1.67) in May (14% increase). However, Tanzania and Kenya saw increases of 60 per cent and 21 per cent respectively in prices at petrol stations (Karuhanga, 2011). Nevertheless, rising fuel prices in Rwanda played out in the higher cost of commodities in the region. As one news report stated, 'Claude Habiyambere, a market vendor said that sales have dwindled in recent months as customers cut spending due to the increase in prices' (Nyesiga and Ngamije, 2011).

Besides the higher food and fuel prices in the country, some parts of Rwanda underwent severe natural disasters between the periods of 2007–10, and the communities are certainly prone to further periodical changes of weather. The western part of Rwanda experienced heavy flooding, leading to a displacement of just over 1000 households or around 5,000 persons, by 12 September 2007. There were also major earthquakes in February 2008 in the southwest of the province (Reliefweb, 2008), and heavy wind and rains affected residents in the Western Province at the end of September 2008. The global economic recession affected Rwanda on top of other ongoing incidences of vulnerability.

Rwanda poverty profile

Rwanda is one of the world's poorest countries with a per capita GDP of approximately US$230. The poverty definition in Rwanda reflects multidimensional elements and is reflected in a complex inter-linkage of past problems that cannot be resolved easily. The poor do not have enough land, income, or resources and have little or no access to basic needs (Republic of Rwanda, 2002). Currently it is estimated that 56.9 per cent live below a national poverty line of 90,000 FRw (Rwandan Francs) (or US$164) per adult per year.

The most recent Household Living Conditions Survey (EICV2 (2005/06)) shows that the gap between the poor and non-poor may be widening. While the Gini coefficient was 0.29 in 1985, it is estimated to be more than 0.5 today. The present distribution shows that the lower 60 per cent of the population account for 20 per cent of the consumption expenditure and the upper 10 per cent mobilize 50 per cent of the consumption expenditure.

The backbone of the economy is agriculture, which employs more than 79.5 per cent of the labour force and contributes up to 34.6 per cent of GDP and 45 per cent of export revenues (as of 2006) (World Bank, 2011). As mentioned earlier, Rwanda has also invested heavily in non-agricultural areas such as telecoms and information and communication technology policies.

In 2008, Rwanda's Ministry of Local Government (MINALOC) implemented the Vision 2020 Umurenge Programme or VUP (Republic of Rwanda, 2008). Within four of the poorest sectors of all 30 districts (120 out of 416 sectors), the VUP provides some direct transfers (to the poorest), 'public works' for able-bodied household members, and access to finance and other technical assistance. Rwanda's agricultural interests, progressive ICT policy, and reduction of poverty since 1995 make the country an interesting study to investigate the household changes which took place during the financial and food crisis in 2007/08, particularly with regards to access to the mobile phone.

The concept of vulnerability

In understanding the theoretical concepts around shocks and crisis, Amartya Sen (1999) elaborates on the capabilities framework where security is highlighted as one of the five capabilities required in order to reach individual freedom. He states, 'freedom from crime and violence, and a social safety net to prevent misery, starvation, death' (quoted in Heeks and Molla, 2008: 32). The PICTURE Africa survey examined vulnerabilities and shocks as one of the dimensions for poverty within an adapted sustainable livelihoods (SL) approach. The adapted SL approach includes coping strategies or livelihood shocks which are relevant to a study undertaken during the food crisis. These elements contribute to the understanding of vulnerability. Vulnerability is 'a dynamic concept generally involving a sequence of events after a … shock' (Glewwe and Hall, 1998). Chambers (1983) discusses how

the less poor have more choices and assets to protect themselves from negative livelihood shocks, while the poor have less protection. Nevertheless, the poor use various livelihood strategies to temper difficult periods (Devereux 1993; Frankenberger et al., 2000).

Rwanda has been beleaguered with ongoing crises since 1994, and the recent global food price crisis had great implications on vulnerability upon households. This study examines vulnerability within the SL approach, but with a particular focus on changes in household spending behaviour and ICT access during 2007–10. The study is useful in seeing that even the poor demanded mobile phones during the food crisis and within constrained household budgets which are coping with high food and fuel costs.

Demographic characteristics of Rwanda's sample

The PICTURE Africa research used panel data collected during an 18-month period (2007–10). Two phases of quantitative and qualitative data collection occurred in the poorest rural and urban enumerating areas of Rwanda. The sample for Wave 1 (2007) of the survey involved 408 randomly selected households, while Wave 2 (2010) covered 302 households, 74 per cent of the 2007 sample (Table 7.1). The same households were interviewed in the second wave as in the first. The study uses both descriptive cross-sectional analysis and matched household samples from the two waves of data.

Table 7.1 Number of households interviewed

	2007	*2010*
Frequency (%)	100.0	74.5
Total households (n)	408	302

Source: PICTURE Africa 2007–10 dataset

Most of the households in both waves (58.8% and 56.6%) were located in urban areas. The 408 households covered during 2007 had a total of 1,940 household members, while the 304 households covered during 2010 had a total of 1,615 household members. The average household size for both 2007 and 2010 surveys was five, which matches with the EICV2 (2005/06) survey's average household size in Rwanda.

The mean age of individuals interviewed in 2010 was 35 years and the median was 32 years (with a standard deviation of 14 years). The mean age of households interviewed in 2007 was 22.7 years and the median 20 years (with a standard deviation of 17 years). The mean age of the Rwandan population reported in EICV2 (2005/06) was 21.4 years, which represented only a small increase from the mean age of 21.0 years in 2000/01. This suggests that the PICTURE Africa data of 2007 are broadly comparable with the national profile.

The majority of the interviewed respondents were female (70.7%), of whom 26.5 per cent were heads of household, 39.0 per cent a spouse of a head of household, and 21.6 per cent a daughter of a head of household. Close to 50 per cent of those interviewed were married.

Relevant change between 2007 and 2010

Financial poverty

The measure of poverty used in this study is based on the level of consumption below which individuals are considered poor or non-poor as computed in the EICV2 (2005/06) (NISR, 2006). This relative poverty line is derived through the cost of basic needs method and was set at 90,000 FRw (US$146) per adult per annum. The PICTURE Africa study uses this poverty line adjusted for the Adult Equivalent Scale. The differences between households in their size and composition are determined through the computation of the household size measured in adult equivalents and using the scale reproduced in Annex 7.1.

In the three years between 2007 and 2010, there was an apparent decline in monthly food expenditure and non-food expenditure per capita per month when estimated at current prices.[1] Food expenditure included items purchased and received as gifts and payment for services, and items produced by the households themselves. Non-food expenditure consisted of items purchased monthly. The survey also notes the dramatic increase of expenditure on household items between 2007 and 2010, and the large allocation of other expenditures in 2010. A possible scenario is that households became poorer after the crisis, thus leading to smaller budgets. Yet at the same time, households made further investments in household items.

Table 7.2 Monthly household (per capita) mean expenditure (FRw)

	2007 mean n = 408	*2010 mean n = 302*
Food expenditure	10,662.0	5,249.8
Non-food expenditure	6,437.6	3,613.3
Other expenditure	–	6,083.9
Household items	1,881.4	4,003.9

n = per household
Source: PICTURE Africa dataset

In an examination of Rwanda's poverty measures in Chapter 2 (May et al., 2014), the PPP$2.50 international poverty line was used (adjusted for domestic inflation rates to 2005 prices and converted to PPP$). Poverty in the country was then calculated based on monthly per capita household expenditure (PCE). Using this approach, the authors found Rwanda's money-metric

poverty status to be 53.3 per cent in 2007/08, rising to 61.1 per cent in 2010, representative of the poorest communities in East Africa. As mentioned above, this study uses the relative poverty line to distinguish the poor from the non-poor, which is realistic in terms of the country's calculated adult basic needs. Figure 7.1 shows the total household monthly expenditure, and food monthly expenditure, per poverty status in 2007 and 2010. There is a clear difference between poor and non-poor households on food and non-food mean expenditures in the sample. The poor spent more on non-food expenditure in 2010 than 2007/08, but the proportion of non-food spending over total spending decreased. The non-poor spent less in 2010 on non-food expenditures than in 2007, and the proportion of non-food costs over total household monthly expenditures also decreased. The household mean monthly food and total expenditures increased for both poor and non-poor households over time. These results show differences when household total expenditure is stratified versus household per capita expenditure (Figure 7.1 and Table 7.2). The mean household total expenditure increased over time, but the mean per capita total food and non-food expenditures decreased over time. Changes in the size of a household and those who generate income probably help to explain such differences.

In-depth examination of rural areas and major urban areas show that rural household expenditures in 2007 and 2010 were dramatically less than urban household expenditures (Figure 7.2). However rural households increased their food and non-food expenditures from 2007 to 2010, while the major urban households experienced decreases (slight drop in food but dramatic drop in non-food) during the same period. These results may be explained by

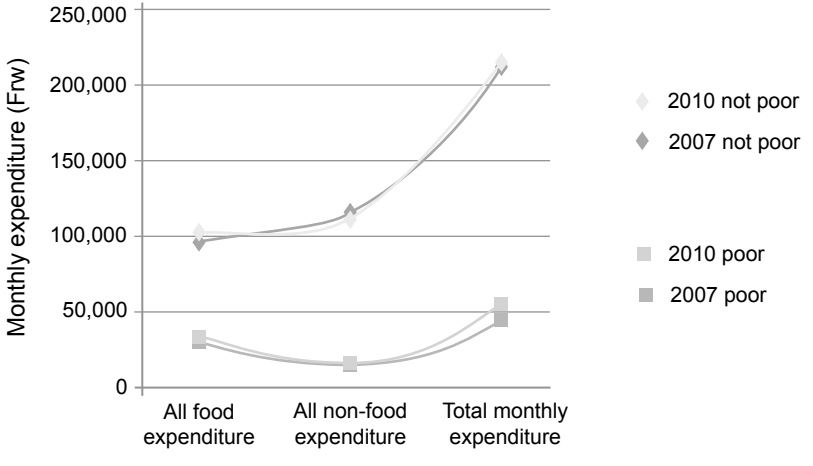

Figure 7.1 Total household monthly expenditure per poverty status (FRw)

Source: PICTURE Africa dataset

the high cost of energy, which takes up 14 per cent of all non-food expenditures for households (Republic of Rwanda, 2007). These increased costs may be the country's high transport or fuel costs during the food and fuel crisis. For urban areas, these higher fuel and food costs may see households adjust their behaviour through less frequent use of fuel by wealthier urban households. Rural households may have had less fuel costs in 2007/08 and thus did not need to adjust as dramatically as urban households. The rural household 2007 PICTURE Africa expenditure data seem close to the EICV2 (2005/06) average, with an undercount of non-food expenditure; however, over time, the rural and urban household expenditures moved away from the EICV2 national average.

Rwanda's household ICT status

Chapter 2 (May et al., 2014) shows Rwanda as ahead of other PICTURE study countries in ICT access to computers, emails, and landlines, which may be a result of the government's concerted effort to invest in major ICT infrastructure within the country. It also remains fairly ahead of Uganda and Tanzania on access to other ICTs in East Africa's poorest communities. Households in Rwanda also gained ICTs dramatically over the period 2007/08–2010. This next section looks more closely at the ICT transitions in the selected matched households (259 households were matched) between 2007 and 2010, which may help to explain the distinct changes in household item expenditures and non-food expenditures.

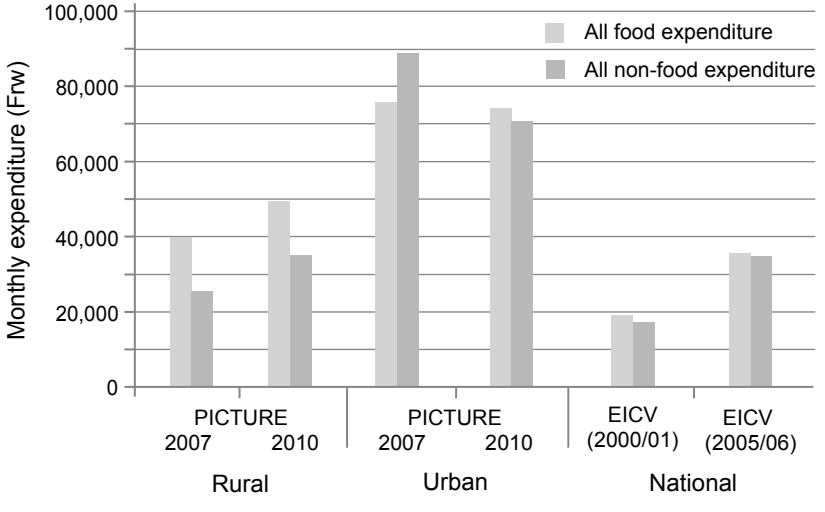

Figure 7.2 Total household monthly expenditure per survey location (FRw)

Source: PICTURE Africa dataset

Table 7.3 shows the changes in household access to ICT and mobiles between 2007 and 2010. The gain or loss of ICT was analysed using the multi-dimensional index of digital poverty with the following variables: per capita mobile access, email access, landline, television, and internet. ICT access appears nearly identical to the mobile phone access, so when households referred to ICTs, it is highly likely that they were referring to mobile phone access. In total, 47.9 per cent of matched households had ICT access in 2007 and 2010, 25.5 per cent of households had no ICT in either year, 24.3 per cent gained access between 2007 and 2010, and only 2.3 per cent lost access.

Table 7.3 Household changes in ICT and mobile access between 2007 and 2010

	ICTs		*Mobile access*	
	Frequency	*(%)*	*Frequency*	*(%)*
No ICT/Mobile	66	25.5	67	25.9
Always ICT/Mobile	124	47.9	122	47.1
Lost ICT/Mobile	6	2.3	6	2.3
Gained ICT/Mobile	63	24.3	64	24.7
Total	259	100.0	259	100.0

Source: PICTURE Africa dataset

Table 7.4 shows the changes in ICT access in matched households differentiated into rural and urban. Similar proportions of rural households either had no ICT in 2007 and 2010 or had ICT in both years. Far more urban than rural households had ICT in 2007. Slightly more rural than urban households gained ICT access over the period (27.0% compared to 21.9%), and more rural than urban households lost ICT access. A total of 58.1 per cent of rural households had ICTs by 2010, which may bring light to Figure 7.1, which shows rural household non-food expenditures increasing in 2010. In urban households, non-food expenditure dropped between 2007 and 2010, despite the gain (21.9%) in ICT. It may be that those who always had ICT and those who gained ICT spent substantially less on average on their mobile phones than in 2007. The period also saw a drop in costs of mobile airtime and services.

When ICT status was analysed in poor and non-poor matched households, the results were similar to those comparing rural with urban households (Table 7.5). As expected, a majority of non-poor respondents had ICT in 2007 and 2010, and most of those who had no ICT in 2007 gained access by 2010 (to give 93%). One-third of poor respondents had no ICT in 2007 or 2010, but 25 per cent gained access to ICT in this period, a similar proportion to the non-poor group. Thus even during a period of food and fuel price rises, households were finding ways to obtain or retain their ICT. Non-poor households had the greatest access to ICT and a marked gain over the period, even though their non-food expenditures dropped.

Table 7.4 Changes in ICT status between 2007 and 2010 per survey location

	Urban		*Rural*	
	Frequency	*(%)*	*Frequency*	*(%)*
No ICT	20	14.6	46	37.7
Always ICT	86	62.8	38	31.1
Lost ICT	1	0.7	5	4.1
Gained ICT	30	21.9	33	27.0
Total	137	100.0	122	100.0

Source: PICTURE Africa dataset

Table 7.5 Changes in ICT status between 2007 and 2010 per poverty status

	Not poor		*Poor*	
	Frequency	*(%)*	*Frequency*	*(%)*
No ICT	6	5.9	60	38.5
Always ICT	72	70.6	52	33.3
Lost ICT	1	1.0	5	3.2
Gained ICT	23	22.5	39	25.0
TOTAL	102	100.0	156	100.0

Source: PICTURE Africa dataset

The results of analysis of change in ICT status according to gender of household head are shown in Tables 7.6 and 7.7. Proportionally, females had slightly greater gains in ICT than males between 2007 and 2010, but losses.

Table 7.6 Households that gained ICT between 2007 and 2010 per gender of household head

		Frequency	*(%)*
Male	No	149	77.2
	Yes	44	22.8
	Total	193	100.0
Female	No	48	71.6
	Yes	19	28.4
	Total	67	100.0

Source: PICTURE Africa dataset

Table 7.7 Households that lost ICT between 2007 and 2010 per gender of household head

		Frequency	*(%)*
Male	No	189	97.9
	Yes	4	2.1
	Total	193	100.0
Female	No	65	97.0
	Yes	2	3.6
	Total	67	100.0

Source: PICTURE Africa dataset

Vulnerability

The study looked at changes over time in the relationship between the mobile phone access indicator and the vulnerability indicator on negative shocks (self-reported). Table 7.8 shows the results of a cross-sectional look at households who had experienced negative shocks in the last two years in 2007 and 2010. Just over 50 per cent of households had experienced one or more shocks in the last two years before both 2007 and 2010. This may indicate that households were experiencing shocks regardless of the food crisis.

In 2007, a similar proportion of the population with mobiles or without mobiles had experienced one or more shocks or no shocks. Between 2007 and 2010, there was a decrease in the proportion of total population of those with no mobile access and no shocks, and a more marked decrease of those with no mobile access and did experience shock, both of which were at least in part due to the decrease in the proportion without mobile access. Similarly, the proportions of total population with a mobile who did not experience shock, or did experience shock, both increased, although the increase in those experiencing shock was slightly greater. A slightly smaller proportion of those who did not own a mobile (52% compared to 57%), and a slightly greater proportion of those who did own a mobile (54% compared to 49%), experienced shock in 2010 compared to 2007. Overall, the results show that the same proportion of households (just over half) experienced shock in 2007 and 2010, but shock did not appear to be related to mobile phone access.

Table 7.9 shows the proportion of negative shocks experienced by the poor and non-poor in the two years before 2007 and 2010. The shock levels in both groups were similar in 2007 and 2010, with a higher proportion of the poor reporting shocks in both years.

Table 7.8 Number of households reporting shock in 2007 and 2010 per mobile phone access

	2007			*2010*		
	Frequency	*(%)*	*(%)*[1]	*Frequency*	*(%)*	*(%)*[1]
No mobile / no shock	57	21.7		38	13.7	
No mobile / yes shock	74	28.1		41	14.8	
% without mobile who experienced shock			56.5			51.9
Yes mobile / no shock	68	25.9		92	33.2	
Yes mobile / yes shock	64	24.3		106	38.2	
% with mobile who experienced shock			*48.5*			53.5
Total	*263*	*100.0*		*277*	*100.0*	

Note: Shock is indicated as one or more shock experience in the preceding two years
1 The percentages in this column are derived by dividing the frequency in the row above ('no mobile / yes shock' and 'yes mobile / yes shock' by total frequency.
Source: PICTURE Africa dataset

Table 7.9 Number of households reporting shock in 2007 and 2010 per poverty status

		2007		*2010*	
		Frequency	*(%)*	*Frequency*	*(%)*
Poverty status	Non-poor	55	39.9	58	39.5
	Poor	83	60.1	89	60.5
	Total	138	100.0	147	100.0

Note: Shock is indicated as one or more shock experience in the preceding two years
Source: PICTURE Africa dataset

These descriptive findings of the PICTURE Africa Rwanda households give one a glimpse within the country's poor communities. There appear to be major differences in household expenditures between non-poor and poor households as well as between rural and urban households. There is also a diversity in change over time between gains or retention of ICTs within the household depending on location, household poverty level, and gender of household head. We also observed household vulnerability level changes over time given mobile phone access. Overall, this gives a more comprehensive

sense of the changing lives of Rwandan households within the context of ICT proliferation and times of global crisis.

Conclusions and recommendations

Rwanda provides an interesting case of what occurs during multiple food and fuel price crises amongst vulnerable groups, particularly on ICT gains and food and non-food spending over time. Those households based in rural areas and/or identified as poor had similar patterns of food and non-food spending. In other words, rural and poor households both experienced slight increases in their food and non-food expenditures between 2007 and 2010. In contrast, urban and non-poor households dramatically dropped their non-food expenditures during the same period. In both poor and non-poor households, ICT and mobile access were either being retained or gained between 2007 and 2010. The data on poor and/or rural households who retained or gained mobile phone access by 2010 seem to correspond with non-food expenditure increases by 2010. These expenditure increases can be related to the increase in ICT between 2007 and 2010. Urban and/or non-poor households, showed decreases in non-food expenditure but retention or gain of ICT access by 2010, which could result from the lower costs of mobile phone services (e.g. airtime). In both 2007 and 2010, the majority of households with no ICT were poor households. In terms of gender, similar proportions of men and women heads of household gained or lost access to ICTs between 2007 and 2010. Finally, the survey found that a majority of poor households had experienced one or more shocks in the preceding two years, but only a minority of non-poor households. No clear relationship was seen between change in experience of shocks, and change in mobile phone access. This supports the notion that continuous shocks affect Rwanda's poorest communities, but these shocks have little relation to their mobile phone access. Rather, coping with everyday shocks, including those resulting from the food crisis, is part of daily life. Households are adjusting their limited budgets accordingly, within the context of greater availability of digital products and ongoing incidences of vulnerability. Further work may need to be done to re-think which ICT indicators can best match vulnerability indicators to give a better sense of well-being amongst poor households.

The findings suggest that households make difficult spending decisions in response to ongoing shocks, including during the food and fuel crisis. Every expenditure, from quantity of food consumption to choices of non-food, must be carefully considered, and values for food and non-food items must be assessed within the confines of limited resources. This study has been able to describe and reflect on the various spending actions taken by Rwandan households. The evidence reflects the gain and retention of ICTs during the 2007–10 time period in the midst of limited budgets and the ongoing insecure lives of the poor.

Independently of East African households' efforts to manage through the difficult period of 2007/08, governments and institutions are also challenged to improve their agricultural, land, and economic policies to better mitigate the effects of the food crisis and other external shocks within their local populations. At the micro-level, this study helps understanding of food spending and the importance of mobile phone access within a context of crisis. Through such understanding, one can move forward to developing innovative government interventions which consider how best to support the lives of the poorest, especially during such external crisis. Given the expansion of ICTs and their access to the poor, further work can be done to examine whether ICTs can play a role in this process. Furthermore, Rwanda still has one of the highest costs of ICTs (mobile phone and broadband) compared to the other three East African countries in the PICTURE Africa study. Lowering ICT costs would give the poor a greater chance to participate, given their limited budgets. At the global level, transparent, fair, and open global trade that enhances the efficiency of agricultural markets should be maintained. Overall the changing environment both at the ecological and digital level will need to be monitored closely particularly on how these changes may affect the lives of the poor.

Notes

1 A limitation to the 2007 survey was that 'other expenditure' allocation information was not collected. This conclusion therefore must be taken with caution.

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Annex 7.1 Adult equivalence scale used for the construction of the consumption indicator

Age range	*Gender*	
	Male	*Female*
Less than 1 year	0.41	0.41
1 to 3 years	0.56	0.56
4 to 6 years	0.76	0.76
7 to 9 years	0.91	0.91
10 to 12 years	0.97	1.08
13 to 15 years	0.97	1.13
16 to 19 years	1.02	1.05
20 to 39 years	1.00	1.00
40 to 49 years	0.95	0.95
50 to 59 years	0.90	0.90
60 to 69 years	0.80	0.80
More than 70 years	0.70	0.70

Source: McKay and Greenwell, 2007

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CHAPTER 8

The complexities of establishing causality between an ICT intervention and changes in quality of life: CLIQ in South Africa

Heidi Attwood, Kathleen Diga, and Julian May

This chapter investigates the impact on quality of life from an ICT intervention (located within a participatory action research process) which provided free computer training and use to over one hundred participants from four communities in South Africa over two years. Data on individual levels of participation and from an evaluation of implementation by area, show that changes in participants' well-being were influenced not only by the newly acquired computer skills and use, but also by the process through which it was delivered and, particularly, by participants' engagement in action research methods with fieldworkers. While overall two-thirds of participants noted an improvement in their quality of life, the proportion was higher among those with better individual participation and in areas with better implementation. The research presents a logic model as the emergent theory behind the intervention and suggests that for a positive effect, the intervention needs to reach a particular level of intensity, or 'tipping point.'[1]

Keywords: action research, agency, information and communication technologies, poverty reduction, quality of life, South Africa

Although information and communication technologies (ICTs) have been shown to promote economic growth, the linkages between ICTs and the promotion of individual or community quality of life remain uncertain. More specifically, although one common means of local accessible delivery of ICTs to the public is through telecentres (Coward, 2008), research on the success of this strategy is inconclusive. This is partly due to differing definitions of what constitutes a telecentre and how telecentre success should be measured in terms of goals and standards (Coward, 2008). Do people enjoy a better quality of life (QoL) if they have access to and use a cell phone? Does access to and use of connected computers increase their well-being? If these answers are positive, then the reasons for impact on QoL need to be explored, alongside reasons for a lack of impact or negative impact on QoL if and when this occurs.

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To explore this, a participatory ICT intervention in four communities from the province of KwaZulu-Natal (South Africa) was undertaken between 2008 and 2011. This intervention known as the Community-based Learning, ICTs and Quality-of life (CLIQ) research project[2] aimed to provide insight into the impact of individual training and use of computers at state-sponsored telecentres on the individual QoL of poorer people. Guided by CLIQ's research question: 'Can access to ICTs (in particular computers) after needs-based training and use, improve the QoL of poorer people as defined by them?', the participatory action research process had a triple focus. The first was to support participants to actually improve their lives, and the second was to support the four participating telecentres through capacity-building activities identified during the course of implementation. The third focus was to analyse information from the research process and individual outcomes in order to understand better the potential impact of ICT use on QoL.

It emerged that connected and unconnected computer use does often impact positively on individuals, and that the process of participation was empowering for many participants. Participants used the CLIQ opportunity to improve their financial resources (through access to jobs and improving their small businesses), as well as their psychological, social, and knowledge resources. From qualitative data, it emerged that many participants were empowered from direct interaction with researchers and with fellow participants, from the nature and focus of individual engagement in research methods such as goal setting, or from feelings of being part of something at community level. This was in addition to empowerment related to computer use, i.e. access to information and increased communication. Thus, the process surrounding new ICT access, skills, and use, and the nature of their involvement, contributed towards impact on people's lives, over and above any new ICT access, skills, and use (of computers and cell phones). The research identified issues which promoted and mitigated against improvement in QoL through ICT use. In addition to qualitative analysis, quantitative data analysis confirmed that the nature of participation and implementation of ICT interventions does matter. This chapter presents CLIQ's quantitative data, confirming the impact of the nature of participation and implementation through a causal diagram. Drawing mostly on qualitative data, the range of influencing factors, participants' activities, a variety of paths to changed QoL, and resultant development outcomes are illustrated through a logic model of the CLIQ intervention.

The chapter is structured as follows. First, the theoretical underpinnings of programme theory and QoL are addressed, as well as the context of the research; the research design process is then briefly presented along with variables for the analysis of some findings. Through analysing the varied experiences of participants over two years, the paper goes on to show how with 'good' participation from individuals and more 'successful' project implementation, QoL is likely to improve beyond that which might have occurred in the absence of the intervention. Some examples are provided of the various

impacts and resultant change in QoL. We conclude that a positive impact was achieved, but that this was a result not only of the provision of computer training and access, but also of the way in which it was delivered – in particular the design and spirit of data collection, as espoused in the principles of participatory methodologies.

The names of the research areas have been changed, to protect the identity of the participants and other local stakeholders involved in the research process. An alias was also assigned to each participant to protect their identity. The reader should take caution when reading numerical tables, as sub-sample sizes are often below 50 people. The data are presented in percentage form to allow for easier comparison across sub-samples of different sizes, however statistical significance testing on differences has not been done.

Programme theory and quality of life

While the powerful role of ICTs in social and economic development is recognized (Warschauer, 2008: 140; Urquhart et al., 2008: 203), there remain huge questions about how best to use ICTs to improve the QoL of poorer people or to the benefit of poorer nations. Attempting to research if and how QoL changes due to ICT use is tricky, not least because 'ICT use' is a very broad term even if confined to newer technologies (see different combinations of ICT devices with various types of connectivity in ITU's 2013 statistics, ITU 2013), and because there is no common definition of QoL or agreement on how it should be measured (Costanza et al., 2008). Rather, quality of life is generally recognized to be a complex multi-faceted construct (Diener and Suh, 1997; Tiwari, 2009). Noting challenges made by Amartya Sen and Martha Nussbaum to an economic approach to well-being measurement, and drawing on the work of Manfred Max-Neef (in 1992) and Martha Nussbaum together with Jonathan Glover (in 1995) among others, Costanza and 20 other colleagues defined human needs (after a conference debating the issues) as including: 'subsistence, reproduction, security, affection, understanding, participation, leisure, spirituality, creativity, identity, and freedom … (where) … quality of life (QOL) is represented as the interaction of human needs and the subjective perception of their fulfilment, mediated by the opportunities available to meet the needs' (Costanza et al., 2008: 18).

With reference to local definitions of well-being, White and Pettit (2004: 6) state that, 'the people living within a situation could plausibly be expected to have a better understanding of the many issues facing them than outside experts'. QoL is widely regarded as difficult to measure, with a common methodological debate centring on objective versus subjective measures of well-being (Tiwari, 2009: 138). Furthermore, establishing causality between ICT use and QoL change or empowerment is difficult. Ng'ambi and Brown (2004: 38) noted in their utilization-focused evaluation of ICT in education: 'No single factor is a necessary and sufficient cause for any other factor', and Hudson (2001: 170) notes how any chain of inference showing a causal

connection between telecentre provision and development outcomes would therefore be complex.

Programme theory using logic modelling provides a mechanism by which interventions aimed at change can be understood. Frechtling (2007: 1) defines a logic model as 'a tool that describes the *theory of change* underlying an intervention, product, or policy. It characterizes a project through a system of elements that include components and connections, with context being an important qualification'.

Interventions themselves are rarely simple, addressing complex problems across different contexts and sectors, with multiple procedures, variable sequencing, and differing levels of successful implementation. The challenge is to provide a model that links the inputs of an intervention; the environment which impacts on it; and the activity or behaviour of the people linked to the intervention. Rogers (2008) discusses aspects of complex programmes which become evident when modelling the inherent logic, which include the involvement of many groups or organizations, many sites of implementation, and multiple or alternate causal chains linking inputs and outcomes that can occur simultaneously within the same intervention. In addition to this, complex logic models can show recursive causality where there is more than 'one pass' through the intervention or through parts of the intervention, i.e. where the causal chain contains feedback or reinforcing loops (Rogers, 2008). 'Emergence' and 'tipping points' are also features in some complex interventions. 'Tipping points' are present 'where a small additional effort can have a disproportionately large effect', while emergence is when 'specific outcomes, and the means to achieve them emerge during the implementation of an intervention' as the 'path to success is so variable that it cannot be articulated in advance' (Rogers, 2008: 39 & 31).

Kubisch et al. (1995: 1) described comprehensive community initiatives (CCIs) as a varied range of initiatives that have a common goal of 'promoting positive change in individual, family, and community circumstances in disadvantaged neighbourhoods by improving physical, economic, and community circumstances', and they also note features of CCIs that make them difficult to evaluate. In reference to CCIs as examples of emergent interventions, Rogers (2008) argues that a logic model can be developed to explain how a complex intervention works – which can change as the intervention and the understanding thereof changes.

There is a need to find better ways of employing ICTs to reduce poverty or improve QoL, or as expressed alternatively, there is a lack of theory with regard to ICT4D (van Dijk, 2006; Urquhart et al., 2008), particularly given the inadequacy of the digital divide concept (Barrantes, 2007; Warschauer, 2008; among many others) particularly regarding its initial technological focus (Vengerfeldt, 2003). In theorizing about the process and resources needed for effective use of ICTs, many in the ICT4D field use logic models (see Heeks, 2002; van Dijk, 2006; Kleine, 2010). This paper presents a logic model that emerged from the initial analysis of CLIQ findings.

CLIQ as an emergent and complex intervention

While the CLIQ intervention was mainly focused at individual and not community level, it has a number of similarities with CCIs as described by Kubisch et al. (1995). Firstly, a key concept in CLIQ, quality of life, does not have a clear definition or commonly accepted way of measuring it (Costanza, 2008). Secondly, while CLIQ was not initially designed to evolve over time, as it became evident that design changes were necessary, we incorporated these into the research design – this is part of the nature of emergent interventions. Thirdly, a number of environmental factors, over which CLIQ had no control, had a direct impact on the nature and success of the intervention, also a common factor found in CCIs. In addition, how and why ICT impacts upon quality of life has yet to be fully theorized due to the recent nature of the entire field of ICT for development.

In the initial design of CLIQ, the definition of quality of life, broadly and more specifically the basis on which participants might conclude improved quality of life, was not defined by the research team. Rather, we expected that the participants would define and conclude on any changes in quality of life (referred to by some as subjective well-being). We also anticipated that participants would make use of the intervention in a variety of ways to improve their quality of life. Common examples used in initial stages of the project were that if someone was happier after the intervention either because they played games on computers, or met someone during activities with whom they formed a relationship, or found a job through the internet, all would be recognized as an improvement of quality of life. This links both to the alternate causal paths and emergent outcomes referred to by Rogers (2008) as a feature of complex interventions.

From the analysis of CLIQ findings, simultaneous and recursive causal strands were identified as different participants engaged with the intervention in different ways, resulting in a range of unique outcomes. This 'what works for whom and in what ways' notion of realist evaluation (from Pawson and Tilley, 1997, cited in Rogers, 2008: 37) matches with the underlying concept in Sen's (1999) *Development as Freedom*, that development or progress means that a person can develop their own life or improve their quality of life in ways that are important for them, and not have to pick from externally determined or sanctioned options of what improved quality of life is. In the initial stages of the project, fieldworkers stressed that CLIQ would not directly improve participants' lives, but that they had to work with and use the CLIQ opportunity to improve their own lives. This is in line with Sen's (1999: 144) assertion that 'the creation of social opportunities makes a direct contribution to the expansion of human capabilities and the quality of life'.

A participatory approach

The core principles of participatory research and action methodologies reflect a number of the issues noted above in relation to QoL, ICT use, programme

theory, and community interventions and are consistent with the ethos embodied in Amartya Sen's capability theory. Participatory methodologies (PMs) are therefore particularly suited to research the impact of ICTs on QoL. Participatory research[3] can accommodate differing research environments and evolve according to local needs and realities (White and Pettit, 2004). PMs include participation and action on the part of participants, researchers, and other stakeholders as integral to the research process, analysis, and findings and are also suited to development and research activity concerned with concepts that do not have a clear or similar definition in different contexts.

The use of participatory research focusing on well-being (or QoL) is supported by White and Pettit's review, stating that 'participatory methods have thus contributed to the much wider recognition of contextual, subjective and non-material dimensions of human experience, and the complex dynamics and causalities behind poverty and well-being', (White and Pettit, 2004: 7). Participatory research is particularly appropriate to use with complex or emerging interventions, as both have processes that are flexible and which evolve over time – an attribute which also makes such interventions difficult to evaluate (Kubisch et al., 1995). Pinkett (2000) and Kleine (2010) support the use of participatory methodologies to research the impact of ICTs on development or poverty reduction.

Research design

In terms of initial research design, PICTURE Africa provided CLIQ's methodological foundation in thinking through the use of a quasi-experimental approach in a panel design. The Tanzanian component of PICTURE Africa (Mascarenhas et al., 2010) entailed the provision of complimentary cell phones, airtime, computers at internet cafes, and internet credit to randomly chosen entrepreneurs who were followed over a two-year period and explored changes of access and use of ICTs at various stages of the intervention. Drawing on this panel research design, the South African project worked with groups of participants who showed an interest in learning to use computers, providing them with computer training and free connected computer use at their local telecentre. Participatory research activities with the same participants included the facilitation of individual goal setting and planning, against the backdrop of participants' local definitions of quality of life, with repeated group and individual assessment of changes in quality of life over the course of the intervention. While the Tanzanian project provided cell phones and airtime in addition to computer use within combined qualitative and quantitative survey methods, CLIQ provided computer training and direct personal interaction with researchers as part of the participatory research.

Compared to PICTURE Africa's methodology, the participatory approach of CLIQ resulted in two methodologically influenced findings, namely that on the whole CLIQ participants benefited from the way the project was implemented, often reflecting on their own level of participation; and

secondly, more exploratory and open-ended visual data collection allowed for emergence of findings and insights into impact beyond that of ICT use. The complexity of the research process, encompassing multiple methods and the broad range of various interconnected and multi-dimensional findings, led to the adoption of programme theory, specifically a complex logic model (which will be discussed in this paper) as a basis for analysing and understanding the findings.

Based on the initial quasi-experimental panel design, four research sites in the KwaZulu-Natal (KZN) province, South Africa, were chosen in which there were operational telecentres[4] containing at least 10 computers connected to the internet. The research sites chosen were eNyakatho, an urban township near Durban; eNingizimu, a peri-urban area near Amanzimtoti on the KZN south coast; eMpumalanga, a rural area near Mangusi in the KZN northern coastal area; and eNtshonalanga, a rural area near Richmond, inland of Durban.

Table 8.1 Description of research sites

Manje sites		*Maduzane sites*	
eMpumalanga	*eNingizimu*	*eNyakatho*	*eNtshonalanga*
A sparsely populated rural area (pop. 2,020), 6 hours' drive from Durban and 30 minutes' drive from a local town (pop. 6,560) close to a national border	A peri-urban area (pop. 1,865) about 40 minutes' drive from Durban (pop. 3.6 million) and about 10 minutes' drive from an urban town centre (pop. 22,575)	A densely populated urban 'township' (pop. 31,786) about 30 minutes' drive from Durban	A sparsely populated remote rural area, 2.5 hours' drive from Durban and one hour's drive out of a local town (pop. 29,209) on gravel roads

Source: Statistics South Africa data and authors' experience of implementing CLIQ

In an attempt to isolate changes in participants' QoL that were due to the ICT intervention, as opposed to changes that may have occurred over time regardless of the intervention, a staggered approach to the introduction of the intervention across the four areas was adopted when designing the intervention. By random assignment, eMpumalanga (rural) and eNingizimu (peri-urban) were designated as *manje* (meaning 'now' in isiZulu) sites, where computer training activity and participants' use of free hours would commence approximately six months earlier than in the designated *maduzane* (meaning 'later' in isiZulu) sites of eNtshonalanga (rural) and eNyakatho (urban). This was to facilitate identification of changes in participants' QoL that occurred due to the intervention (as opposed to changes that would probably have occurred due to the normal course of life). Working in two rural areas and two urban / peri-urban areas, allowed for comparison across area 'type' within this difference-in-difference approach (where one rural

area and one urban area were randomly selected as manje areas). However, due mainly to problems with telecentre functionality across the sites, the implementation of this approach proved problematic. Instead a continuum of treatment resulted from the implementation of CLIQ, ranging in intensity, with eMpumalanga experiencing the highest intensity of the intervention and eNtshonalanga the lowest, as will be shown later. This can be thought of as varying 'dosages' of the ICT intervention.

In each of the study areas, action and research-orientated fieldwork activities comprised five stages. The first stage entailed the identification and recruitment of interested participants, in partnership with the staff of the four participating Universal Service and Access Agency of South Africa (USAASA) telecentres. The desired sample was a total of 120 participants across the four research sites using a quota sampling approach, which aimed at an equal split of participants across gender and between the three occupational groups of community activists, self-employed people, and unemployed youth.[5] From the 227 people who attended the first project activity (the *interested sample*) across the four areas to find out what the project was about, 148 were selected as participants, and together with the late acceptance of another 14 participants, resulted in a total *selected sample* of 162 participants.

The second stage involved initial QoL, and information and communication assessments, which were undertaken using visual diagramming methods in groups to identify local definitions of QoL and participants' relative QoL. Importantly, this stage also involved participants setting their own life goals during individual interviews.

The third stage involved the development and provision of two computer training courses, together with the provision of 100 hours of free computer and internet access to participants at their local telecentre. The first training course focused on computer basics, word processing, and the use of internet and email. The second focused on common life goals amongst participants, with a view to how the computer could assist in attaining those goals. In addition, this stage included a mid-QoL assessment after the first training course, both to monitor changes in QoL and, particularly, to input into the content of the second computer training course.

The fourth stage focused on participants' stated changes in QoL over the two years of fieldwork, as well as the use and impact of ICT access, and the impact of the project as a whole. Information was gathered mainly through intensive individual in-depth interviews. During the fifth and final stage, interactive dissemination workshops were held with participants in each area.

Challenges experienced during the research that impacted on the implementation of the methodology included trade-offs between the sometimes conflicting project goals of research and improvement in participants' QoL; communication with and location of participants; varying capacity and motivation of different participating telecentre managers and facilitators; low or non-functionality of telecentres; sustaining commitment and interest from participants; and time demands on participants.

The CLIQ sample

Analysis of the impact of CLIQ was possible for those participants who attended at least two assessments (as each assessment collected data on their perceived QoL and changes in QoL), but not necessarily participating in any training sessions, as well as those who only attended the final assessment. Across the four areas, 113 participants fitted these criteria, hereafter referred to as the *impact sample*, resulting in an overall attrition rate of 30 per cent.

The urban areas experienced higher attrition (41% and 39%) than the rural areas (30% and 11%). While factors other than the nature of the area had an influence on the attrition rate, the area difference does provide some indication that the urban environment impacts more negatively on medium-term project participation (two years) than rural environments. The in-depth interviews from rural areas indicated that there were fewer competing opportunities regarding training, education, and jobs, which is probably one reason for the lower attrition.

Variables explored during the analysis of the data were sex, age, area, and the urban/rural divide. Additional key variables for analysis emerged from the research process, namely individual levels of participation and the relative success of implementation of CLIQ at an area level. In addition to these, whether or not people's QoL improved is a finding as well as an analysis variable. Below, characteristics of the impact sample are presented in terms of these analysis variables.

Age and gender

Overall more women than men were interested in the CLIQ project – a ratio of seven women to three men, based on those that attended CLIQ's initial questionnaire day. While the aim was to get an equal gender split per area, this was only possible in eMpumalanga and eNyakatho. In eNingizimu, three-quarters of the selected sample (74%) were women, and in eNtshonalanga, four-fifths of the selected sample (81%), were women. Overall, two-thirds of both the selected sample and the impact sample were women, indicating no gender difference regarding attrition, which held across all areas.

The selection criteria did impact on the sample in terms of age. The target that a third of participants should be unemployed youth aged up to 24 years skewed the sample towards the youth. The average age of participants was 27 years, with ages ranging from 17 to 64 years. Just over half the total sample (55%) was aged up to 24 years – eNingizimu displayed a different pattern, with the average age being 35 years, and only 25 per cent aged 24 years of less – the average age for the other three areas was between 24 and 27 years.

Level of individual participation

Based on attendance data per participant from assessments and computer training sessions, the level of individual participation of those included in the impact sample was classified as good, average, or poor, as defined in Table 8.2. This classification is used as an analysis variable to investigate links between the level of participation and QoL change.

Table 8.2 Individual participation across all activities by area

Nature of individual participation	*All areas (%)*	*eMpumalanga (%)*	*eNingizimu (%)*	*eNyakatho (%)*	*eNtshonalanga (%)*
Good: Attended all CLIQ activities or skipped only one activity	57	73	50	52	49
Average: Skipped more than one activity but did attend some training	21	21	45	22	8
Poor: Did not attend any training	22	6	5	26	43
Impact sample (n)	113	33	20	23	37
Individual participation-based area ranking (1 = best, 4 = worst)		1	2	3	4

Considering attendance at all activities on an individual basis, participation by almost three-fifths of the sample was good, with one-fifth displaying average participation and another fifth displaying poor participation. When looking at the areas, eMpumalanga stands out, with almost three-quarters of participants falling in the good participation group, whereas the proportion was around half for the other areas. However, in eNingizimu, the proportion of participants with poor participation was lower than eNtshonalanga and eNyakatho, and about the same as eMpumalanga. eNtshonalanga displays the worst scenario with poor participation at 43 per cent (followed by eNyakatho at 22%). Based on individual participation, the four areas can be ranked from the best (eMpumalanga) to the worst (eNtshonalanga) as shown in Table 8.2. The level of individual participation was influenced by a range of individual and environmental factors[6] and can be used as a proxy for the intensity (or dosage) of the intervention in the area.

Evaluation of implementation

As the project set out to examine whether or not QoL improves with access to free computer training and computer use, it is important to consider, at an area level, the extent to which the project was able to effectively deliver

computer training and to facilitate participants' use of their 100 free computer hours (paid for by CLIQ), through the local telecentre.

The project was implemented to varying degrees of intensity in the four areas, due to a range of issues, including the non-functionality of computers; theft of computers; damage to buildings housing computers; poorly skilled telecentre facilitators; scheduling difficulties with computer trainers; and electricity cuts. To get an overall classification on the success of implementation (based on the supply side), Table 8.3 provides some qualitative measures from the implementation process, against which to view the participation numbers discussed above.

Table 8.3 Indicators of success of CLIQ implementation

Process indicator	*eMpumalanga*	*eNingizimu*	*eNyakatho*	*eNtshonalanga*
a. Months between initial assessment and phase 1 training	good	problematic	problematic	problematic
b. Months between phase 1 and phase 2 training	acceptable	good	acceptable	problematic
c. Months between phase 2 training and final assessment	acceptable	good	problematic	problematic
d. Access to free computer hours at local telecentre (TC)	good	acceptable	problematic	problematic
e. TC facilitator on hand and generally willing to help participants	good	problematic	problematic	problematic
f. Relationship between fieldworkers and participants	good	acceptable	acceptable	acceptable
Implementation-based area ranking (1 = best, 4 = worst)	*1*	*2*	*3*	*4*

Where computer training was delayed, this often affected the project negatively. Some participants either lost interest in the project; changed their mobile phone number (meaning they could not be contacted); or forgot what they had learned in the previous computer training. This resulted in attrition or in less effective computer learning and use.

Process indicators a, b, and c in Table 8.3 show that overall eMpumalanga enjoyed the best process in terms of timing, followed by eNingizimu and then eNyakatho, with the eNtshonalanga process being the worst affected by delays in project activities. Access to the telecentre to use free hours and

assistance from the TC facilitators followed the same pattern, with eMpumalanga being the best and eNtshonalanga being the worst. This implementation ranking is another proxy for the intensity of the intervention.

With many activities making up the intervention and with many possible variations in terms of individual participation in these activities, it is useful to cross-check the effectiveness of the delivery of the intervention, as delivery and participation are critical features to bear in mind when analysing the impact on participation. Table 8.4 provides quantitative information on numbers of participants per area that participated in various key project activities, confirming the participation and implementation rankings noted above.

Table 8.4 Participation in project activities per area

Project numbers and indicators	*All areas*	*eMpumalanga*	*eNingizimu*	*eNyakatho*	*eNtshonalanga*
1. Number of participants selected (selected sample)	162	37	34	38	53
2. Sample for impact analysis (impact sample)	113	33	20	23	37
3. Impact sample as percentage of selected sample (%)	70	89	59	61	70
4. Proportion of selected sample that received some computer training (%)	57	86	62	45	42
5. Proportion of impact sample that received some computer training (%)	78	94	95	74	57
6. Proportion of impact sample at final assessment (%)	78	88	85	83	62
Activity-based area ranking (1 = best, 4 = worst)		*1*	*2*	*3*	*4*

Importantly, Table 8.4 shows that while over four-fifths of participants in the impact sample from eNingizimu, eNyakatho, and eMpumalanga attended the final assessment, this proportion dropped to 62 per cent for eNtshonalanga (see Table 8.4, indicator 6). Considering the proportion of participants that received computer training (see Table 8.4, project indicators 4 and 5), again eMpumalanga emerges as the best area regarding attendance at computer training, followed by eNingizimu, eNyakatho, and lastly, eNtshonalanga.

To sum up regarding implementation and participation levels, the research findings can be analysed using an 'intensity (or dosage) of intervention' ranking, as follows: 1st eMpumalanga; 2nd eNingizimu; 3rd eNyakatho; and 4th eNtshonalanga.

Quality-of-life change as an analysis variable

Causality is very difficult to establish given the variety of influences on human being and human doing, and the interaction between these influences. To distinguish between changes that would probably have occurred in participants' lives regardless of CLIQ and those that were influenced by the CLIQ project, we applied four questions when analysing the data post-field:

1. Did the person's QoL improve, stay the same, or get worse (as concluded by the participant)?
2. What were the main factors or events leading to QoL change?
3. Did the participant feel that CLIQ impacted on their life?
4. Did the aspects of CLIQ that impacted on their life directly support any of their main reasons for QoL change?

Data gathered on changes in participants' QoL as a key finding in itself, are also used as an analysis variable. Using the questions above, participants were allocated into three impact groups: 1) those who linked CLIQ impact to at least one of their reasons for QoL change (CLIQ affect on QoL); 2) those who noted an impact of CLIQ on their life but did not link the impact to any of their reasons for QoL change (CLIQ impact); and 3) those who did not indicate any impact from CLIQ on their lives or for whom CLIQ impact was unclear (no/unclear CLIQ impact). The two QoL change groups were: 1) improved QoL, and 2) unchanged or declined QoL. The number of participants falling into the different impact and QoL change groups is shown in Table 8.7.

Local definition of quality of life

Participants shared their views on what constitutes good and poor QoL during the initial assessment and again individually, as part of their in-depth interview in the final assessment. For example, one participant, SliF30 described an indicator of poor QoL as, 'When sick and you call ambulance, there is no road for the ambulance to get to you'. Following Tiwari's (2009) example of exploring 'wellbeing at the "grassroots"' from different angles to enhance the depth of information, and given the complexity of the concept of well-being, individual goals (that would lead to a better life) from 2008 data and reasons for changed quality of life (things that actually influenced well-being) from 2010 data, were considered alongside participants' definitions of high and low well-being. Attwood (2013: 10) presents a table with examples of indicators of QoL from these three approaches, which together reveals that the most common local indicators of QoL were housing, education, jobs, small businesses, access to money and having a car. Less common indicators were friends and networks; attitude, behaviour and states of being; community engagement and voluntary activity; basic services; family; education for family members; and other assets (Attwood, 2013: 11). Thus, like

Tiwari (2009: 138), CLIQ found that livelihoods and financial resources were more prominent aspects of locally defined well-being, however local conceptions were nevertheless still multi-dimensional.

Changes in quality of life and the impact of CLIQ

Of the 113 participants, two of every three reported an improvement in their QoL between the first and final assessments (approximately two years), while one in three reported that their QoL had declined or remained the same.

Table 8.5 Changes in quality of life by area

	All areas	*eMpumalanga*	*eNingizimu*	*eNyakatho*	*eNtshonalanga*	*eMpumalanga*
CLIQ intensity/ dosage		1st	2nd	3rd	4th	Non-participants
Improved QoL (%)	65	73	70	65	57	60
Unchanged or declined QoL (%)	35	27	30	35	43	40
Impact sample	113 (100%)	33 (29%)	20 (18%)	23 (20%)	37 (33%)	

eMpumalanga and eNingizimu, with higher intensities of the intervention, recorded a higher proportion of participants with improved QoL (73% and 70%, respectively), than the areas of eNyakatho and eNtshonalanga (65% and 57%, respectively). When considering QoL changes amongst a group of non-selected people at eMpumalanga (who qualified to be part of the project but were randomly excluded), the results are similar to those of eNtshonalanga and eNyakatho. This suggests that the higher dosage of CLIQ (better participation and more successful implementation) led to an increase in the number of people with a positive change in QoL.

Table 8.6 shows that overall, a third of participants (36%) noted an impact from CLIQ that directly contributed to one of their reasons for QoL change. Another two fifths (41%) were also impacted on by CLIQ, but they did not associate the impact with any of their reasons for QoL change. The remaining 23 per cent noted no impact from CLIQ or impact was unclear (often due to lack of information from those in the impact sample that did not attend the final assessment).

Table 8.6 Nature of CLIQ impact by area

Nature of CLIQ impact	*All areas*	*eMpumalanga*	*eNingizimu*	*eNyakatho*	*eNtshonalanga*
CLIQ intensity/dosage		1st	2nd	3rd	4th
CLIQ affect on QoL (%)	36	55	50	26	19
CLIQ impact (%)	41	45	30	39	43
No/unclear impact (%)	23	0	20	35	38
Impact sample	*113 (100%)*	*33 (29%)*	*20 (18%)*	*23 (20%)*	*37 (33%)*

As with changes in QoL, the nature of impact on participants follows the same pattern as the CLIQ intensity ranking when looking at those who reported an effect on QoL (55% in eMpumalanga, down to 19% in eNtshonalanga) and when looking at those who reported no impact (none in eMpumalanga up to 38% in eNtshonalanga).

In many cases, QoL change (or lack of change) was due to more than one reason, with different factors improving or lowering QoL over a period of time and CLIQ being only one potential source of change. The bulk of those noting CLIQ affect on QoL and CLIQ impact on their lives (85% and 70% respectively) perceived an improvement in their QoL, while the bulk of those indicating no impact or where impact was unclear (73%) perceived no change in their QoL or a decline in their QoL (see Table 8.7).

Table 8.7 Quality-of-life change by nature of CLIQ impact

Nature of CLIQ impact	*Total*	*CLIQ effect on QoL*	*CLIQ impact*	*No/unclear impact*
Improved QoL (%)	65	85	70	27
Unchanged or lower QoL (%)	35	15	30	73
Total impact sample	*113 (100%)*	*41 (36%)*	*46 (41%)*	*26 (23%)*

In the six cases where CLIQ directly affected the reason for QoL change and the person's QoL remained unchanged or declined, the impact from CLIQ was positive and other factors were responsible for a decline in their QoL. For example, SallyF24 got a job because of her new computer skills, but over the same period her father died. Sally's father was an integral part of her life and so she perceived an overall decline in her QoL. Multiple compounding, or multiple but counteractive reasons for changing QoL, was found in a number of cases and illustrates the complexity of life and therefore well-being. In most cases where CLIQ impacted on the lives of participants, this impact was positive, however some negative impacts were recorded.

It is very difficult to attribute causality with regard to changes in QoL because of the multitude of global, national, local, and individual factors that coalesce to produce change. Therefore, it is important to consider the link

between the intervention and subsequent change in QoL from a number of angles in order to triangulate the findings of this research. While Table 8.5 considered QoL change in relation to CLIQ dosage at an area level, and Table 8.7 shows QoL change according to nature of impact on participants, Table 8.8 shows individual participation by change in QoL. Those with improved QoL were more likely to have participated well in CLIQ (69%), than those with unchanged or declined QoL (32%). Similarly, those with unchanged or declined QoL were more likely to have participated poorly (46%) than those with improved QoL (9%).

Table 8.8 Quality of individual participation by change in quality of life

Nature of individual participation	*Total*	*Improved quality of life*	*Unchanged or declined quality of life*
Good (%)	57	69	32
Average (%)	21	22	21
Poor (%)	22	9	46
Impact sample	*113 (100%)*	*74 (65%)*	*39 (35%)*

Table 8.9 looks at the nature of CLIQ impact on participants according to the quality of their individual participation. Virtually all (97%) participants with good individual participation were impacted on directly or indirectly by the project. Almost three-quarters of those who participated poorly (including non-attendance at computer training sessions) did not indicate any impact on their lives from CLIQ.

Table 8.9 Nature of CLIQ impact by quality of individual participation

Nature of CLIQ impact	*Total*	*Good participation*	*Average participation*	*Poor participation*
CLIQ affect on QoL (%)	36	52	33	0
CLIQ impact (%)	41	45	42	28
No/unclear impact (%)	23	3	25	72
Impact sample	*113 (100%)*	*64 (57%)*	*24 (21%)*	*25 (22%)*

To sum up regarding impact and changes in QoL, more effective implementation of the intervention (one part of the dosage) leads to an increased proportion of participants with improved QoL and an increased proportion of participants linking the project impact to their reasons for QoL change. Good participation (the other part of the dosage) is more likely to lead to a CLIQ affect on reasons for QoL change, which in turn is more likely to lead to an increase in QoL. Figure 8.1 illustrates these causal linkages visually, with reference to the data tables that support the linkages.

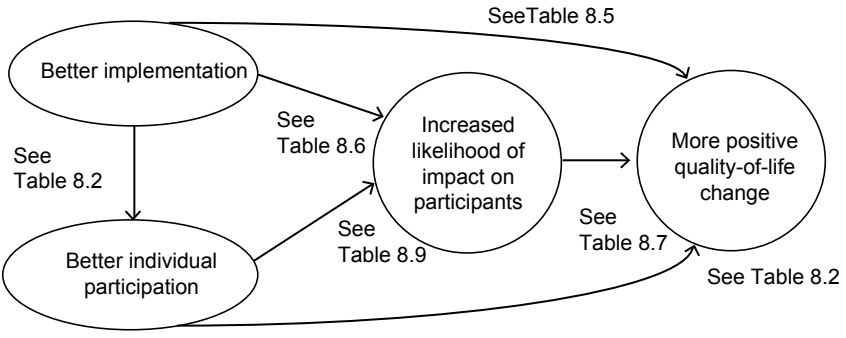


Figure 8.1 The impact of CLIQ dosage on changes in quality of life

But how and why does better participation in areas with relatively more successful project implementation lead to an increased likelihood of improved QoL? Or put differently, what is the logic behind how the intervention worked?

Causality and a logic model

Inherent in the research goal of CLIQ is the question of causality. Broadly, two aspects of CLIQ had the potential to impact on the well-being of participants. These were the computer training and free use of computer hours; and the participatory process they engaged in, particularly the assessments, but including communication and interaction beyond the assessment activities. This refers to the multiple causal strands in complex programme theory.

Outcomes were not pre-determined but rather emerged from data analysis, through a coding process drawn from grounded theory.[7] This method of data analysis is consistent with the concept of emergence in relation to programme theory, as well as with the principles of participatory research. Initial stages of analysis were frustrating as with each new set of participants analysed, a different causality chain would emerge linking different project engagement with various reasons for change. Similar outcomes were direct reasons for a change in QoL for some participants, but not for others. With the huge variety of causal paths illustrated through different participants' experiences, attempts at a causality diagram linking outcomes always ended when the diagram could no longer accommodate yet another set of arrows linking factors already on the diagram. As Rogers (2008: 30) points out, attempts to explain the logic inherent in complex programmes 'do not involve creating messier logic models with everything connected to everything'.

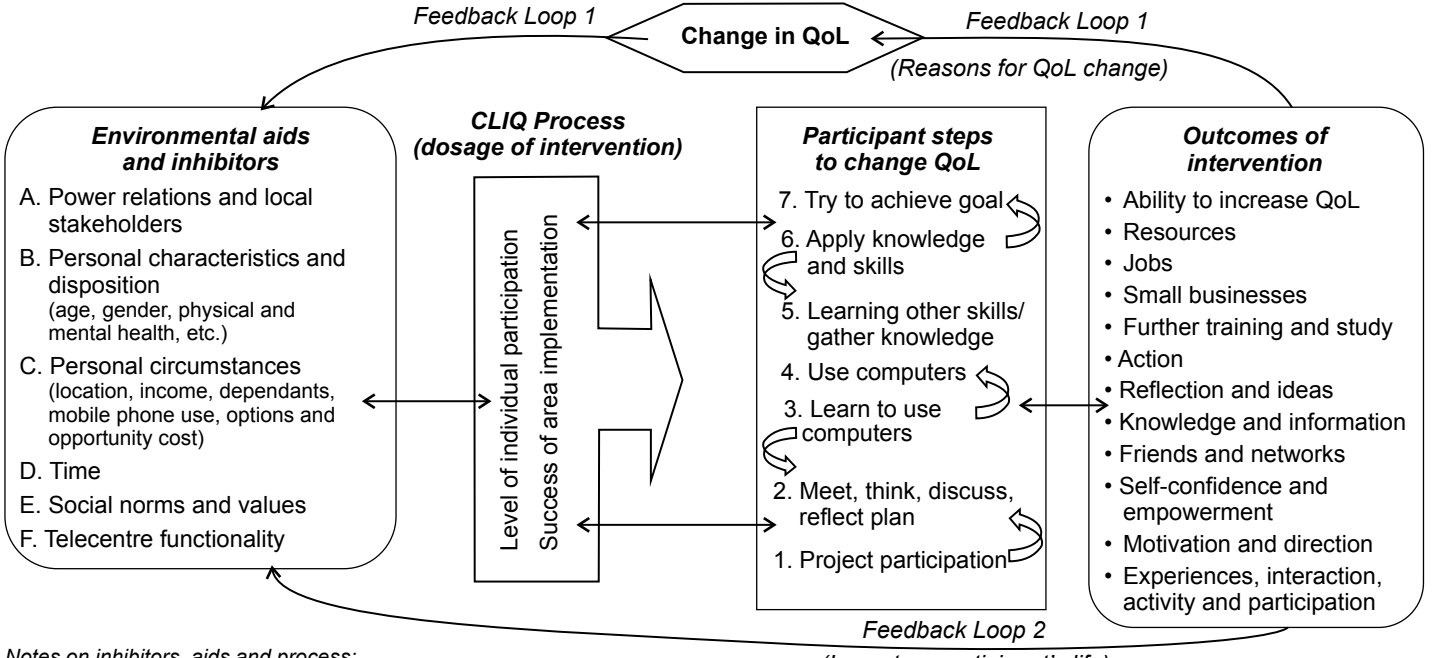
A useful diagram did nevertheless emerge from this analysis process: a logic model was created based on factors hindering and facilitating CLIQ implementation; the nature of participants' engagement with the intervention; and observed outcomes. This was based on qualitative data from group

discussions and three individual interviews per participant over the two years, as well as our experience of implementing the project. The logic model is shown in Figure 8.2. It shows recursive and multi-directional causal linkages between participants' environment, the CLIQ process, participants' steps to improve their QoL, emergent project outcomes, and QoL change.

Starting in the centre of the illustration, participant steps 1 to 5 to change QoL reflect the different stages in the research process facilitated by CLIQ together with participants and telecentre staff, while steps 6 and 7 were dependent on participants' efforts. These steps were impacted on by the CLIQ process, and the environmental factors. Participants alternated between steps as they engaged with the project and each other. The emergent outcomes (on the right) are a summary of the factors that participants noted as impacting on their lives, which in some cases changed their QoL. Environmental factors (both aids and inhibitors) A to F are the factors that emerged from analysing why CLIQ impacted differently on participants.[8] These environmental factors not only impacted on participants' ability to participate in and make use of the CLIQ intervention, but also on the process and success of the CLIQ intervention at an area level. Participants usually entered the causal model at step 1 but exited at different stages, depending on their personal mix of environmental factors. Over the two years, participants' individual mix of environmental aids and inhibitors (A to F) changed, either due to the normal course of life or due to their participation in CLIQ and the resultant outcomes (shown as feedback loops 1 and 2). While particular outcomes were more likely to be linked to particular steps (for example, the empowerment outcome can link with step 2: meet, think, discuss, reflect plan), linkages between steps and outcomes are not shown because these varied across participants.

CLIQ findings can also be interpreted through Kleine's Choice Framework, (Kleine, 2010: 680) which is based on a model by Aslop and Heinsohn (2005: 6) and also draws on the sustainable livelihoods framework used by the UK Department for International Development (DFID) and Sen's capability approach (Kleine, 2010: 676–7). Kleine's model (2010: 680) presents development outcomes as a result of choices made at different levels (or 'degrees of empowerment'), which in turn have been influenced by a combination of structure and agency, where agency is composed of a set of ten resources centred on the person.

As illustrated in Attwood et al. (forthcoming), aspects of structure impacting ultimately on development outcomes include, for example, the rules governing opening hours of telecentres, policies regarding charges for computer use in telecentres, and prevailing gender and other social norms. Examples of individual resources impacting on agency (both positively and negatively) and ultimately development outcomes, include health (where poor health prevented attendance at computer training); financial resources (where lack of money for travel prevented use of computers inbetween scheduled CLIQ activities); psychological resources (where low mental health or poor self-esteem limited participation); social resources (where meeting in groups at the telecentre promoted self- and peer-learning); and many more.



Notes on inhibitors, aids and process:

- CLIQ process and steps to changed QoL are impacted on by various aids and inhibitors.
- CLIQ process defines steps 1 to 5, which are conducted together with participants and telecentre staff and is also changed in response to nature of participants' engagement in various steps.
- Aids and inhibitors are continually impacted on by outcomes and changes in QoL (feedback loops 1 & 2), which in turn affected CLIQ process.
- Feedback loops represent the start of another "pass" through the intervention.

Notes on steps and outcomes:

- Participants undertake and exit at different steps and recursive loops between the steps are common.
- Participation and effort throughout steps 1 to 7 create development outcomes.
- Outcomes are reasons for QoL change for some and impacts, not affecting overall QoL for others.

Figure 8.2 Logic model outlining the impact of CLIQ on quality of life

One of the ways in which the choice framework improves on CLIQ's initial model is that it differentiates between structure and agency, locating individual resources and characteristics in the model and thereby accommodating an infinite set of interactions between these. It provides a model for Sen's capability theory (Kleine, 2010: 674) indicating how the same set of resources can allow different functions because of the individual's context and specific obstacles (Munyua, 2009: 127), and it also recognizes development goals unique to each person.

Nature of improvement in quality of life

The outcomes of participants' engagement with CLIQ (shown in Figure 8.2 as 'outcomes of intervention') show the range of impacts, each supported by a unique story. NelliF37 grew in confidence in relating to others and changed her perception of her role as a mother, wife, and daughter-in-law within the home. Her belief that a woman should stay at home and care for the family (in 2008) led her to venture outside the home to learn skills to care for her ailing mother-in-law, which resulted in her becoming part of CLIQ. Through CLIQ, she met people who taught her mat-making skills and she began to use her cell phone more regularly, which increased her social connections beyond the domestic realm. A similar finding was noted by Bakesha and colleagues through their work in Uganda, namely that classes at a local telecentre benefited women in terms of social interaction with other women and public expression, and that with women's increased confidence, came the potential to transform existing gender relations (Bakesha et al., 2009: 150).

While for NelliF37 the empowering impact of CLIQ was mainly social and psychological, for MthembeniM28, it was mainly economic through his new business skills. MthembeniM28's tiling business grew as a direct result of his application of what he learnt during CLIQ training. During the fieldwork period, he created marketing material on a computer to advertise his business and communicated with customers via email. By the end of the two-year fieldwork period, he had hired six workers, bought tiling equipment, and no longer relied on personally approaching shoppers in the parking lots of tile shops for business.

Impact also extended beyond participants to others in the community. Various participants mentioned assisting others in the community through their new skills and telecentre access, including typing church notices, making wedding invitations for a neighbour, finding development information for a local leader, teaching others to access the internet through their cell phones, and typing soccer fixture lists. For example, through CLIQ, MbonaM22 found a passion for ICTs, clearly visible in his demeanour when discussing what he learnt from CLIQ. He had a brightness of spirit, newfound confidence, and changed sense of self in relation to the world. In 2010, MbonaM22 stated: 'Before CLIQ, I only knew that computers were not for people like me who are from a poor family. I did not have a positive thing about computers – they

were only for people who studied at tertiary places or for richer people, so I never bothered myself about computers. I didn't know what it could do.... Now I see it as something that can change the life of a person, as long as he is given the relevant information'.

In 2008, MbonaM22's friends warned him that CLIQ was not a project aimed at helping him, however MbonaM22 was so passionate about CLIQ that he typed and printed many of his friends' handwritten CVs and gave them to them, effectively showing them that CLIQ did hold value. As others in the community witness outcomes from the use of ICTs (or generally from project engagement), there is the potential that others will be encouraged to use computers or access the internet through their cell phones. It is foreseeable that this may impact on the way future development-oriented projects would be engaged with by members of the community. It is also not beyond reason to hope that as community members see women reaping and sharing benefits from ICTs use, oppressive gender norms may be eroded.

The frequency of some form of empowerment or increased social interaction as a CLIQ impact seems to be well captured by Warschauer's comment that 'it is essential to understand and exploit possible catalytic effects of ICT. Many important changes in social relations may come from the human interaction that surrounds the technological process, rather than from the operation of computers or use of the internet' (Warschauer, 2008: 148).

With the passing of time

The impact on participants' lives must be seen in the context of time. Firstly, impact and people's perception of impact changes over time. SallyF24's QoL declined because she lost her father during the fieldwork period, and despite acquiring a job as supervisor at a car wash because she had computer skills. Her decline in QoL was probably less than it would have been without her new computer skills, which led to a better job than she was hoping for and, with time, may lead to her analysing an improvement in her QoL as she learns to cope with the pain of losing her father.

Secondly, the development outcomes reported here are based on participants' perceptions in mid 2010. Continued application of ICT skills acquired through CLIQ, ongoing interaction with new friends and networks, and further thought and action regarding information gained and their own life goals, have to date contributed (mid 2013), and will continue to contribute, to further development outcomes. An unexpected research benefit of establishing good relations with participants was that some remained in contact with CLIQ after fieldwork had ended. During the final CLIQ assessment, BathaF21 felt that a positive impact of CLIQ was that she made good friends that were supportive of her. 'Most of the people I met here are still my friends and we groom each other to be great people'. About a year after fieldwork had ended, Batha contacted CLIQ via Facebook: 'Good news is your computer skills helped me a lot coz now I'm doing admin clerk training at circuit office.

Even sometimes it hard you know but hey I'm getting there everyday'. This resonates with White and Pettit's statement that 'the "social life" of any research project – its principles, conduct and relationships established with respondents – is in fact central not only to its mortality, but also to the quality of information it can yield' (White and Pettit, 2004: 24).

MlamuliM28 posted a message to CLIQ on Facebook from his mobile phone after the final assessment in March 2010. 'Hi, i has been long time no chat, invitation to my wedding which will be at (eMpumalanga) telecentre on the 10/07/2010, i almost reach my goal cos i got job, house en wife, only car miss. nw en i'm looking 4ward in to it. Cliq participants are real progressing ....!!!'. The impact of CLIQ on QoL noted in this paper, must be seen as an interim impact which will change as time passes.

Conclusion

The social, psychological, economic, educational, and other developmental impact of participants' engagement with CLIQ cannot be precisely determined or quantified. Neither can the chain of impact on participants and others be fully traced as participants continue to live their lives, with CLIQ's impact merging with their other ongoing activities and life events over time. However, our evidence suggests that this ICT intervention did contribute to an improvement in QoL for many of the participants and did not lead to a decline in QoL for any.

Some participants' QoL improved mainly due to their use of computers for producing documents for information and communication, which resulted in them getting a job or starting a small business (among other outcomes). Others noted beneficial impacts such as new friends and networks, the acquisition of knowledge and feelings of empowerment or self-confidence, mainly due to the process and ethos of implementation. The process through which ICT skills are learnt and the social interactions surrounding and resulting from this process, together with the context of subsequent ICT access, skills acquisition, and use, is critically important to the adoption of ICTs by those in resource-poor communities.

With hindsight, the decision to provide computer training and use for free for a limited period to selected participants was the best option with respect to promoting the use of computers and ICTs more generally among poorer people, and in order to set up an intervention where people would both be able to learn computer use and to access and use computers for a limited period to improve their lives, while at the same time allowing research into the actual impact of computer training and use with respect to QoL over time. Limited local awareness of the existence of telecentres for public access computing, local perceptions that computer use is not for poor/black/uneducated people, and limited conceptions about what computer use can enable and specifically how it can be harnessed to further the personal goals of poorer people, mean that before people with no computer skills are likely to spend scarce resources

on computer training or use, the benefits of use have to be very clear. This is reflected in the discussion of CLIQ findings around livelihoods, financial, and time resources, and opportunity cost (in Attwood et al., forthcoming), as well as supported by the call to see ICTs as a tool, which will be used when the costs and benefits of use are clear (Barrantes, 2007) and when ICT use meets people's needs for information, communication, or participation (cf. Pinkett, 2000; Urquhart et al., 2008).

Looking forward

'ICTs must be considered as part of a package of development tools, alongside other interventions' (Moolman et al., 2007: 6). While CLIQ's paper on issues affecting telecentre functionality (Attwood et al., forthcoming) supports the general finding of other comprehensive reviews of telecentres as not meeting the challenge of sustainability, Coward points out that 'sustainability is not required for developmental impact, and one question is whether they offer enough value that they should become supported as public goods, like schools and libraries' (Coward, 2008: 4).

Telecentres should focus on the use that people can make of ICTs as a tool for development with respect to their personal goals; their need for communication, information, and participation; and the local context. 'Improved access to information and ICT skills … can enhance poor people's capabilities to make strategic life choices and to achieve the lifestyle they value' (Gigler, 2004). With this focus, telecentre facilitators should be trained to be more like development workers, where human development (and not technology) becomes paramount. To promote the effective use of ICTs by poorer people, the policies and practices of telecentre management need to adjust to a broader view of the role of ICTs in local development, where developmental progress will result from the agency of people, as enabled by their resources and as impacted on by structural factors (which also affects local ICT skills, access and use).

Notes

1 The process and findings of the participatory action research project on which this chapter is based is the result of a collective effort. We acknowledge the work of the team of fieldworkers and trainers, and we thank the participants for the time and energy they shared as they worked with us.

2 Community-based Learning, ICTs, and Quality of life (CLIQ) was implemented by the School of Built Environment & Development Studies at the University of KwaZulu-Natal (UKZN) with research funding from the National Research Foundation (NRF) and support from the Norwegian Institute for Urban & Regional Planning (NIBR), which has funding from the National Research Council of Norway. CLIQ was undertaken as a participatory action research project. Key research partners were the Universal Service Access Agency of South Africa (USAASA) – a unit within the National Department of Communications (South Africa) which funds

telecentres in under-serviced communities – and the staff of telecentres participating in the project.

3 Participatory research, along with numerous others like participatory learning and action, participant-led evaluation, and so on are part of a broad family of participatory methodologies (Chambers, 2008).

4 Or telecentres that were considered by the USAASA provincial office as 'soon-to-be functional'.

5 These 'occupational' categories defined by the research team were not useful in the analysis of results (as they did not match with participants' understanding) and were therefore not used.

6 These facilitating and hindering factors (both individual- and area-specific) are noted in the latter part of the paper.

7 In reference to grounded theory, Strauss and Corbin (1998: 12) note that 'Theory derived from data is more likely to resemble the "reality" than is theory derived by putting together a series of concepts based on experience or solely through speculation.'

8 These are presented in detail in Attwood, May, Braathen, and Diga (forthcoming).

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CHAPTER 9

Internet gone mobile in Namibia

Christoph Stork and Enrico Calandro

The 2007 African ICT access and usage survey demonstrated alarmingly little access to the internet in Namibia, together with a large-scale absence of computers and smartphones and compounded by a high cost of connectivity. However, the mobile phone is now the key entry point for internet usage in the country. Internet access has increased significantly as a result of a reduction of mobile communications costs and an increasing reliance on the mobile phone and applications such as social media that lend themselves to the mobile internet platform. Mobile internet requires fewer ICT skills and fewer financial resources, and does not rely on electricity at home, in contrast to computer or laptop and wired-internet access. Further, the more affordable prepaid mobile internet also allows those living at the bottom of the pyramid (BOP) to gain access to the internet.

Keywords: bottom of the pyramid, information and communication technologies, internet, mobile, mobile broadband, Namibia

This chapter uses data from a household and individual ICT access and usage survey conducted by Research ICT Africa in July and August 2011 in Namibia (hereafter referred to as the RIA survey 2011). The survey was conducted in cooperation with the Namibian regulator, the Communications Regulatory Authority of Namibia (CRAN), and the Namibian Broadcasting Corporation (NBC) and funded by the International Development Research Centre (IDRC), Ottawa, Canada. The chapter explores how Namibians access the internet and what applications drive internet adoption. The findings show that although computer ownership at household level increased between 2007 and 2011, the scope of adoption of the technology is smaller than internet connectivity at household level. In rural Namibia, computer ownership at household level decreased, while internet access increased during that time period. The mobile phone is a key entry point for internet usage in Namibia and social networking applications are driving the adoption of mobile internet in the country. Mobile internet requires fewer ICT skills and fewer financial resources (electricity at home and a computer or laptop) than fixed internet access. Prepaid mobile internet further adds a pro-poor dimension to internet access, which was otherwise only available through internet cafes that are generally not available in rural areas.

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ICTs and social and economic development

Communication and information are critical factors for markets to function efficiently. Information and communication technologies have been heralded as a key component for the reduction of poverty in developing nations. According to Bhavnani et al. (2008), few studies explore the effect of mobile adoption on sustainable poverty alleviation; in particular the literature on mobile internet for poverty reduction is scarce. The majority of studies link ITU teledensity figures for fixed, mobile, or broadband users to macro-economic variables such as GDP or total factor productivity.

At a macro-level, mobile telephony adoption was found to have a positive impact on economic welfare and GDP, it generates employment opportunities in the sector and it improves the productivity of other sectors, as it contributes to business expansion, to entrepreneurship, to banking the unbanked, and to reduced transaction costs. Lastly, it generates direct taxation revenue (Bhavnani et al., 2008).

Investment in telecommunication infrastructure has a direct and indirect positive effect on economic growth. For instance, Canning (1999) shows that investment in the telecommunication sector is substantially more productive on average than investment due to direct and indirect effects. Norton (1992) argues that both the fixed costs of acquiring information and the variable costs of participation in the market are lowered by improvement of the ICT sector.

Jipp (1963) was among the first to identify the positive association between telecommunications infrastructure and economic growth. Hardy (1980), using 45 countries divided into two groups of developed and less developed, estimated that there is a larger benefit for the less developed countries than the developed countries. According to Röller and Waverman (2001), 40 per cent of the population connected to voice services is the critical mass threshold identified as necessary to be reached before network effects that make commercial innovations such as mobile banking and employment of agricultural information services viable, and that drive economic growth and development, are realized.

More recently, Koutroumpis (2009) demonstrated the existence of several levels of return from broadband infrastructure based on the level of penetration. He asserts that there is evidence of a critical mass phenomenon in broadband infrastructure investments, and identified a critical mass of 20 per cent penetration level of the population connected to the network. His study refers to OECD countries, but can be extended to the African context since he uses standard parameters in the calculation such as GDP, level of education, broadband penetration, and prices. According to Koutroumpis, this percentage creates a vision for countries to capitalize the beneficial effects that the network can provide, and it also implies a 0.89 per cent aggregate growth rate due to broadband externalities. The World Bank asserts that in low and middle income countries every 10 percentage points increase in

broadband penetration, accelerates economic growth by 1.38 percentage points (Kim et al., 2010). The economic growth associated with the increase in broadband penetration is even higher than that associated with penetration of other telecommunications services, such as fixed or mobile phone (Kim et al., 2010).

At the social or micro-economic level, Bhavnani et al. (2008) point out that mobile telephony adoption enhances entrepreneurship and job search, since it reduces costs of starting a business and may even enable starting a new one. Further, it reduces information asymmetries and market inefficiencies, and in some instances might substitute transportation. With regards to access to information, Bhavnani et al. (2008) argue that a common characteristic of rural communities is the difficulty to access affordable and relevant knowledge services and information that would increase their knowledge of market opportunities.

Oyewumi (2006) asserts that the availability of market information in the rural agriculture context allows farmers to incorporate market situation analysis and price consideration in their production, financial, investment, and strategic decisions. However, challenges related to the low level or absence of functional literacy and numeracy require that the information provided suits farmers' reality. From a policy and regulatory perspective, in the case of agricultural policies, Oyewumi (2006) points out that where market failure exists, creating environments where information can be easily accessed by all participants would be a better alternative to formulating countervailing policy. As a result, according to de Silva (de Silva, 2005, in Oyewumi, 2006), equal access to market information would reduce marketing channel costs and transportation costs, and would ensure fair transactions.

Another study conducted by Jagun, Heeks, and Whalley (2008) on the impact of mobile telephony on the development of microenterprises in Nigeria concluded that mobile phones reduce some information failures which constrain investment and business activities in developing countries. The study demonstrated that in the cloth-weaving sector in Nigeria, mobile telephony supported markets to act more efficiently and effectively. Therefore, they deduced that the increase in mobile penetration promoted business activities and investment in the sector. In particular, findings revealed that mobile telephony had an impact on economizing effects on supply chain processes. However, they could not find indicators showing a significant restructuring effect on the organization of supply chains.

Using the capability approach (Sen, 1992), a study conducted by Ndung'u and Waema (2011) concluded that integration of ICT into many aspects of the economy has created a digitally enabled economy and that money transfer services, initially intended for the unbanked segment of the bottom of the pyramid (BOP), have been embraced by other different sectors of the economy, improving business productivity.

Other studies investigate the relationship between access and usage of information. It is widely recognized that the benefits of accessing timely

information and market knowledge have mostly accrued to those with resources and skills, leaving out the majority of the rural population (Bhavnani et al., 2008). For instance, in the farming sector, the high costs associated with accessing relevant and value-added information through ICT, and in particular fast-speed internet, represents a disincentive for farmers (Rheingold, 2005), unless the benefits of access will outweigh the costs. However, studies argue that the benefits associated with mobile phone adoption in rural areas are higher than in urban areas (Bhavnani et al., 2008). For instance, in the case of mobile banking, mobile phones can reduce transport costs thus reducing the expense of running a business.

The mobile phone has become the most easily accessible and ubiquitous communications device in rural areas due to the affordability of the handset and the prepaid mechanism, although many barriers, such as high usage prices, are still hampering mobile telephony adoption in rural communities (Bhavnani et al., 2008). Mobile telephony also reduces entry barriers to telecommunications services in general, since it can be used for text, voice, and also the internet, TV, and radio.

More than just access: social media applications

More recent studies on the digital divide also take aspects related to ICT usage and content into account. In particular, Ali (2011) acknowledges that the digital divide encompasses more than just physical access to ICTs, and also includes how and for what ICTs are being used. Ali (2011) argues that as a legacy of measuring connectivity and access to telephony that had only a single use, indicators measured the digital divide only in terms of physical access to infrastructure – for instance, ownership of a phone and number of telephony lines. However, he asserts that the internet has different possible uses, such as communication, education, commerce, and social and professional networking. Thus in the context of the internet, studies investigating the relationship between ICT and poverty alleviation should take into account, and make a distinction between, physical access to the infrastructure and actual use of the internet. In particular, making a distinction between access and use of the internet clarifies the goal of policies aiming at closing the digital divide, which should include not only an equal distribution of physical access to the infrastructure, but also socio-economic equality in terms of full participation and inclusion of the poor, even if they lack the financial resources. Internet content is a relevant component, especially in developing nations, and policy makers should ensure that it is available, accessible, and useful to people (Ali, 2011).

Policy and interventions should thus focus on promoting a social adoption of ICT, stimulate content creation, and promote ICT skills in developing nations. In particular, social media have the power to integrate ICTs into communities which have been socially resistant to ICTs. ICT policy based on a social media paradigm to bridge the digital divide would attract a wider

user base, stimulate content creation in local languages, and promote basic ICT skills.

Due to their specific characteristics, social media applications, such as Facebook, provide a simple channel of communications which is not dependent on any content published by a proprietary entity or dependent on a particular technology. Social media applications empower people to publish their own content and to share with their community what is relevant for them in their local language, removing the limiting one-to-many centralized approach of broadcasting information or the restricted one-to-one communication in the form of text messages or emails. Moreover, mobile social media applications lower the ICT skills requirements, requiring less technical training to learn compared to computers.

The content is available for free and may be in local languages. Therefore, another potential of social media applications to reduce the digital divide is their capability of overcoming linguistic barriers. Linguistic barriers represent a major obstacle to internet adoption in developing countries. Blogging and social networking applications have been solving the technical challenges behind the language barrier and can support any language. Lastly, social media have the capacity of fostering participation and democratization, since they shifts the role of users from listeners to active participants in public debates.

Livingstone et al. (2011) conducted a face-to-face survey of 25,000 9–16 year-old internet users and their parents in 25 countries and found that social networking is the most popular activity among European children, with 38 per cent of the 9–12 year-olds and 77 per cent of the 13–16 year-olds having a social networking profile (Facebook, for example). In developing countries, a similar trend is expected. This chapter investigates how Namibians access and use the internet and social media applications, and how the digital divide is being narrowed through the mobile phone.

Methodology

The RIA e-access and usage survey conducted in Namibia delivers nationally representative results for households and individuals. The random sampling was performed in four steps for households and businesses, and five steps for individuals, using enumerator areas (EA) from the national census sample frame of 2011 as primary sampling units, and sampling households from created listings.

- Step 1: The national census sample frame was split into urban and rural EAs.
- Step 2: EAs were sampled for each stratum using probability proportional to size (PPS).
- Step 3: A listing was compiled for each EA, and served as a sample frame for simple random sections.

- Step 4: 24 households were sampled using simple random samples in each selected EA.
- Step 5: From all household members 15 years or older or visitor staying the night, one was randomly selected based on simple random sampling.

The desired level of accuracy for the survey was set to a confidence level of 95 per cent and an absolute precision (relative margin of error) of 5 per cent. The population proportion P was set conservatively to 0.5, which yields the largest sample size (Lwanga and Lemeshow, 1991). The minimum sample size was determined using the following equation and inserting the parameters for the survey (Rea and Parker, 1997):

$$n = \left(\frac{Z_a \sqrt{p(1-p)}}{C_p} \right)^2 = \left(\frac{1.96\sqrt{0.5\ (1-0.5)}}{0.05} \right)^2 = 384$$

For the sampling method chosen for the survey, the minimum sample size has to be multiplied by the design effect variable (Lwanga and Lemeshow, 1991). In the absence of empirical data from previous surveys that would have suggested a different value, a default value of two was chosen for the design effect (UNSD, 2005). This yields a minimum sample size of 768 for households and individuals. The actual sample size was slightly larger than the minimum requirement to compensate for clustering effects and to have a wide enough spread of EAs throughout the country (see Table 9.1).

Table 9.1 Survey summary

Target population	all households and individuals 15 years or older
Domains	1 = national level
Tabulation groups	urban, rural
Oversampling	urban 60% rural 40%
Clustering	enumerator areas (EA) national Census
None response	random substitution
Sample frame	census sample from NSO
Confidence level	95%
Design factor	2
Absolute precision	5%
Population proportion	0.5, for maximum sample size
Minimum sample size	768
Household	Constitutes a person or group of persons, irrespective of whether related or not, who normally live together in the same housing unit or group of housing units and have common cooking arrangements

Head of household	Person who economically supports or manages the household or, for reasons of age or respect, is considered as head by members of the household, or declares him/herself as head of a household. The head of a household can be male or female
Member of a household	All persons who lived and ate with the household for at least six months, including those who were not within the household at the time of the survey but were expected to be absent from the household for less than six months; all guests and visitors who ate and stayed with the household for six months or more; housemaids, guards, baby-sitters, etc. who lived and ate with the household even for less than six months

Weights were constructed, for households and individuals. The weights were based on the inverse selection probabilities[1] and gross up the data to national level when applied.

Household weight: $$HH_w = DW \frac{1}{P_{HH} * P_{EA}}$$

Individual weight: $$IND_w = DW \frac{1}{P_{HH} * P_{EA} * P_1}$$

Household selection probability: $$P_{HwH} = \frac{n}{HH_{EA}}$$

EA selection probability: $$P_{EwA} = m \frac{HH_{EA}}{HH_{STRATA}}$$

Individual selection probability: $$P_1 = \frac{1}{HH_{m15+}}$$

Where:

DW = design weight compensation for over-sampling of major urban and other urban EAs and under-sampling of rural EAs

HH_{EA} = number of households in selected EA based on information of last census or updated listing by field team

HH_{STRATA} = number of households in strata (major urban, other urban, rural)

HH_{m15+} = number of household members or visitors 15 years or older

m = target number of EAs for each stratum, (major urban, other urban, rural)

n = target number of households in EA

i = number of house

Table 9.2 Population characteristics: Census 2001 and medium projections for 2011

		2001 Census	*Estimates based on medium forecast*
Population	Total	1,826,895	2,184,091
	Rural	1,228,143	1,468,271
	Urban	598,752	715,820
Households	Total	140,940	413,953
	Rural	209,386	250,325
	Urban	136,867	163,627
Enumerator areas	Total	4,073	
	Rural	2,662	
	Urban	1,411	

Source: Central Bureau of Statistics, National Planning Commission of Namibia

The bottom of the pyramid is defined in this study in line with the poverty line used by the World Bank as individuals having less than US$2.50 a day or $75 a month[2] in terms of implied PPP conversion rates for 2011 of N$5.993.[3] This implies less than N$450 per month. Nearly 50 per cent of Namibians 15 years or older have to live with less than US$2.50 a day at implied PPP conversion rates. In rural areas it is nearly 60 per cent (see Table 9.3).

Table 9.3 Bottom of the pyramid – 15 years or older

	%	*N*
Namibia	49.4	1,410,179
Rural	55.9	948,003
Urban	36.1	462,176

ICT access and usage at household level

Research ICT Africa conducted nationally representative surveys in Namibia in 2004, 2007, and 2011. Comparing the results over time can document both progress in terms of access and usage of ICTs and changes in the digital divide. Table 9.4 shows the percentage of households with working ICTs of different type in each of the three years, in rural and urban areas and the country as a whole. The digital divide (the divide between those that have access to electricity and ICTs and those that do not) declined in Namibia from 2004 to 2007. A higher proportion of households had access to electricity, a fixed-line phone, a TV, a computer, and/or an internet connection at home in 2007 compared to 2004. The only ICT access indicator that declined during that period was the number of households with a working radio; indicating a substitution of radio by TV or mobile phone. The difference between rural and urban areas' access to electricity, fixed-line phones, radio, and TV at home also declined. However, the difference between rural and urban households for computer and internet increased, despite both groups having more access. Computer and internet access, apart from requiring a larger one-off, as well as a monthly, financial commitment, are also limited by educational barriers.

In 2011, a different trend emerged, with a widening gap in terms of household electricity access between urban and rural households. The number of households with electricity decreased from 47 per cent to 45 per cent in Namibia during that period. Furthermore, access to electricity in urban areas increased, whilst access in rural areas decreased. The drop in households with electricity in rural areas may be linked to a slowing down of rural electrification projects.[4]

The digital divide between rural and urban households with respect to household computer and internet access also widened further between 2007 and 2011, despite progress in internet access in both rural and urban areas. Household ownership of a computer or laptop in rural areas dropped dramatically in 2011 compared to 2007, most likely due to a shift towards the use of mobile phones for internet access. More households had internet connection than a working laptop or computer.

A further noticeable trend was the decline in households with working fixed-line connections. An important conclusion from those trends is that Namibian ICT policies should ideally be formulated in a technologically neutral way. Fixed-line access is decreasing in significance, whilst mobile access is rapidly increasing in importance. This is the consequence of product design and roll-out by Namibia's operators.

Table 9.4 Households with working ICTs

	Namibia				*Urban*				*Rural*				*Urban–rural difference*			
	2004 (%)	*2007 (%)*	*2011 (%)*		*2004 (%)*	*2007 (%)*	*2011 (%)*		*2004 (%)*	*2007 (%)*	*2011 (%)*		*2004 (%)*	*2007 (%)*	*2011 (%)*	
Electricity	34.4	46.6	45.5	↓	77.9	81.0	81.9	↑	6.1	24	21.5	↓	71.8	57.0	60.4	↑
Fixed-line phone	13.0	17.4	11.5	↓	30.5	32	24.6	↓	1.6	7.9	2.8	↓	28.9	24.1	21.8	↓
Radio	77.1	72.6	72	↓	88.0	82.0	81.1	↓	69.9	66.4	66	-	18.1	15.6	15.1	↓
TV	31.1	37.9	40.6	↑	70.7	72.4	73.3	↑	5.2	15.4	18.8	↑	65.5	57.0	54.5	↓
Computer	4.6	11.2	14.7	↑	11.0	22.8	34.8	↑	0.4	3.6	1.3	↓	10.6	19.2	33.5	↑
Internet connection	1.6	3.3	11.9	↑	4.1	6.7	26.9	↑	0.0	1.1	1.9	↑	4.1	5.6	25.0	↑

Which EA is rural and which urban is defined by the Census.

Source: RIA 2004–2007 and 2011 surveys

Individual mobile use

The details of individual mobile use are shown in Table 9.5. Prepaid is still by far the most popular payment type with 92 per cent of all mobile owners using it, and 99 per cent among those living in rural areas and in the bottom of the pyramid group (BOP). Mobile internet is popular in Namibia and is on the way to becoming the dominant form of accessing the internet; 24 per cent of Namibians with a mobile phone used it to browse the internet and 17 per cent for social networking applications, i.e. about 187,000 mobile internet users above the age of 15. MTC claims to have more than 250,000 mobile subscribers that access the internet (MTC, 2011). The difference to the survey figures may lie in those under 15 years using mobile internet and/or duplicated SIM cards belonging to mobile internet users. Mobile communication via social networks such as Facebook is more popular than sending and receiving emails. Even 12 per cent of the BOP used their mobiles to surf the internet and 7 per cent for social networking. The BOP own and use ICTs slightly more than rural dwellers, who are mostly BOP as well.

Table 9.5 Mobile phone owners 2011

	Namibia		*Rural*		*Urban*		*BOP*	
	%	*N*	*%*	*N*	*%*	*N*	*%*	*N*
15 years or older with a mobile phone	56.1	790,801	46.1	437,463	76.5	353,339	47.9	504,982
Proportion of mobile phone owners								
with prepaid SIM card	91.8	722,853	98.9	432,815	82.9	290,038	98.9	498,732
with a handset capable of browsing the internet	30.7	242,394	15.3	66,786	49.8	175,608	15.2	76,378
that use their mobile for browsing the internet	23.8	187,466	10.7	46,876	40.3	140,590	11.7	58,634
that use their mobile to read and write emails	12.3	96,246	3.2	13961	23.7	82,285	3.3	16,733
that use their mobile for accessing social networking applications[1]	17.3	135,951	4.9	21,403	32.8	114,548	6.9	34,370

1 such as Facebook, Twitter, Mxit

The voice gap has mostly been closed in Namibia through prepaid mobile, both in terms of network infrastructure and affordability. Those without a handset plan to get one in the future and handsets are globally available

at prices that Namibians without a handset are willing and able to pay. Challenges remain with respect to the data gap. Only a third of mobile phone users own a handset that is capable of browsing the internet. Among the BOP and rural dwellers it was just 15 per cent (Table 9.5).

Individual computer or laptop use

Table 9.6 shows the details of computer ownership and use among the different groups. Among Namibians 15 years or older, only 13 per cent used a computer or laptop. In urban areas, about 38 per cent used computers, but in rural areas, only 1.2 per cent, and among the BOP only 3.2 per cent (Table 9.6).

Table 9.6 Individual computer or laptop use

		Namibia (%)	*Urban (%)*	*Rural (%)*	*BOP (%)*
Do you use a computer (desktop or laptop)?		13.0	37.6	1.2	3.2
Where do you use a computer	Work	43.0	57.4	6.9	17.4
	School, university	25.6	34.4	3.9	10.7
	Library	20.0	28.0	0.0	6.4
	At home	53.3	66.7	20.0	17.1
	Internet cafe	20.1	28.2	0.0	4.3
	At a friend's place	31.4	41.5	5.8	13.1
What do you use your computer for	Writing letters, editing documents	64.2	83.9	14.8	29.1
	Calculations using spreadsheets such as Excel	54.1	71.3	10.9	19.6
	Browsing the internet	55.8	71.6	16.0	19.3
	Programming	34.2	47.3	1.3	10.4
	Remixing content found online: music, videos	35.3	48.8	1.3	8.7
	Playing games	49.9	64.2	14.8	22.2
Do you own a personal computer or laptop?	Desktop	30.8	43.0	0.0	8.9
	Laptop	39.7	51.3	10.9	12.4
	Both	19	26.6	0	3.7

The majority of Namibians used their computer at home, in both urban and rural areas and for the BOP; 20 per cent of the population overall, 28 per cent of those in urban areas, used public access points such as libraries and internet cafes. However, these facilities were not used in rural areas, mostly due to a lack of availability.

Offline activities such as writing letters and editing documents were the main occupations performed with a computer, at national, urban, and BOP

level, whereas a slightly higher proportion of rural users used it for browsing the internet compared to writing or editing. The choices given in the questionnaire were not sufficiently detailed to capture details of the main use in rural areas. This would need to be followed up by qualitative research.

Laptops (40%) were more popular than desktops (31%), and a large number of those that owned a computer or laptop owned both (19%). Computer or laptop ownership was higher in urban than in rural areas; rural users only owned laptops. It is clear that computer or laptop ownership remains a domain of the wealthy and that computer use extends further to those with jobs or access in schools and public access facilities.

Individual internet access and usage

Details of individual internet use are shown in Table 9.7 and the proportion of internet users by access location in Figure 9.1. About 16 per cent of all Namibians 15 years or older used the internet in 2011, with 6.2 per cent among the BOP and 5.2 per cent among those in rural areas. As many as 48 per cent of internet users started using the internet first on a mobile phone, and 87 per cent used the internet on a mobile phone either as a primary or secondary access device (Figure 9.1). This indicates an increasing reliance on mobile phones to access the internet. In the BOP group, 81 per cent used the internet first on a mobile phone and 96 per cent used it currently to access the internet. All groups

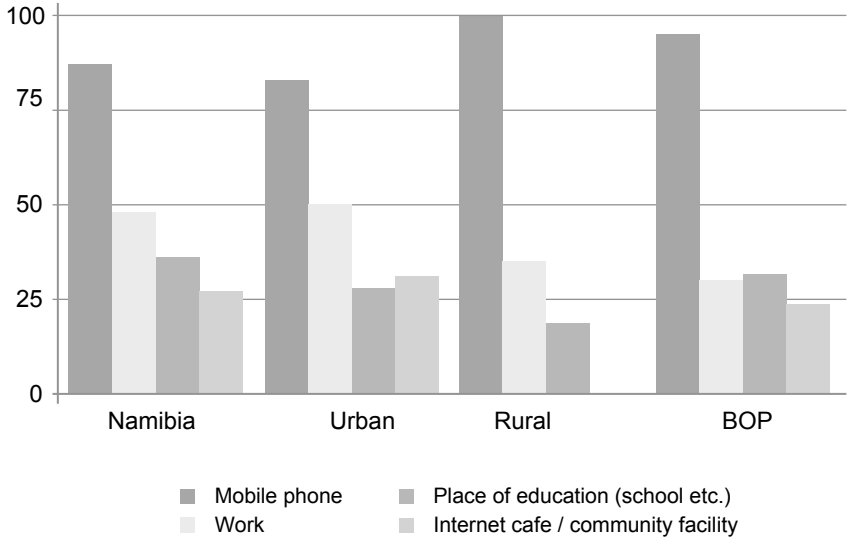

Figure 9.1 Percentage of internet users by access location (multiple responses allowed)

predominantly used mobile phones to access the internet, while some had additional access at work or a place of education, such as a school. Interestingly, even some people in the BOP group used the internet at work. They may work as a cleaner or security guard and still be able to use the computer of the receptionist or another office worker, for example, from time to time.

Table 9.7 Individual internet use

		Namibia		*Rural*		*Urban*		*BOP*	
		%	*N*	*%*	*N*	*%*	*N*	*%*	*N*
Namibians 15 years or older using the internet		15.9	223,539	5.2	49,046	37.8	174,493	6.2	65,488
Proportion of internet users that used the internet first on a computer or laptop		51.9	114,319	15.4	7,860	63.0	62,560	19.2	12,602
Proportion of internet users that used the internet first on a mobile phone		48.1	105,813	84.6	43,253	37.0	62,560	80.8	53,158
Factors limiting the usefulness of the internet	very slow	38.2	66,414	3.7	967	44.3	65,447	25.5	8,619
	too expensive	46.6	81,841	53.5	13,815	45.4	68,026	51.0	17,798

Figure 9.2 shows internet use as captured in the 2007 RIA e-access and usage household survey and the 2011 RIA survey. There was a considerable increase in the proportion of internet users, from 9 to 16 per cent overall.

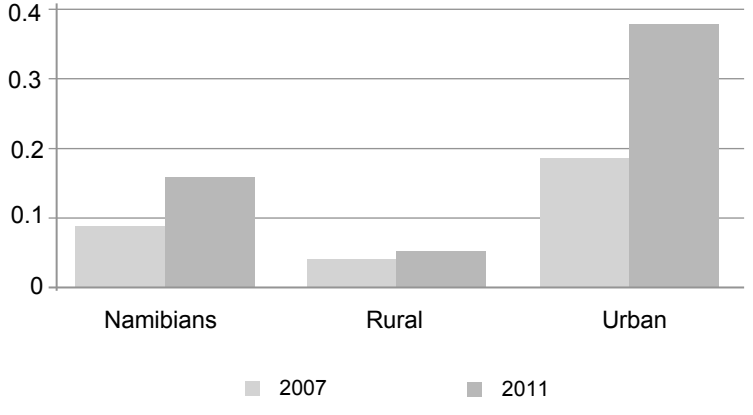

Figure 9.2 Namibians 15 years or older using the internet

Moreover, not only did the number of internet users increase between 2007 and 2011, the usage frequency also changed (Figure 9.3). The number of internet users using the internet every day increased from 35 per cent in 2007 to 59 per cent in 2011, and the share of weekly internet users increased from 33 per cent to 35 per cent. Those that use it once per month or less dropped from 32 per cent to 6 per cent. Urban internet users were more likely than rural users to use the internet daily (66% compared to 15.5%). This may reflect the cost barrier but also the coverage barrier (3G coverage) that rural internet users face.

Figure 9.4 shows the proportion of internet users by the number of years they have been using the internet. In 2011, about 12 per cent were new users of a year or less, one-third had used it for two years or less and more than a half for three years or less, indicating a recent surge in internet adoption. Of all rural internet users, 87 per cent had started using it in the past three years, compared to 65 per cent of BOP internet users.

One of the primary uses of the internet is to access social networking applications such as Facebook. Figure 9.5 shows the proportion of internet users with an email and/or social networking account (Facebook or similar). Overall, 81 per cent of internet users had an account with a social networking application, slightly more than had an email address (79%). In urban areas, internet users more often had an email address than a social networking account (84% compared to 80%), whereas in rural areas, more had a social networking account than an email address (85% compared to 50%). The large number of rural internet users without an email address is an interesting phenomenon that needs to be investigated further using qualitative research techniques. Possible explanations could be that not many peers have email

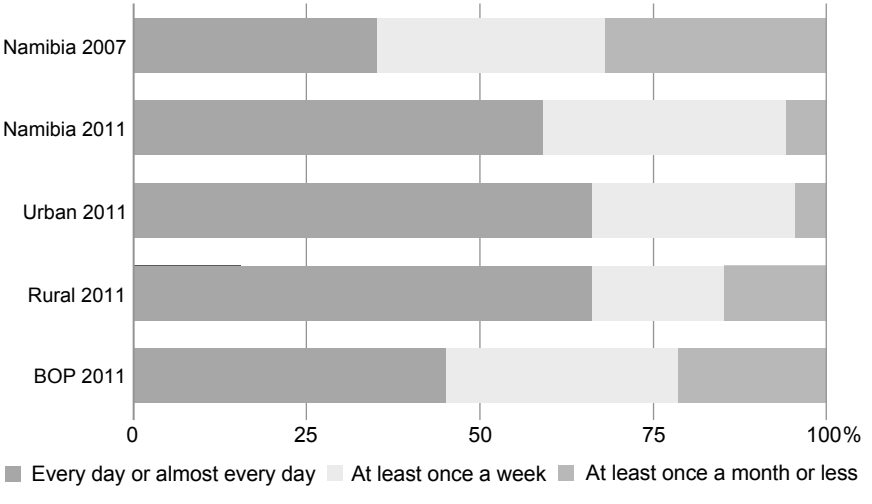

Figure 9.3 Frequency of internet use in the last three months

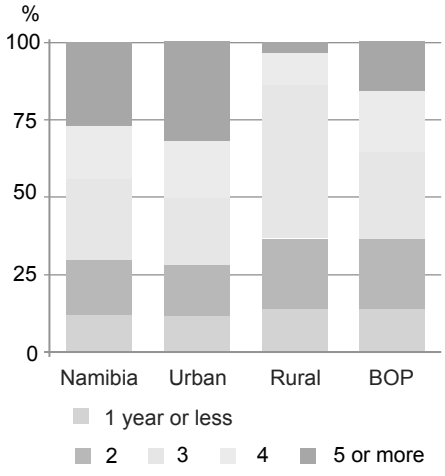

Figure 9.4 Number of years since first using the internet

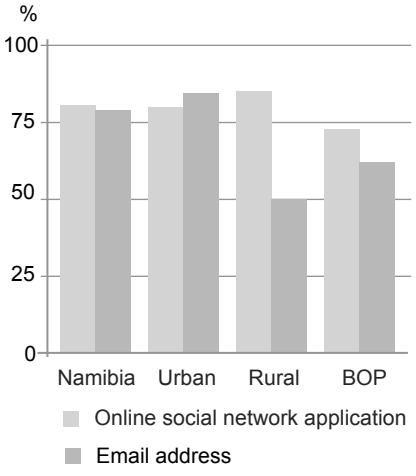

Figure 9.5 Proportion of internet users with an email address or social networking account

addresses, and hence voice and chat are used as communication channels instead. Another explanation could be that some social networking applications, such as Mxit, do not require an email address. Some people may also have an email address without knowing it, which was created for them when signing up for a social networking application. Figure 9.5 may thus be better understood as not using email rather than not having an email address.

Table 9.8 shows the frequency of use of the internet by specific activities. Internet banking and e-commerce (buying goods and services via the internet) were the least popular activities with 57 per cent and 61 per cent respectively never engaging in them. Social networking applications were the most frequently used applications, with 31 per cent using them daily. Finding a fact or looking up a word was the second most frequent internet activity.

Table 9.8 Use of the internet for different activities

	Never (%)	*Occasionally (%)*	*Weekly (%)*	*Daily (%)*
Social networking or video-sharing websites (Facebook, YouTube, etc)	19.2	22.4	27.3	31.1
Find or check a fact/look up a word definition	11.9	30.5	26.7	30.9
Send or receive email	23.3	21.6	26.6	28.6
Read or download online newspapers, magazines, e-books	15.4	43.7	21.0	19.9
Get information about goods or services	30.0	42.3	12.5	15.2
Download movies, images, music; watch TV/ video; listen to radio/music	16.2	41.9	29.2	12.7
Play or download video games or computer games	20.9	41.0	27.5	10.6
Get information related to health or health services	33.4	42.4	15.2	9.0
Get information for school or university related work/research a topic	23.4	43.6	24.0	8.9
Collaborate online on documents (example Google docs)	36.6	30.2	25.4	7.8
Download software	38.8	38.3	15.5	7.4
Get information from government organizations	43.9	34.6	14.1	7.3
Interact with government organizations	51.7	31.0	10.8	6.5
Internet banking	57.4	23.8	12.5	6.4
Post information or instant messaging	49.8	22.8	21.1	6.3
Education or learning activities (formal)	30.6	42.3	21.1	6.0
Telephone over the internet/VoIP	53.2	22.9	18.0	5.9
Purchase or order goods or services	60.9	20.2	14.3	4.7
Participate in distance learning for an academic degree or job training	45.7	33.4	16.6	4.2
Look for free education content, such as free courses	28.7	48.9	19.2	3.2

It would also be interesting to analyse the differences in terms of age, gender, and educational background, among others. For example, according to data taken from the Socialbakers website in November 2011, 65 per cent of Namibian Facebook users at that time were between 18 and 34 years old, and 7 per cent were over 65 (Figure 9.6). The jump for the 65+ compared to the 55–64 groups may be partly explained by the category covering more than 10 years, but is still surprising. This and other questions are left for a follow-up paper to explore. It could be that retired people are more likely to use Facebook to stay in touch with grandchildren.

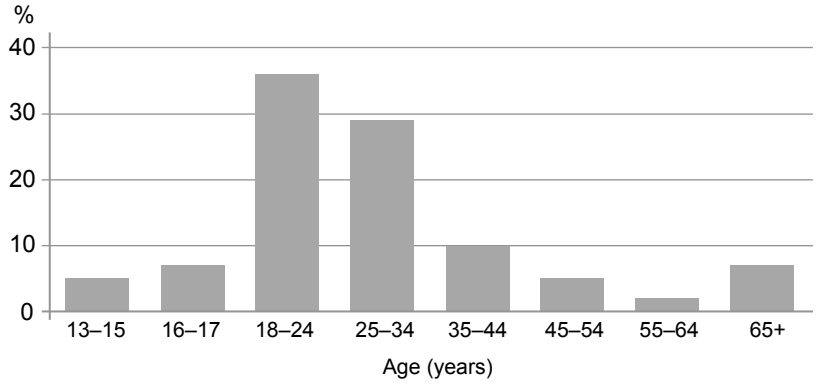

Figure 9.6 Users of Facebook by age

Those who did not use the internet were asked why; the results are shown in Table 9.9. The main reasons given were not knowing how to use it (88%) or not having access to a computer and/or internet connection (91%). Many would want to use the internet if it were available close to where they live (36% overall – approximately 51% of urban dwellers, 40% of BOP, and 31% of rural dwellers).

Table 9.9 Reasons for not using the internet

		Namibia		*Rural*		*Urban*		*BOP*	
		%	*N*	*%*	*N*	*%*	*N*	*%*	*N*
Reasons for not using the internet	no interest/ not useful	59.1	714,591	62.1	565,403	49.8	149,188	60.1	264,880
	don't know how	88.1	1,065,560	94.3	858,010	69.3	207,551	73.4	324,028
	no computer/ internet connection	90.7	1,097,997	93.8	853,415	81,3	244,582	94.0	415,069
	too expensive	78.4	948,412	80.4	730,175	72.6	218,237	77.1	340,329
Never used the internet but interested in using if available nearby (internet cafe)		36.1	438,416	31.0	283,849	51.4	154,567	39.4	175,953

Conclusions

The increasing reliance on the mobile phone and applications that lend themselves to the mobile platform – such as social media – indicate that the mobile phone is a key entry point for internet adoption in Namibia. Internet access has increased significantly at the household level, with internet connectivity at home increasing from 3.3 per cent in 2007 to 11.9 per cent in 2011. The 2011 ICT household and individual access and usage survey found that half of internet users used the internet first on a mobile phone, and 23.8 per cent had used their phone to browse the internet. The mobile internet is also narrowing the rural–urban internet access gap; 84.6 per cent of the internet users living in rural areas had first used the internet on a mobile phone. The mobile phone is thus not only narrowing the voice gap in Namibia, it is also increasingly closing the access to data gap. There is, however, still a potential role for public internet access, and for high speed bandwidth required to optimize internet usage under particular circumstances.

Mobile internet access and more affordable prepaid mobile internet allow less affluent people to gain access to the internet. They can recharge airtime to use the internet whenever they have money available, and use a device with which they are already familiar for internet access. Mobile phones require less capital to purchase and considerably less skill to operate than computers. There is a clear trend towards cheaper smartphones, and this will have an impact on mobile broadband penetration rates. However, there is still substantial progress to be made in reducing barriers to prepaid mobile broadband, ranging from lowering cost and reducing taxation to improving data coverage.

Notes

1 See UNSD (2005: 119) for a detailed discussion on sampling weights.
2 See for example: <www.globalissues.org/article/26/poverty-facts-and-stats>
3 World Economic Outlook database September 2011 <www.imf.org/external/ns/cs.aspx?id=28> [accessed 9 September 2013].
4 See for example: 'Rural electrification too slow', *Namibian*, 14 June 2010 and 'Rural electrification moving slow', *Namibian*, 27 May 2011.

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CHAPTER 10

Conclusion and recommendations

Ophelia Mascarenhas

This final chapter attempts to draw sense out of the findings from the previous chapters. In essence it tries to answer the following questions: 'What new evidence has the book provided with respect to access to and use of ICTs and the link of such access and use on growth and poverty at the household level?' and 'What are the major issues arising from the findings?'. The chapter begins with a background summary of the research projects on which the previous chapters are based. This is followed by a summary of the main findings on the link between ICTs and poverty in terms of access, use, and impact. The findings are analysed using the sustainable livelihoods framework, which constituted the main conceptual framework for the majority of the chapters. Some key issues emerging from the findings are then discussed to increase understanding of the various complex dimensions of the links between ICTs and poverty. This section is followed by some suggestions for further research and the conclusion.

Keywords: East Africa, information and communication technologies, ICT access, ICT impact, ICT research, ICT use, ICT/poverty nexus, Southern Africa

Background: the research projects

The rationale for this book is the current debate on the role of ICTs in growth and poverty reduction, which is extensively covered in Chapter 1. The debate barely covers Africa and has tended to focus mainly at the macro-level, although there are exceptions (Souter et al., 2005; Duncombe, 2006; Bollou and Ngwenyama, 2008; Grimshaw and Kala, 2011). At the same time, policy makers are being advised to invest in ICTs as a panacea for growth and poverty reduction without credible evidence of the positive impact of ICTs on economic and social development. This realization contributed to the initiation of the research project in East Africa known as Poverty and Information and Communications Technology in Urban and Rural Eastern Africa (PICTURE Africa), which was funded by IDRC and carried out in four countries in East Africa – Kenya, Rwanda, Tanzania, and Uganda – between November 2006 and June 2011. The majority of the chapters in this book (six out of ten, Chapters 2–7) are based on PICTURE Africa. The primary

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objective of the project was to answer the question as to what changes result in poverty reduction from changes in access to and use of ICTs. In other words what is the impact of enhanced access to ICTs on poverty reduction?

Two of the remaining chapters (Chapters 8 and 9) describe findings from research projects in Southern Africa. Chapter 8 is based on a study from South Africa which assessed the impact of free access to the internet in a telecentre on the quality of life of the users. Chapter 9 looks at the use of mobile phone-based email and internet in Namibia. Neither study is related to PICTURE Africa, but they provide insights into the potential role of ICTs on the improvement of livelihoods at the micro-level. A number of robust methodologies were used in collecting and analysing the data in all these chapters.

The chapters detailing the research findings are preceded by a very extensive literature review on what is known to date on the link between ICT, growth, and poverty reduction (Chapter 1). This review comes to the conclusion that, while there is growing evidence of the link between ICTs and growth and poverty reduction, the mechanisms through which this link takes place have yet to be systematically interrogated. It also found that the discussion is mainly at the macro-level, with few studies addressing the link at the micro-level. This is particularly true in Africa.

In the chapters based on the data from PICTURE Africa, a range of ICTs were considered, with a special focus on mobile telephones and the internet, but also including radio, television and fixed-line phones. The study from South Africa focused only on the internet, while the study from Namibia focused on mobile telephony. PICTURE Africa used a multi-dimensional definition of poverty, as did the studies using the data from it. The multi-dimensional definition was based on the sustainable livelihoods (SL) framework developed by DFID in 1999 (DFID, 1999), drawing from research such as Moser (1998). The SL framework identifies five 'capitals' that a household requires for sustainable development, namely, financial, human, physical, social, and natural. PICTURE Africa selected the first four as being the most appropriate and developed proxy indicators as dependent variables (see Chapter 1). The two studies from Southern Africa do not use poverty in their conceptual framework.

A rich set of data has been collected, analysed, and described in the chapters, contributing substantially to understanding the link between access to ICTs and poverty reduction. In addition, there are extensive data on country poverty profiles and national ICT policies and institutions. This concluding chapter focuses mainly on the findings that deal with the link between ICTs and poverty reduction, and some key issues that emerge from such findings.

Findings

The overall focus of the book is the link between ICTs and poverty reduction. This link has been considered at three main levels: 1) access to ICTs and the relationship of such access to poverty; 2) impact of ICTs on poverty

reduction; and 3) use of ICTs as potential pathways to poverty reduction. The impact is assessed both in terms of the causal relationship between enhanced access to ICTs and poverty reduction, and in terms of benefits perceived by the ICT users in the various studies. In all three cases, poverty is assessed within the SL framework.

Access to ICTs and the ICT/poverty nexus

The data on access to and use of ICTs was collected primarily for the PICTURE Africa studies for a range of ICTs including older ICTs, such as radio and television, as well as the relatively newer ICTs, namely the mobile telephone, email, and internet. The data were collected in two time periods – 2007/2008 (CS1) and 2010 (CS2) – and revealed a number of findings that contribute towards a better understanding of the ICT/poverty nexus. First, access to some ICTs such as the radio and mobile was quite high by comparison with the wealth status of the households in the sample. Less than 40 per cent were categorized as non-poor, and yet nearly 70 per cent had access to the radio and mobiles, showing that both the non-poor and the poor were accessing ICTs. This confirmed the findings that even the poor have access to ICTs.

Second, overall there was an upward trend in access to all ICTs between 2007/08 and 2010, especially for mobile telephones, reflecting the overall trend in Africa and similar developing countries. The main exceptions in the upward trend were for fixed-line telephones and email. An interesting finding was the fact that the pattern was not consistently upward among all households – some households that had ICTs in 2007/08 had lost them by 2010, while some that did not have ICTs in 2007/08 had gained them. Those that gained access to ICTs had experienced a real gain in their per capita expenditure (PCE) between CS1 and CS2, showing a strong relationship between gains in ICTs and reduction of poverty. Overall the gains were greater than the losses, resulting in an upward trend overall between 2007 and 2010. This is one aspect on which there is very little information in the current literature on access to ICTs in developing countries. Most studies and reports on trends on the ownership of ICTs focus on the overall increase and ignore the rate of loss of ownership, which could be equally significant in understanding the challenges associated with the access faced by the poor.

In terms of scale of ownership, radio and mobile phone predominated. By comparison, email was significantly low across the four PICTURE Africa countries, posing one of the challenges of access to the more recent ICTs in the four countries. There were differences among countries, with Kenya having the highest access both to ICTs overall and to mobiles and the internet. Kenya also has the highest development score according to the UNDP development index, which seems to support those who assert that the lower the ICT access the lower the national economic status (Flor, 2001).

At the household level, access was affected by location (urban or rural), gender, and ICT policies. The analysis found that the likelihood of having

ICTs in urban areas is just over 1.5 times that in rural settlements. This finding is not surprising, since rural areas in the four countries are generally disadvantaged in many aspects including higher rates of poverty, less access to basic services such as housing, electricity, and water, and a poorer ICT network infrastructure.

The rural/urban divide, and how this has been affected by ICT policies at the national level, is analysed in depth in Chapter 3. This provides another dimension to access to ICTs by showing how policies at the national level impact on access to ICTs at the household level. The authors found that the greater access to mobile phones and radio is partly due to policies and regulations that resulted in a competitive market structure which facilitated the operation of a number of mobile companies and proliferation of FM radio stations. By comparison, fixed-line phone was a monopoly by a single institution, which restricted its access to urban areas. However, the operative word is 'partly'. While not disputing the role of policies in promoting easy access to ICTs in rural areas, there are other reasons why the radio and the mobile are popular, such as versatility of the technology and affordability of the initial price in the case of the mobile, and relatively low price and cost of operation for the radio. Nevertheless the role of policies in facilitating or constraining access to ICTs is important and the analysis is convincing.

The variation in ICT access according to the sex of household head was found to be not as striking as the urban/rural divide. Nonetheless, in 2007/08, households headed by women were more likely to be in extreme poverty with significantly less access to ICTs, especially the newer ICTs such as the mobile and the internet. The pattern of access to ICTs by location and gender did not change during the second data point of the panel methodology (2010), indicating that there are underlying causes that affect access to ICTs according to these two aspects.

The relationship between access and the selected proxies of the indicators of poverty based on the SL framework, namely, financial (income, expenditure especially per capita expenditure and economic assets), human (at least one member of the household having secondary education), physical (aggregate score of housing and access to basic services), social exclusion (participating in groups or in local government decision-making bodies), and vulnerability (proxied by the number of shocks experienced in the two years prior to data collection) was assessed statistically. The four-country study based on PICTURE Africa data (Chapter 2) showed that there was a strong link between ownership of ICTs and poverty levels overall, and by several of the selected proxies of poverty. First, households without ICT were found to be poorer in all dimensions than those with ICT. The assessment found positive and significant links between most of the dimensions of poverty and ICT access, except for social capital and vulnerability in 2007/08, the first data point for the panel study. The odds of gaining access to ICT were more than doubled (2.228) by a unit improvement in the logarithm of the poverty score. The relationship was

even stronger for education. The likelihood of a household containing a member with secondary education having ICTs is around four times that of households without this educational level. The findings on the positive association between ICTs and several of the multi-dimensions of poverty is important and confirms the growing literature on the positive links between poverty and ICTs (Djiofack-Zebaze and Keck, 2009; Kenny, 2002; Flor, 2001; McNamara, 2003).

To conclude, the data found a strong relationship between access to ICTs and most of the dimensions of poverty within a context where there were inequalities of access caused by geographic location, ICT policies, and gender.

Use of ICTs within the SL framework

A number of chapters provide insights into the uses of ICTs (Chapters 3, 4, 5, 6, 7, and 8). These chapters together make a substantial contribution to understanding some of the ways in which the impact and benefits of using ICTs are achieved. The summary of the main uses is described within the context of the SL framework and is shown in Table 10.1.

Table 10.1 Uses of ICTs within the SL framework

SL capital/ asset	*Mechanism of contributing towards poverty reduction*	*Source (chapter)*
Financial	Use ICTs to reduce travel time and costs for social and business communications purposes	2,6
	Network with friends to look for information about jobs	2,6
	Use ICTs for getting new products and business clients	4,5,8
	Use mobiles to send and receive money	4,5,6
Human	Obtain new skills by using new ICTs, and new products on the mobile such as mobile banking	5,6
	Get information, especially from the radio, relevant to improving agriculture	4,5,7
	Children getting educational information especially via the radio	5
Physical	Not mentioned	None
Social	Communicate with friends and family	4,5,7,8
	Participate in local government decisions	5
	Avoid face to face communication with political and social opponents	4
Vulnerability	Use the mobile to get assistance during need and in emergencies	4,5,7

A noticeable omission was the use of ICTs to improve physical capital. There was no mention even in the qualitative data that ICTs contributed towards better housing or increased access to better household services such as electricity, water supply, or waste disposal. The link between ICTs and this dimension of poverty was also not evident in the statistical analysis assessing

impact nor was it mentioned under benefits. Obviously the use of ICTs had a differentiated level of impact and benefits on each of the selected dimensions of poverty.

Impact of ICTs on poverty reduction

While the link between ICTs and some of the dimensions of poverty are important, the primary objective of PICTURE Africa was to find evidence on the causal factor. Do ICTs result in poverty reduction? Will an increase in access to ICTs increase socio-economic growth and correspondingly reduce multi-dimensional poverty? This aspect was the focus of all the studies based on PICTURE Africa (Chapters 2, 3, 4, 5, 6, and 7). The study from South Africa (Chapter 8) uses the conceptual framework of quality of life for assessing impact of ICTs. At first sight, the two conceptual frameworks seem different, but some of the indicators used to measure quality of life (increased income through jobs secured using the internet) match some of the proxy indicators used for the poverty dimensions in the SL framework.

To what extent does the book provide evidence about the impact of ICTs on poverty reduction? This question will be answered in this chapter using the SL framework, since it was the main conceptual framework for most of the chapters. There are two exceptions. Firstly, the analysis of the data from the four countries in East Africa uses 'economic assets', proxied by durable assets such as a fridge, vehicle, stove, or ownership of livestock, to capture the economic status of the household. In the assessment of the evidence of the impact of ICTs on poverty reduction provided by the various chapters, we use 'financial asset', one of the five assets of the SL framework, proxied mainly by income and expenditure, especially per capita expenditure (PCE); but we consider economic assets in the form of durable goods where appropriate.

Secondly, the SL framework does not include vulnerability, yet there is growing literature that reduction in poverty is very much dependent on the extent to which the poor feel less vulnerable. Chambers (1985), Kessy and Tostensen (2008), and Duncombe (2006), to name just a few, emphasize the need to look at the *vulnerability* aspect – the poor are more vulnerable to negative changes than the less poor because they have fewer resources and options to cope with adversities and shocks and are usually isolated from mainstream development. They argue that any reduction in vulnerability constitutes a reduction in poverty. In agreement with this argument, PICTURE Africa included vulnerability as one of the dimensions of poverty.

Finally, in addition to summarizing the findings on impact of access to ICTs on poverty reduction based on sophisticated statistical analyses, the assessment also considers benefits as indicators of impact. Benefits can be taken to have a positive impact on growth and poverty reduction, although in this case they were based on perceptions and did not statistically show the extent to which the overall poverty levels or individual poverty dimensions were affected by the perceived benefits. The findings are summarized in Table 10.2.

Table 10.2 Evidence of impact of ICTs on poverty reduction

SL capital/ asset	*Proxy indicator – PICTURE Africa*	*Impact*	*Benefits*	*Source (chapter)*
Financial	Income, expenditure, especially per capita expenditure (PCE), acquisition of durable assets	An increase in one unit of ICT resulted in a 2.5% decrease in poverty levels	Got new jobs and new business clients thus increasing income	2,6
		Poverty level dropped 39% in the benefit group that had interventions, compared with 17% in the control group that did not	Reduction in travel leading to increased savings in income and time	3,4,5,8
				4,5,6
			Received and sent money for business and social purposes	5
		People running up huge bills on their mobile phones as a result of extensive use for social purposes		4
Human	Level of formal education at hh level		Obtaining new skills (learning to use the computer; getting skills to improve agriculture [radio])	3,4,5,6
			Children able to get educational programmes (radio)	5
Physical	Aggregate score of housing conditions, access to basic services (water, electricity, waste disposal)		Not evident in the statistical analysis or even perceived by respondents in the qualitative data collection as one of the benefits of using ICTs	
Social	Belonging to groups		Increased ability to communicate socially with friends and family	3,4,5,7,8
	Participate in local government decision-making		Increased ability to participate in discussions on political decisions (mainly radio)	4,5,7,8
Vulnerability	Number of shocks experienced in previous two years		Reduction in vulnerability due to increased ability to communicate and get assistance easily during crises	4,5,6,7

Statistically significant evidence for the direct impact of enhanced access to ICTs on financial assets is presented in Chapters 2 and 6, using quantitative data from two data collection points to illustrate the link. Chapter 2 found that gaining access to ICTs by poor households was associated with a positive reduction in poverty between 2007/08 and 2010. Specifically, the authors found that the ICT index *statistically causes* change in PCE. A one unit increase in ICT access over the two-year gap between 2007/8 and 2010 resulted in a change in the logged PCE of 3.7 per cent. In other words, controlling for all other dimensions of poverty, the results show that gaining access to ICT was associated with a 2.5 per cent improvement in poverty status between 2007 and 2010. It further found that the impact was pro-poor because over a ten-year period the modest gains from ICT disproportionately benefit the very poor (those below median PCE) compared to the rest of the sample. Another way of interpreting this finding is that over a decade, the gains resulting from ICT access for the most poor are twice that for the non-poor.

Chapter 6 found that enhanced access to ICTs due to a deliberate targeting of ICT interventions resulted in a significant reduction in poverty. Based on data from surveys undertaken in 2008, *before* the targeted interventions, and 2010, *after* the interventions, the study found that those with enhanced access to ICTs due to the deliberate interventions (benefit group) were able to reduce financial poverty at a higher rate than those who had not received such interventions (the control group). Both areas had started at about the same level of poverty (based on a poverty line set at a PCE of US$1.00 per day) of around 55 per cent in 2008, but in the survey carried out in 2010 after the end of the period of interventions, the proportion of poor had decreased to 16 per cent among the benefit group, whereas it was about 38 per cent among the control group. Poverty had dropped in both areas, but the rate of reduction was higher among the benefit group who had received interventions to enhance their access to and use of the mobile and the internet. These two studies from PICTURE Africa provide empirical evidence to illustrate that ICTs do contribute to reducing financial poverty.

The findings from the analysis of the perceived benefits described in other chapters (3, 4, 5, 7, 8) give further evidence of the contribution of ICTs to poverty reduction. Among individuals that either *used* or *have* a mobile phone or a SIM card

> we found that 79 per cent thought that using a mobile phone made their lives easier in general terms. Also, more than half of the respondents perceived benefits related to socialization, information, and travel time and costs savings. In the remainder of the benefit categories (jobs/businesses and security in emergencies), the percentages were close to 50 per cent. (Chapter 4)

The PICTURE Africa study was deliberately carried out in areas that were designated as 'poorer' areas according to the national census bureau in each

of the four countries. Indeed the poverty level was nearly 60 per cent in the total sample (Chapter 2), which means that the non-poor were about 40 per cent. Therefore if nearly 80 per cent found that ICTs made their lives easier, both the poor and non-poor found ICTs beneficial. These findings confirm what was found overall in the two earlier chapters (2 and 6) about the strong positive relationship between access to ICTs and growth and poverty reduction or better quality of life. They also show who benefits the most. Females found ICTs more useful than males. Benefits were also differentiated by education, age, and location rural/urban (Chapter 4). However, the results do not show the mechanisms of how this works. Insights into this aspect are shown by analysis of the use of the ICTs, which is discussed in the section that follows.

Key emerging issues

Significance of the findings

Has the book provided new evidence and insights to the ICT–poverty link? The question can be answered affirmatively with a high degree of confidence. The analysis using data obtained from both quantitative and qualitative methodologies shows 1) that there is a direct association/link between access to ICTs and poverty (Chapter 2); 2) that ICTs have a direct impact on poverty reduction (Chapters 2 and 6); 3) that access to and use of ICTs can have many benefits that have a positive impact on improving livelihoods and thus reducing poverty (Chapters 3, 4, 5, 6, 7, and 8); and 4) the benefits are mediated through a range of uses which provide insights into the mechanisms of how ICTs contribute towards poverty reduction. These findings make a substantial contribution to understanding the link between ICTs and poverty and even how this link is achieved.

There are a number of other significant contributions. First, a major contribution of the evidence described in the book is the use of a multi-dimensional approach of poverty for assessing the link between ICTs and poverty reduction based mainly on the SL framework, but also adding vulnerability. There are few studies that have carried out such an analysis of the link between ICTs and poverty reduction in developing countries using a range of dimensions of poverty, particularly in Africa. The tendency of most other studies has been to focus on economic impact, although it is generally accepted that poverty is multi-dimensional.

Second, few studies have tackled the *impact* of ICTs at the household level; such impact analysis has mostly been at the macro-level involving several countries (Bollou and Ngwenyama, 2008; Djiofaek-Zebaze and Keck, 2009; von Braun and Torero, 2006). The conceptual framework and the analysis at the micro-level therefore provide new insights into how to assess the link between access to and use of ICTs and poverty reduction overall and by specific dimensions of poverty.

Third, the evidence provided in this book also makes a contribution to understanding the mechanisms by which ICTs can contribute to growth and poverty reduction. Most of the studies involved in the current debate about the ICT/poverty nexus have focused on the role of ICTs on growth and poverty reduction. While there is a growing consensus on this link, there is comparatively little in the literature about the mechanisms by which this link is achieved. The mechanisms described in this book are by no means the full range of potential mechanisms, and the analysis does not show a statistical link, but they are particularly important because they relate these mechanisms to specific dimensions of poverty, again using the SL framework.

Finally the evidence was cross-referenced using a number of known and tested methodologies from quantitative to qualitative data collection methods and from statistical correlations to making sense of people's perceptions for the analysis. The way the data from the various methodologies complement and supplement each other makes the evidence both interesting and credible. This does not mean that there is no room for improvement.

Direct and indirect impacts of ICTs on poverty

There is a growing tendency to see the link of ICTs to poverty as being mainly indirect, that is, ICTs build capabilities to reduce poverty rather than reduce poverty directly. This capability factor is based on the writings of Sen and his example of the bicycle (Sen, 1985). The capability aspect is strongly supported in this book, primarily through the analysis of the uses of various ICTs. However, the disaggregation of the links by particular dimensions of poverty has revealed a new perspective to this aspect of direct or indirect link. The findings show that the relationship is rather complex. In some cases, ICTs can have a direct impact, while others the links are indirect. There is a direct link between the use of ICTs and reduction of social exclusion – users feel more connected with friends and family immediately through the use of ICTs, especially the mobile phone. This feeling of connectivity immediately increases social capital and reduces vulnerability. In the case of financial capital and physical capital, the link is indirect – ICTs enhance the capacity of the user to increase or expand income (through getting a new job or through getting more business clients resulting in bigger sales and increased income). The increased income can then be used to acquire durable assets (economic capital) and enhance physical capital (improved housing or increased access to basic services).

In terms of human capital, the impact can be both. The data show that access to ICTs such as the radio can provide new skills directly, such as new information on health or agriculture broadcast over the radio. In more developed countries, such information can be obtained from websites or even via the mobile phone. Enhanced access to ICTs coupled with training provided the targeted groups in Tanzania and South Africa with direct

benefits in terms of skills to use the computer, the internet, and email thus increasing human capital (Chapters 6 and 8). Access to the mobile phone encourages the owners to learn how to send text messages and how to send and receive money. However, the impact is indirect, and has a time lag for formal education. ICTs do not directly increase educational levels such as the transition from primary to secondary – just assist the capability of the household to find appropriate educational facilities. Educational achievements depend on the quality of the education system and the abilities of the learners, and ICTs cannot directly impact these. In terms of vulnerability as well, the impact can be direct and indirect. Using ICTs can reduce vulnerability directly by being able to communicate via the telephone and know that the person at the other end has understood the situation and has promised to help. It can be indirect if the assistance is designed to reduce future risks, such as providing subsidized agricultural inputs to ensure more sustainable food security.

These findings contribute towards the ongoing discussions as to whether the impacts of ICTs on poverty are direct, or indirect through building the capacities of households to improve livelihoods and thereby reduce poverty.

Uneven linkages between ICTs and some dimensions of poverty

Although the book has contributed to credible evidence about the link between ICTs and poverty, the analyses also show that there are some challenges in establishing the link equally for all the dimensions. The statistical analysis of the impact found a link only for the money-metric indicators. It was not possible to establish a significant link between access to ICTs and social capital in the analysis of the association between access to ICTs and poverty levels (as opposed to a more definitive causal impact) (Chapter 2).

In the analysis of the link using perceived benefits, there was a significant omission of the link with physical capital (aggregate score of housing quality and access to basic household services). The link was seen only at the level of association between ICTs and poverty, but not at the level of impact or benefits.

One of the reasons for the uneven links is the time factor. Impact on human capital in terms of formal education requires a longer time frame than the two-year span of the study. The same could apply to assets (durable goods). Therefore the link between ICTs and poverty can be very strong for some indicators of poverty and less evident for others, but this could change given changes in the time frame. In recognition of this, one of the conclusions from the four-country PICTURE Africa study was that a panel study of more than two waves is needed to confirm the findings about the impact of ICTs on poverty (Chapter 2). Some impacts can be seen immediately; others require a longer time span.

The gender factor

The data about how gender affects the access to, and benefits of, ICTs were mixed. There was a clear gendered distribution of ICT access. Females definitely had less access to ICTs, with women 1.5 times less likely than men to have a mobile phone or email address (Chapter 2). The analysis was controlled for income and education, thus the difference cannot be explained in terms of the often quoted finding that females are at the lower end of poverty and generally have less access to post-primary education, and therefore have less access to ICTs. The conclusion is that socio-cultural factors are responsible for the difference. However, in terms of benefits, females out-numbered males, as seen in Table 10.3.

Table 10.3 Gender differences in perceptions of benefits of ICTs

Benefit	*Females as % of all respondents who perceived this benefit*	*% of females among all female respondents who perceived a benefit*	*% of males among all male respondents who perceived a benefit*
Save travel time and costs	68	–	–
Information on latest news	63	65	59
Socialization	69	69	60
Job/increased business	67	47	45

Source: Okinda Miroro and Adera, 2014

Thus although females were disadvantaged in terms of access to ICTs, once they had the access they found them more useful than males, although in most cases the differences were not significant. These findings show that there is all the more reason for ensuring that females have equitable access to ICTs, since they find ICTs more useful in improving their livelihoods and managing their triple responsibilities: productive, reproductive/domestic, and social.

One aspect that is not covered in the book is the issue of empowerment. Even in the analysis of the qualitative data, there appears to be no mention by women of the issue of empowerment. Perhaps that is because the analysis of the data followed the SL framework, which does not specifically include empowerment. As Gurumurthy (2006) argues, gains in access to ICTs do not always result in equitable gender relations or gender empowerment. Analysis of access to ICTs by female-headed households has to go beyond poverty and also consider empowerment as part of the impact on vulnerability.

Likelihood of accessing internet/email on the mobile

Mobile phones and radio were found to be the two most important ICTs in all four countries in East Africa. At the time of the first survey in 2007/08, radio was the more important overall. By 2010, the year of the second survey, mobiles had overtaken the radio overall showing the growing importance of this ICT.

The mobile is popular not only for communication but also for an increasing number of other products, especially mobile banking. In a highly competitive market, mobile companies are busy developing new products designed to capture a larger share of the mobile use market. One of the most popular new products is mobile banking. As more products become available, the mobile is likely to grow in importance because of the versatility of the technology, the ever changing capacity to provide more services, the flexible price range, and ICT policies that enable competitive markets and prices for services.

The study from Namibia asserts that a new development will be an increasing trend to access internet/email via a mobile, which will thus increase the rate of penetration of these ICTs, which currently is very low within East Africa. There are very few data on who uses email via a mobile. Currently, the prices of mobile phones with the capacity to provide email facilities are beyond the means of most of the people who are struggling to improve their livelihoods and reduce their vulnerability. They will have to be convinced of the positive impact of internet/email to invest in an expensive mobile just to access them. In addition to prices, there are other constraints, such as level of education, appropriate training, and relevant content. However, the mobile will continue to be an important ICT for the poor and their strategies to get out of poverty in the foreseeable future.

Importance of the radio for the poor

Despite the growing importance of mobiles, the analysis found that radios were still very important, being second overall in terms of ownership in 2010, but first among rural people. The importance of the radio in rural areas is shown by the relatively small difference in access to radio between rural and urban areas in comparison with mobiles. In 2010, mobile ownership was 80 per cent among urban households compared with 59 per cent in rural areas. For radios the ownership was 75 per cent in urban areas and 65 per cent in rural areas. While mobile telephones had replaced the radio as ICT of first priority by ownership in urban areas, radio was still the first ICT in rural areas.

Qualitative data confirmed that radio was useful in getting a range of information relevant to livelihoods and health immunization programmes, and that in some cases, as in Kenya (Chapter 5), children were benefiting from school lessons aired over the radio. In developing countries like those covered in PICTURE Africa, the radio is still a very important source for getting information and in some cases for communicating. The communications aspect

of radios has been facilitated by two developments: community radios that enable two-way communications, and live interactive programmes on national radio designed to get the public to air their views on a selected issue of national interest.

Within East Africa, the radio is popular across all ages and economic groups. Most vehicle drivers will have a radio on while driving to work/business and back for both music and news. The youth are also attracted to radio because of the music, sports, and chat programmes. Thus while the focus is on mobiles and internet/email, it is necessary to assess impact of ICTs by looking at the ICTs that are most used by households.

The context in which ICTs are used is important

Although not fully discussed in the various chapters, the analysis also draws attention to the importance of the context in which households and communities use ICTs. The focus of the book has been on the unequal access between rural and urban areas. While generally rural areas are worse off than urban areas in the various factors that promote access, there could be differences even within the urban areas. Some rural areas may have better socio-economic conditions and ICT infrastructure than some urban areas. It is the specific context of the households and the wider community in which they are located in urban or rural areas, not geographic location per se, that affects the potential use of ICTs to reduce poverty.

Another aspect of context that is hinted at in the book is the relationship between access and livelihoods. Those engaged in business had higher access to ICTs and appeared to benefit more from the use of such ICTs (Chapter 6). This was supported by the perceptions of the respondents (Chapter 4). They felt that ICTs were more beneficial to those doing business than to those who use the mobile mainly for communication. Assessment of the impact/benefits/use of ICTs by livelihoods would provide better insights into the importance of livelihoods for the link between ICTs and poverty reduction.

Why do some people not use ICTs?

Two of the chapters show that people will not use some ICTs even when they are provided free of cost to the user. In South Africa and Tanzania, a very small proportion of the potential beneficiaries made use of the free access to internet and email. In both cases, the free use was preceded by training in the use of the computers and internet/email. The explanation may lie in the current factors that lead to low use of internet/email, such as level of education, lack of training in the use of the internet/email, and lack of appropriate content.

What is more surprising is the fact that in the case of the Tanzania study, not all the beneficiaries were able to use the free mobile airtime that was credited to them directly on the freely provided mobile phone. So it was not a question of not being able to afford the phone or the airtime. The main focus

of the study was to assess the impact of enhanced use of ICTs facilitated by ICT interventions on poverty reduction so the question of non-use was not fully explored.

One possible explanation might be the capability factor. For ICTs to be used effectively to reduce poverty, some other factors need to be in place. It appears that enhanced capability to communicate is not very useful if the household does not have the capacity to use this airtime. What are the determinants of this capacity? Is it a threshold of poverty, the type of livelihood or other factors?

Should governments invest in ICTs?

In view of the evidence provided the answer to the question of whether governments should invest in ICTs is a strong *yes*. The sample was taken mainly from the poorer sections of the population in the four countries. The high rates of investments into ICTs, especially mobiles and radio, show that even the poor were investing. The analysis of the impact, and the perceived benefits of the use of ICTs by a high majority (about 70%), also show that the poor found ICTs beneficial in improving their livelihoods and reducing poverty. For these reasons we strongly recommend that governments invest in ICTs.

Further areas for research

The following areas are suggested for further research.

- More research is required to establish a statistically significant impact of ICTs on dimensions of poverty other than the money-metric dimensions. The impact should also be assessed in terms of specific ICTs that are prioritized by the communities/households in which the research is carried out.
- Further research is required in understanding the mechanisms through which ICTs contribute towards poverty reduction directly and by increasing capabilities to address and reduce poverty. The assessment needs to link the data on the mechanism with the impact on the relevant poverty dimension.
- A third area of further research is to determine the poverty-related and non-poverty-related factors that hinder the poor from accessing and using mobiles and email.
- More research should be conducted to understand the linkages between ICT policy and regulation, the resultant market structures, how these influence people's access to and use of ICTs, and how this in turn affects poverty reduction at the household level.
- Finally, there is a need to look at the impact of ICTs on empowerment (within the context of social capital) particularly with respect to gender empowerment.

Conclusion

This book has provided definite statistical evidence that access to ICTs has a link with poverty, and that such access does have an impact in reducing poverty. Enhanced use of ICTs leads to higher rates of poverty reduction. However, the book has raised many issues that need further research. Four areas of research are suggested, but there could be more based on the findings from this book.

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