UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

INFORMATION ECONOMY REPORT 2010

ICTs, Enterprises and Poverty Alleviation

EMBARGO
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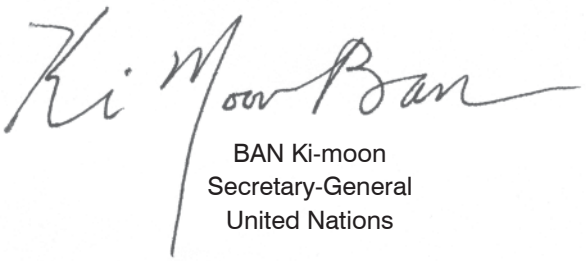
PREFACE

Fighting poverty lies at the heart of the efforts of the United Nations to promote the economic and social well-being of the world's people. In order to meet the internationally agreed development goals, especially the Millennium Development Goals, every possible avenue must be fully explored. Today there is particular promise in new, technology-based solutions that did not exist a decade ago, when the Goals were first articulated and endorsed. With that in mind, this year's *Information Economy Report* looks at the potential role of information and communication technologies (ICTs) in creating new livelihoods and enhancing the productivity of enterprises of direct relevance to the poor.

The contribution of ICTs to poverty reduction lies in their power to enable poor women and men to build "livelihood assets" or more secure employment opportunities. We are witnessing a new dawn in the way new technologies can make a difference, even in the most remote places. The diffusion of some ICTs – especially mobile phones – has improved dramatically, including in regions where many of the world's poor live and work. This translates into new micro-enterprises in different sectors, new services and new ways to market produce and other goods.

As stressed in the Report, however, policies matter in ensuring that improved access to ICTs leads to poverty reduction. The outcome depends on the context and on the environment in which ICTs are introduced and used. Governments have a key role to play in devising policies that respond effectively to the specific needs of the beneficiaries – needs that differ among enterprises, between rural and urban areas, and between countries.

The policy challenge is to take full advantage of the significant improvements in connectivity in ways that bring benefits to the poor. This task is far from complete. I urge Governments and development partners to read the *Information Economy Report 2010* and carefully consider its recommendations.



BAN Ki-moon
Secretary-General
United Nations

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LIST OF ABBREVIATIONS

ARPU	average revenue per user
B2B	business-to-business
B2C	business-to-consumer
BPO	business process outsourcing
CEE	Central and Eastern Europe
CELAC	Collecting and Exchange of Local Agricultural Content
CGAP	Consultative Group to Assist the Poor
CSR	corporate social responsibility
DESA	United Nations Department of Economic and Social Affairs
ECLAC	United Nations Economic Commission for Latin America and the Caribbean
EIT	economies in transition
ESCAP	United Nations Economic and Social Commission on Asia and the Pacific
EU	European Union
FAO	Food and Agricultural Organization of the United Nations
FDI	foreign direct investment
GDP	gross domestic product
GNI	gross national income
GVC	global value chain
ICT	information and communication technology
ICT4D	ICT for Development
IFI	international financial institution
IRAS	Incessant Rain Animation Studies
ISIC	International Standard Industrial Classification
IT	information technology
ITU	International Telecommunication Union
LDC	least developed country
MDG	Millennium Development Goal
NGO	non-governmental organization
OECD	Organization for Economic Cooperation and Development
ODA	official development assistance
PC	personal computer
PPP	purchasing power parity
PRS	poverty reduction strategy
PRSP	Poverty Reduction Strategy Paper
SIDS	small island developing states
SIM	subscriber identity module
SME	small and medium sized enterprise
SMS	short message service
TCO	total cost of ownership
TNC	transnational corporation
UIS	UNESCO Institute for Statistics
UNCITRAL	United Nations Commission on International Trade Law
UNDAF	United Nations Development Assistance Frameworks
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-ESCWA	United Nations Economic and Social Commission on Western Asia
UNIDO	United Nations Industrial Development Organization
USF	universal service or access funds
WSIS	World Summit on the Information Society
WTO	World Trade Organization

EXECUTIVE SUMMARY

The world is witnessing a new dawn with regard to the potential of information and communication technologies (ICTs) to contribute in the fight against poverty. For the first time, there are now realistic opportunities for inhabitants of remote locations in low-income countries to get connected via ICTs. Farmers, fishermen as well as entrepreneurs in urban areas are rapidly adopting mobile phones as a key tool to advance their commercial activities, and some poor people are finding new livelihoods on the back of this trend. Against this background, the *Information Economy Report 2010* focuses on the nexus of ICTs, enterprises and poverty alleviation. Whereas the knowledge base needs to grow considerably, the evidence presented in this Report suggests that more attention should be given by policymakers and other stakeholders to this new set of opportunities.

The Report is organized into five chapters. Chapter I introduces a conceptual framework for the analysis that follows. Chapter II reviews recent connectivity and affordability trends to gauge the degree of access and uptake of different ICTs among the poor. Chapter III turns to the role of the poor in the production of ICT goods and services (the ICT sector). In chapter IV, the focus shifts to the use of ICT by enterprises, with emphasis on those that matter most for poor people, namely small and micro-enterprises in urban and rural areas. Finally, chapter V presents the main policy implications from the analysis.

Chapter I: Exploring the link between poverty, ICTs and enterprises

Reducing extreme poverty lies at the heart of the United Nations' efforts to promote development. Progress in this area has been uneven and every avenue towards poverty alleviation needs to be continuously re-examined. Even if the target of cutting the 1995 global poverty in half by 2015 is met, almost 1 billion people are likely to remain in extreme poverty by that year. In absolute terms, the largest numbers of people living on less than $1.25 per day are in Asia, followed by Africa. In relative terms, however, the incidence of poverty is the highest in sub-Saharan Africa, where more than half of the population are below the poverty line, according to the World Bank. Most of the world's poor live in rural areas, and their livelihoods include subsistence farming, wage labour and production for sale. Many work in the informal sector.

Sustained and equitable growth is necessary for making substantial progress in reducing poverty. Consequently, enterprises play a crucial role. They can help reduce poverty in two main ways: (a) through direct income generation and diversified livelihood opportunities; and (b) through more secure employment opportunities. From a poverty reduction perspective, it is important to focus attention on enterprises which have the greatest involvement of the poor – typically small and micro-enterprises. *Subsistence-based enterprises* support the livelihoods of the poor pushed into economic activity by the lack of other income-generating opportunities. They form the majority of enterprises in low-income countries, and most are in rural areas making use of natural resource inputs (e.g. farming and fishing). There are also *growth-oriented enterprises* among poor communities. Earnings from such activities become an important source of income, especially for those who have climbed above the poverty line.

Poverty has an important informational dimension. Poor people often lack access to information that is vital to their lives and livelihoods, including weather reports, market prices and income-earning opportunities. Such lack of information adds to the vulnerability of the people concerned. In terms of livelihood strategies, information plays a dual role: (a) informing and strengthening the short-term decision-making capacity of the poor themselves; and (b) informing and strengthening the longer-term decision-making capacity of intermediaries that facilitate, assist or represent the poor. The contribution of ICTs to poverty reduction through enterprise lies in their power to give poor women and men access to improved information and better communications to help them build livelihood assets. The introduction of ICTs in the enterprise sector can contribute to productivity growth, innovation, economic transformation and, ultimately, improved standards of living.

Meanwhile, the ICT landscape is rapidly changing. For the first time, affordable connectivity is becoming a reality even for people and enterprises located in

remote areas of low-income countries. While this is creating new possibilities to reduce poverty, more research is needed to understand how the new roles of ICTs may affect poor communities. There are no guarantees that improved access to ICTs leads to poverty reduction. Information accessed through ICTs has to be relevant and appropriately presented to benefit the poor, reflecting the needs, skills and capabilities of the latter. Policy efforts to enhance affordable access to ICTs thus need to be complemented with broader strategies to foster the development of adequate content and to raise the capabilities of the users.

Regrettably, the growth of ICT availability has not been matched by an equally rapid expansion in knowledge concerning how ICTs impact on development and poverty. Far more needs to be understood about the emerging new roles and impacts of ICTs in poor communities. As few empirical studies have looked specifically at this question, the evidence base remains weak. By placing the spotlight on this area, this Report points to the need for more attention in terms of research and policy analysis to help identify the best ways forward in order to seize maximum development gains from the new ICT landscape.

The Report highlights two main roles for ICTs as they are mediated through enterprise. First, ICTs can give rise to activities that did not previously exist, involving the production of new goods or services. Secondly, access to ICTs can change the way existing activities are undertaken, leading potentially to increased revenues, lower costs and improved quality. The report thus distinguishes between the production (chapter III) and use (chapter IV) of ICTs by enterprises. Before turning to those two aspects of ICTs, enterprises and poverty, chapter II reviews the extent to which enterprises in different countries currently enjoy affordable access to different ICTs.

Chapter II: Trends in connectivity and affordability

In order to assess the scope for ICTs in the enterprise sector to contribute to reducing poverty, a natural starting point is to consider the extent to which enterprises have access to different ICTs. The analysis shows that the connectivity situation varies greatly by country. In addition, the cost of using different ICTs also differs, with obvious implications for enterprise use.

Access to most ICTs continues to grow in poor countries, but at very different rates depending on the technology. Growth also varies by region and income level. Access to fixed telephone lines in the poorest countries is extremely low and almost negligible in rural areas. By contrast, mobile access deepens each year as networks extend to more of the formerly unreachable. After a radio or a television set, the next most likely ICT device found in poor households is a mobile phone. According to data from the International Telecommunication Union (ITU), average global mobile penetration stood at 68 subscriptions per 100 inhabitants at the end of 2009. It is expected that the total number of mobile subscriptions will reach 5 billion in 2010. Penetration in both developed and transition economies now exceeds 100 subscriptions per 100 inhabitants while in developing countries it stood at 58. In the LDCs, there are now on average more than 25 subscriptions per 100 inhabitants.

In rural areas, increased access to mobile phones and associated applications and services may have a particularly important impact on poverty. Rural populations in low-income economies often lack access to fixed telephony. While mobile penetration in rural areas is rising, it is still low in some least developed countries (LDCs). In fact, at the end of 2008, almost half of the rural population in the LDCs was still not covered by a mobile signal. Thus, despite improvements, there is still scope for further expansion of mobile coverage in areas where many poor people live. Some LDCs (e.g. Liberia and the United Republic of Tanzania) have been more successful than others in raising the level of mobile penetration, partly as a result of more competitive wireless markets. In these cases, the reach of mobiles appears to extend to those defined as living in poverty.

Increased ubiquity of mobiles is creating new opportunities for ICTs in the enterprise sector to contribute to development and to reduce poverty. On the back of more widespread mobile connectivity, a wealth of non-voice applications and services has sprung up, including text and picture messaging, Internet access and money transfer services. Mobile-money services are of particular importance for entrepreneurs that are operating in locations with limited banking services. They have also been found to be far cheaper than both formal banks and informal options, especially for low value transactions.

Penetration rates are considerably lower in the case of most ICTs other than mobile phones.

For example, personal computer (PC) use in low-income countries is extremely low and virtually negligible in rural areas. Furthermore, limited coverage of fixed telecommunications, electrification and PC ownership has seriously inhibited fixed Internet access and use in these countries. In addition, the Internet has skill prerequisites (notably literacy) for its use that many of the poor do not possess. UNCTAD data show that Internet use is also limited among micro-enterprises. For example, in Azerbaijan, Egypt, Jordan, Lesotho and Mexico, less than 1 in 10 micro-enterprises uses the Internet, and less than 1 in 25 has a web presence. In the case of broadband subscriptions, ITU data point to a massive gap between developed and developing countries, and in LDCs, fixed broadband barely exists. A person in a developed country is on average over 600 times more likely to have access to fixed broadband than someone living in an LDC.

At the same time, the use of mobile phones to access the Internet is growing rapidly and may eventually become more prevalent in developing countries than in developed countries. In East Africa, for example, Internet access via mobile phones now far exceeds fixed Internet subscriptions. This underscores the potential for mobile phones to transform Internet use in the developing world. While costs of Internet-enabled handsets and mobile Internet user charges need to come down further, and while the range of services available needs to widen, the potential is apparent. With some encouragement, mobile Internet is likely to emerge as a useful tool also for the poor and for micro-enterprises.

Though a growing number of people are gaining access to ICTs, particularly mobile, usage is sometimes constrained by high prices, particularly for the poor. This inhibits the full development of ICTs as poverty reduction tools. In the case of mobile telephony, there are wide variations in usage costs across developing countries. The most affordable usage charges can be observed in South Asia. India, for example, has some of the lowest "prepaid" prices. Wholesale termination costs in India (as well as in other South Asian nations) are among the lowest in the world and service taxes are far below those in many other developing countries. India has also been a pioneer in reducing operational and investment costs which contribute to lower prices. Revenues are generated using low tariffs but high volume. As a result, an Indian subscriber spends much more time talking on the mobile than his/her counterpart in many other developing countries. From the perspective of low-income users, it would be desirable if the South Asian model spread also to other low-income economies.

Lack of electricity is another barrier to ICT take-up for the poor, particularly in rural areas. This is less of a problem for ICTs that use batteries (such as radio) or mobile handsets, which can be recharged using car batteries. However, it poses a challenge for computers. ICT access will remain restricted, particularly among the poor and small and micro-enterprises in rural areas until solutions are found for providing stable and affordable electricity.

Chapter III: The ICT sector and the poor

The ICT sector represents a significant part of the world economy. In some developing countries, it accounts for more than 10 per cent of business sector value added. Production of ICT goods and services can contribute through various channels to poverty reduction. The ICT sector can offer jobs and income-generating opportunities and, in some cases, create entirely new livelihoods. Moreover, a vibrant ICT sector is important to facilitate and sustain more widespread use throughout the rest of an economy. Nonetheless, few studies have examined the contribution of ICT production to development, livelihoods and poverty reduction. This chapter seeks to shed some new light on these issues.

Available evidence does not permit a full assessment of the impact on all aspects of the livelihoods of poor people. However, it suggests that the scope for the ICT sector to contribute to poverty alleviation depends on the nature of activities involved. For most low-income countries, telecommunication services may be the part of the ICT sector offering the greatest opportunities for employment creation. By contrast, ICT manufacturing is characterized by high concentration of global production and exports, significant economies of scale and high barriers to market entry for new countries and companies. Its contributions to poverty alleviation are mainly confined to those countries – mainly in Asia – that have successfully managed to develop an internationally competitive ICT industry.

Within some of these economies, the impact appears to have been substantial, however. In China, the world's largest exporter of ICT goods, the expansion of ICT manufacturing now employs millions of migrant workers, who transfer significant funds from urban

to rural areas. Entry barriers for new workers to join low-end manufacturing and assembly activities are typically low. Second-order effects are also likely to have played a role, for example, through increased spending by ICT manufacturing workers, with trickle-down effects on local enterprises. New income-generating opportunities are likely to have improved the financial assets of both the workers and their families. In addition, working in ICT-manufacturing enterprises may have offered opportunities for learning and skills upgrading, thus also developing human capital assets. However, examples of discrimination, excessive overtime, low wages and exposure to health, safety and environmental risks have also been observed, with negative consequences for the people concerned. More research is required to obtain a better picture of the full effects of ICT manufacturing on poverty.

A growing number of developing countries view outsourcing and offshoring of information technology (IT) services and ICT-enabled services as a potential source of employment generation and export revenues. For example, the Government of Kenya has set a target for the number of jobs in the business process outsourcing sector to grow from the current 8,000 to 120,000 by 2020, and the Government of Ghana aims to create 40,000 new such jobs by 2015. While outsourcing and offshoring may contribute to poverty reduction, benefits to the poorer segments of society are not automatic. The main potential contributions to the poor are linked to second-order effects, such as indirect job creation. So far, relatively few countries have succeeded in developing sizable activities in this area, partly due to stringent requirements in terms of infrastructure, quality and costs. The successful cases of India and the Philippines illustrate that most direct and indirect job creation has occurred in a few major urban agglomerations. However, companies in both these countries are beginning to spread activities to second and third tier cities, and some are also considering rural locations. There are interesting developments related to "social outsourcing" – the outsourcing of services to poor communities in developing countries with an explicit aim of poverty alleviation or the achievement of other development objectives – which can contribute to improving the livelihoods of people in rural areas.

The part of the ICT sector with arguably the greatest direct involvement of poor people, and which is spreading rapidly in many low-income countries, is that related to ICT micro-enterprises. There are relatively low barriers to entry into some of the activities conducted in this field, making it possible for people with limited skills to participate. The simplest mobile card selling or vending jobs can typically be conducted by people with few formal skills and capabilities. In the Gambia, for example, disabled street beggars were offered the opportunity to start working for Gamcel, one of the mobile telecom operators. As authorized dealers, rising in the economic stature and earning above average wages, they felt empowered to participate in society. A simple activity as selling mobile subscriptions in this case helped to reduce poverty and improve the livelihoods of the people involved.

The mobile sector is among the most dynamic sources of ICT micro-enterprise. In many parts of the developing world, ecosystems of mobile entrepreneurs have sprung up to serve local demand for mobiles and for associated applications and services. Throughout the developing world, there is a proliferation of shops and market stalls selling used and new mobile phones, kiosks that offer mobile phone applications and content, and activities such as installation, setup and various repair services. Selling airtime or mobile money services on the streets or in shops engages large numbers of people in low-income countries. Such services can play an important role in sustaining the use of ICTs, especially among poor segments of the economy. ICT micro-enterprises in the informal sector often complement enterprises in the formal sector by selling goods and services that are better adapted to low-income consumers. In Ghana, for example, ICT micro-enterprises have played an important role in extending connectivity to remote areas not well covered by the established operators.

However, ICT micro-enterprises are exposed to volatility and risk, and returns on investment are often low, forcing entrepreneurs to draw on other sources of income as well. When considering ICT micro-enterprises as a new source of livelihood, the sustainability of different business models should be kept in mind. By the time a particular technology, intervention or business model has proved successful in one context, its relevance elsewhere may have been overtaken by events. The "village phone" service developed by Grameen Phone in Bangladesh (and replicated in other countries) illustrates this point. While it initially allowed rural women to establish micro-enterprises reselling capacity on mobile phones, the

business model became less sustainable as more and more people had phones of their own.

Coping with changing business environments requires the ability of entrepreneurs to adapt and identify other, sometimes related, opportunities. Thanks to the importance of networks and close interaction with other informal and formal enterprises, the opportunities for ICT micro-enterprises to develop are greater in urban settings. In rural areas, the scope for creating livelihoods around such activities appears to be more limited.

Some ICT-related activities in the informal sector may have negative effects on the livelihoods of the poor. This applies, for example, to activities resulting from e-waste being sent to low-income countries for recycling. Uncontrolled discarding or inappropriate waste management can generate hazardous emissions, with severe impacts on health and environment. There is an urgent need for responsible action on the part of both public and private sectors to ensure that the collection, sorting/dismantling, pre-processing and end-processing in the recycling chain are conducted in a sustainable way.

From a policy perspective, it is necessary to address both the opportunities and the risks associated with an expansion of the ICT sector. As stressed above, given the cross-cutting nature of ICTs, the supply of ICT goods and services has implications for the economy as a whole. A vibrant ICT sector is important not least to facilitate and sustain more widespread use of ICT in enterprises across sectors and industries.

Chapter IV: ICT use by enterprises and poverty alleviation

This chapter reviews the available evidence – which mainly exists in the form of micro-studies from a wide range of countries and industries – to examine how ICT use has affected the performance of enterprises and the livelihoods of the poor. Special attention is given to how different ICTs have helped address the various information and related needs that enterprises face along their sectoral value chains.

Both subsistence-based and growth-oriented enterprises with direct involvement by the poor have the potential to benefit from greater use of ICTs and related services. However, the outcome varies considerably depending on the respective needs and capabilities of the specific enterprises. Judging from available research, the main potential benefits of ICT use are twofold: (a) a reduction in information search and transactions costs; and (b) improved communications within supply chains leading to benefits for individual enterprises and overall improvements in market efficiency.

ICTs are most valued by entrepreneurs when tangible benefits accrue from greater efficiencies – particularly those which relate to supporting two-way information flows with key customers or suppliers. Given that most enterprises in developing countries serve local and regional markets (or work through intermediaries to channel their products to national and foreign markets), such efficiencies are gained primarily through better use of basic business communications. Benefits from mobile phone use are the most frequently cited. ICTs can also strengthen internal information systems for those (predominantly growth-oriented) enterprises that own a PC and are able to make effective use of computer-based applications. There is evidence that ICT use can provide other benefits around the strengthening of social and human capital assets (enhancement of skills, increased self-confidence, participation of women, empowerment, and security against income loss).

The impact of ICT use in subsistence-based agriculture enterprises is particularly relevant. Mobile phones are increasingly used by farmers to obtain relevant information and coordinate activities with other participants in the value chain. Positive effects of cell phones by way of reduced transaction costs and better market prices have been observed, for example, in the cases of grain markets in Niger, dairy farmers in Bhutan and onion traders in Ghana. In some instances, even those who do not themselves use the phone have benefited from better functioning of markets and from information passed on from phone owners.

Some farmers are also beginning to appreciate new mobile service applications. Mobile applications for the delivery of financial transfers are being commercially implemented, with infrastructure and service platforms sufficiently scaled to provide the potential for all types of enterprise to receive money or to make payments. Such services are rapidly taken up by farmers and are used extensively to facilitate trading in rural areas. Mobile solutions for providing micro-insurance, which have only recently begun to emerge, can also contribute in important ways to poverty reduction since farming activities are highly susceptible to weather, price variability and other risks.

When not insured against adverse weather conditions, farmers tend to use as little inputs as possible to minimize the risk of incurring losses. This inevitably results in less productive yields. The practice of mobile solutions is still at an early stage of development, and more evidence is required for assessing its impact on poverty. However, the potential is considerable. In Kenya, for example, within one month of its launch, 9,500 farmers had subscribed to a new weather index insurance scheme and another 40,000 are expected to join.

Solutions based on combinations of different ICTs offer great potential for serving the needs of rural enterprises by leveraging the widespread access to mobile phones and advantages offered by other technologies. Such opportunities are being explored through various initiatives aimed at delivering information via intermediaries, particularly to subsistence-based enterprises in remote areas. This may involve the integration of the Internet with other technologies that are more accessible by subsistence-based enterprises (such as mobile phones or community radio). In Africa, some community radio stations that are connected to the Internet have pioneered a phenomenon known as radio browsing programmes. These programmes provide indirect access for rural enterprises and others to the Internet and broadcast to communities. They help raise awareness of what is available online, allowing people to find new solutions to their varying needs.

Fishing is another natural resource based industry of direct relevance to the poor. A number of typical information market failures can affect traditional fishermen in low-income countries. While at sea, they have limited bargaining power in the market. A lack of knowledge of market prices makes it difficult to identify in which market location they would get the best price. Due to the cost of transportation and perishability of their products, they can only visit one market per day, often ending up selling in their local market. There is convincing evidence, especially from South India, that increased use of mobile phones has helped fishermen address information asymmetries between fishermen, traders and consumers. Interestingly, benefits in the communities studied have extended beyond the individual fishermen who were using the phones, partly as a result of greatly improved functioning of the fish markets more broadly. Better market coordination has resulted in increased profits for the fishermen (with or without phones), lower fish prices for poor consumers, as well as a reduction in the wastage of fish.

Small-scale manufacturing and services encompass a wide range of micro and small businesses. Such enterprises can be found in both rural and urban areas and the types of activities performed by them may relate to retail sales, small manufacturing, artisans, taxi driving, household work and other services. As with the examples noted in agriculture and fishing, ICT use among small and micro-enterprises in manufacturing or services in low-income countries is mainly made available through mobile phones. Depending on the nature of activities, such phones may be used to stay in touch with existing suppliers and/or customers, or to find new ones. Micro-enterprises are furthermore likely to gain from new mobile money services. By contrast, relatively few micro-enterprises in low-income countries so far make use of computers and the Internet.

A key challenge is to mitigate the risks of ICT access leading to widening divides and at the same time seize maximum gains from the opportunities that emerge from more widespread use of ICTs in low-income countries. In some cases, enterprises that are non-users of ICTs will be unable to attain full benefit of reduced transaction costs and improvements in communication and may find themselves at a competitive disadvantage. Moreover, while ICT use often leads to beneficial disintermediation, it can sometimes reinforce the market position and power of existing trading intermediaries, whose actions may not impact positively on the livelihoods of the poor. Finally, the role of ICTs might be more limited in local value chain systems (particularly of subsistence-based enterprises) that rely heavily on pre-existing, informal and culturally rooted communication where the exchange of valued information is by means of personal contact. Addressing these challenges requires adequate policy responses.

Chapter V: The policy challenge

This Report is primarily concerned with the potential that ICTs have to enhance livelihoods and opportunities for the poor, and thereby contribute to internationally agreed poverty reduction goals. The relationship between poverty and economic growth is complex. Sustained economic growth is necessary for achieving substantial progress in reducing poverty. However, it cannot overcome poverty on its own. The challenge for policymakers is to identify and facilitate

growth in ways that reduce poverty and inequality, and that empower those in poverty to achieve more sustainable incomes and enhance their livelihoods, as well as achieving macroeconomic gains.

As with other goods and services, increased ICT ownership is likely to be associated with higher levels of income and of other resources and capabilities required for their effective use, such as literacy and education. There is always a risk that ICT adoption increases disparities between more established and better resourced enterprises and those which are less well-endowed. A poverty-focused approach to ICTs and enterprise needs to address this challenge. Policymakers need to identify and facilitate growth in ways that are socially and economically inclusive. They need to support ICT adoption and use at lower levels of economic activity and sophistication if they wish to address the enterprise requirements of the poorest social groups. This means that adequate attention needs to be paid to both subsistence-based and to growth-oriented enterprises. Where market-based solutions can be found, the chances increase that the interventions are sustainable. However, long-term public support is likely to be required to address market failures in the delivery of information or services to subsistence-based enterprises with very low purchasing power.

An important lesson emerging from available research is the need for policies to reflect the diversity of ICTs, enterprises and the poor. ICTs vary in terms of their accessibility to the poor, their functionality and requirements of users. Many people who run micro-enterprises in low-income economies cannot read or write. Therefore, programmes need to make innovative use of voice-based telecommunications interfaces and of proxies such as infomediaries. Moreover, the need for information and other inputs varies depending on the size, industry and market-orientation of enterprises. As a result, so does the extent to which different enterprises may benefit from improved access to certain ICTs. The poor similarly differ in the degree and nature of their poverty, whether they live in urban or rural areas, with regard to literacy and other capabilities, by gender and in terms of the natural and political environment surrounding them. All these factors mean that policy interventions – to be effective and reach intended beneficiaries – must be demand-driven and context-specific.

Many strategies and policy initiatives aimed at reaping development gains from ICTs in the past 15 years have been supply- rather than demand-driven, thus failing to respond effectively to the specific context of diverse communities. This has sometimes involved a centralized, top-down model, with insufficient attention given to the needs and priorities of small-scale enterprises in rural and urban areas. In order to make policies for ICTs and enterprise more effective in the fight against poverty, three points are especially important.

Firstly, policymaking should include careful prior assessment of the needs and experience of the intended beneficiaries. Secondly, policymakers need to recognize and build on (and learn from) the ways in which people (including the poor) and enterprises (including micro-enterprises) appropriate ICTs as they become available, making innovative use of them in ways that suit their business circumstances. The forms that appropriation has taken have often surprised both policymakers and service suppliers – from the extensive adoption of short message service (SMS) and the use of airtime as currency to the rapid take-up of mobile money services in some countries. Thirdly, to address the first two points, policymaking needs to secure the input and engagement of enterprises at all levels, especially those most relevant to the poor, in programme design and implementation. Both subsistence-based and growth-oriented enterprises should be consulted about their requirements and their communications preferences. This increases the likelihood that initiatives lead to the promotion of those services that are of direct and immediate value to the enterprises concerned.

Such tailored policy interventions are needed in several areas, including: (a) enhancing access to ICT infrastructure, especially wireless technology; (b) making ICT access affordable; (c) promoting relevant content and services development; (d) strengthening the ICT sector; and (e) improved links between ICT and enterprise policies and poverty reduction strategies. Content and services need to be delivered in formats that low-income users can readily access and absorb. The rapid growth of mobile access suggests that it would make sense for governments to take a fresh look at how relevant business support services can be delivered using mobile phones.

It is similarly time for development partners to explore how best to exploit this new situation in ways that bring benefits to the poor. New interventions need to be rooted in today's realities – including the needs and circumstances of micro-enterprises and

the communications environment available to them – and in realistic assessment of future prospects. Development partners can support the efforts of national and local governments to achieve positive gains from the use of ICTs by enterprises. Four main areas of support are identified in the Report:

- Support for the integration of ICT and enterprise policies into national development planning processes, including strengthening of the legal and regulatory frameworks for ICTs and enterprise;
- Investment in relevant infrastructure deployment in geographical areas where commercial investments are insufficiently forthcoming, or in technological areas of high potential. This may involve public-private partnerships (PPPs);
- Support for government initiatives in the ICT sector, enterprise and human capacity development; and
- The development of a deeper understanding of the impact of ICTs on enterprise by building a more extensive and more critical evidence base and establishing frameworks for the analysis of national communications environments and needs.

In the past few years, there has been a trend among development partners to "mainstream" their ICT support into broader areas of development policy. In this process, some development agencies have chosen to dismantle dedicated secretariats or expert units for the cross-cutting treatment of ICT for development. This may make it more difficult to implement a demand-driven approach to policymaking, which is likely to require more rather than less technical expertise within development agencies for them to act as effective partners. There is also a risk that the potential of ICTs – particularly as cross-cutting developmental inputs – will be undervalued within development agencies, and that knowledge and experience will be poorly collated and diffused. Development partners need to stay abreast of the rapid developments taking place within the ICT field and to ensure that the potential of ICTs is given adequate attention within their programmes.

Governments and agencies should act not just to improve ICT connectivity but also to raise the capabilities of micro-businesses to make use of ICTs and to foster a business environment which encourages and rewards them for doing so. Enterprise-related ICT policies need to become more fully integrated in national development strategies and in the agreements, such as United Nations Development Assistance Frameworks (UNDAFs), which governments enter into with donors and International Financial Institutions. In a 2009 review by the United Nations Economic Commission for Africa (ECA) of 20 UNDAFs in Africa, however, only two included ICT-related projects.

At the same time, governments and development agencies alone cannot deliver on the promise of ICT for poverty reduction. The private sector is crucially important as the primary source of infrastructure investment and service innovation. Citizens and enterprises have shown themselves to be innovative in appropriating technologies and services to meet their needs. Governments and development actors need to learn from this experience and make interventions that help the private sector and civil society to seize opportunities created by recent technology developments. Successful projects aimed at enhancing the productive use of ICTs by enterprises have often seen the involvement of multiple stakeholders acting in partnerships. A starting point would be to make better use of ICTs, notably mobile applications – in government services targeting economic opportunities among the poor.

With access increasingly reaching poor producers in low-income countries, there are now much better possibilities than before to ensure that ICTs contribute to poverty reduction. It is the shared responsibility of all relevant stakeholders to make the most of the many new opportunities that are emerging. This will require, among other things, that national governments and development partners are well informed before launching new policy interventions and that they work in close collaboration with those partners that can bring the knowledge and experience needed to produce desired outcomes. The findings presented in the *Information Economy Report 2010* will serve as a valuable input in this process.

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1 EXPLORING THE LINK BETWEEN POVERTY, ICTs AND ENTERPRISES

Reducing extreme poverty lies at the heart of the United Nations' efforts to promote development. Progress has been uneven and every avenue towards poverty alleviation needs to be continuously re-examined. This chapter presents a framework for assessing the impact on poverty of ICT use and production by enterprises. It stresses the importance of considering different aspects of poverty as well as the diversity of both ICTs and enterprises in the analysis.

The chapter is organized into five sections. Section A introduces the reader to the overall focus of the report. Section B provides a brief review of some characteristics of poverty and presents different approaches to considering poverty alleviation. Section C highlights some key features and trends related to ICTs for development, while section D identifies the types of enterprise that matter most for the poor. The final section brings the three areas of poverty, ICTs and enterprises together and proposes a conceptual integrated framework for the analysis that follows.

A. INTRODUCTION

Fighting extreme poverty lies at the heart of the United Nations' efforts at promoting development. With its proclamation of the *Second United Nations Decade for the Eradication of Poverty* (2008–2017), the United Nations General Assembly reiterated that poverty eradication is the greatest global challenge facing the world and a core requirement for sustainable development. Progress with regard to poverty reduction has been uneven, although it may still be possible to meet the target of cutting the 1995 global poverty rate in half by 2015. But even if the goal is met, almost 1 billion people are likely to remain in extreme poverty by the end of 2015.[1] Against this background, every avenue towards poverty alleviation needs to be re-examined.

Sustained and equitable growth is necessary for making substantial progress in reducing poverty. In this context, enterprises play a crucial role. Countries that have been most successful in reducing extreme poverty managed to sustain high economic growth over prolonged periods, and most managed to do so by increasing agricultural productivity followed by dynamic growth of modern industry and services sectors.[2] Meanwhile, the creation of jobs is essential for poverty eradication as they are the source of income both for the entrepreneurs and workers directly involved, and for governments through taxation.

Historically, the introduction of new technology and its effective application in business operations has contributed greatly to productivity growth, innovation, economic transformation and, ultimately, improved standards of living (Broadberry and Irwin, 2005). In this context, information and communication technologies (ICTs) represent an important factor. First, the production of ICT goods and services has given rise to new economic activities, thus generating jobs, incomes and livelihoods. Secondly, greater use of ICTs by enterprises in various industries can transform the ways in which goods and services are produced, with implications for the people involved.

The extent to which ICTs influence economic activities varies both between and within countries. Wide gaps remain in terms of availability and uptake of different ICTs, depending on rural–urban location, age, gender, education, company size and – often underpinning all four others – income. Countries with large human resource pools, competitive firms and strong institutional capacity are at an advantage in exploiting the opportunities created through ICTs. Moreover, skills requirements and costs involved vary between different technologies. In other words, the introduction of ICTs is not neutral. It can bridge or widen prevailing divides, depending not least on the choice of policy.

At the same time, the ICT landscape continues to evolve rapidly. An important development in recent years has been the dramatic increase in the availability of mobile phones also in low-income countries. For example, in the least developed countries (LDCs), average penetration of mobile subscriptions rose from 2 per 100 inhabitants in 2003 to 25 per 100 inhabitants in 2009.[3] Wireless technology also opens new opportunities to access the Internet.

The focus of this Report is on direct economic use of ICTs by the poor mediated by enterprise. This focus is timely. The year 2010 is the halfway point between the Tunis phase of the World Summit on the Information Society (WSIS) and 2015, when the United Nations General Assembly will review progress towards achieving the targets set at the WSIS. World leaders are recognizing the importance of leveraging ICTs, as illustrated, for example, by the focus on ICTs in Africa and the recent Summit of the African Union.[4] Moreover, as stressed by the United Nations Secretary-General in a recent report to the General Assembly on the Millennium Development Goals (MDGs):

> *" New technology-based solutions that did not exist when the Goals were endorsed can and should be leveraged to allow for rapid scaling up. The most important of these technologies involve use of mobile telephones, broadband Internet, and other information and communications technologies."*[5]

The growth of ICT availability has not been matched by an equally rapid expansion in knowledge concerning how ICTs impact on development and poverty. Far more needs to be understood about the emerging new roles and impacts of ICTs in poor communities. As few empirical studies have looked specifically at this question, the evidence base remains weak. This Report places the spotlight on an area which deserves more attention in terms of both research and policy analysis. The overriding question posed is what can be done to seize the opportunities created in the new landscape related to enterprises and ICTs in order to bring tangible benefits to the poor. The remainder of this chapter provides a brief review of some characteristics of poverty (section B), a description of the ICT (section C) and enterprise (section D) scope covered in the remainder of the report, and a conceptual integrated framework for the analysis that follows (section E).

Table I.1. People living on less than $1.25 (PPP) per day, by region, 1996 and 2005 (millions and percentage of population)

Region	1996			2005		
	Number of poor (million)	Population (million)	Poverty rate	Number of poor (million)	Population (million)	Poverty rate
Africa	329	678	48.5	359	845	42.5
Asia and Oceania	1,186	3,046	38.9	896	3,429	26.1
Latin America and the Caribbean	53	485	10.9	45	550	8.2
Transition economies	19	296	6.5	15	291	5.1
Developed Europe	1	105	1.0	0	102	0.2

Source: UNCTAD, based on data from PovcalNet of the World Bank. See also annex table I.1.

B. CHARACTERISTICS AND DISTRIBUTION OF POVERTY

Poverty is multi-faceted. It can be expressed in terms of (a) a lack of (or low) income; (b) insufficient access to the basic necessities of life such as food, clean water, shelter and health; (c) limited future opportunities (due to illiteracy or no education); or (d) in social terms, reflecting lack of rights, freedom, voice and empowerment (Greenberg, 2005). It also has an informational dimension. As summarized in one report (Marker et al., 2002: 7):

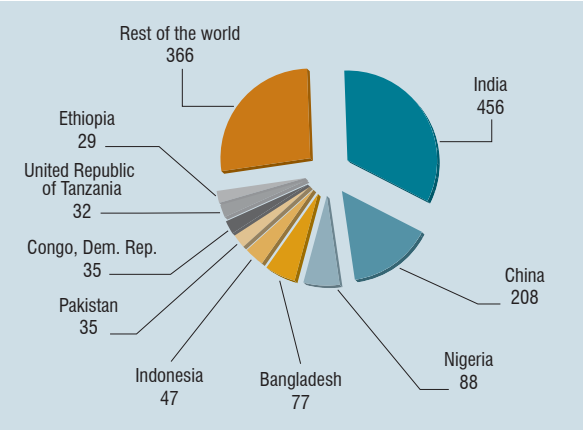
> *" The poor are not just deprived of basic resources. They lack access to information that is vital to their lives and livelihoods: information about market prices for the goods they produce, about health, about the structure and services of public institutions, and about their rights. They lack political visibility and voice in the institutions and power relations that shape their lives. They lack access to knowledge, education and skills development that could improve their livelihoods… They lack access to, and information about, income-earning opportunities."*

1. The distribution of poverty

Poverty is unevenly spread across the world as well as within countries. In terms of income poverty, the World Bank estimates that, in 2005, some 1.4 billion people, or almost 22 per cent of world population, lived on less than $1.25 a day (Chen and Ravaillon, 2008). Taking into account population growth between 1981 and 2005, the poverty rate during this period fell by about 25 per cent. Most of this improvement was related to Asia and Oceania, where the share of people living on less than $1.25 a day (the poverty rate) fell from 39 per cent in 1996 to 26 per cent in 2005 (table I.1). China's performance has been particularly remarkable. During the same period, its poverty rate fell from 36 per cent to 16 per cent, or by about 235 million people (annex table I.1).

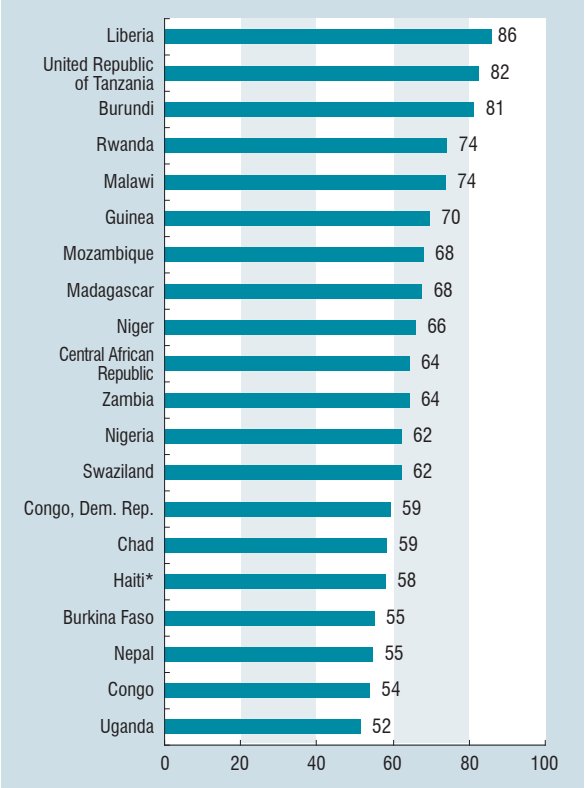
In absolute terms, the largest numbers of people living on less than $1.25 per day in 2005 were in Asia, followed by Africa (table I.1). Most of the world's poor live in rural areas.[6] By country, India has the largest number of poor people, with more than 450 million people living on less than $1.25 per day in 2005. India was followed by China, Nigeria, Bangladesh and Indonesia (figure I.1). In relative terms, the incidence

Figure I.1. People living on less than $1.25 (PPP) per day, by country, 2005 (millions)



Source: UNCTAD, based on data from PovcalNet of the World Bank.

Figure I.2. Twenty countries with the highest shares of people living on less than $1.25 (PPP) per day, 2005 (%)



Source: UNCTAD, based on data from PovcalNet of the World Bank. See annex table I.1.

**Regression-based PPP.*

of poverty was the highest in sub-Saharan Africa, where more than half of the population lives on less than $1.25 per day. Moreover, the 15 countries with the highest relative poverty rates are all located in that region, led by Liberia, the United Republic of Tanzania, Burundi and Rwanda (figure I.2).

The group of people living in poverty is not homogenous. A distinction can be made between poor and the chronically poor, the latter having been defined to include those remaining below the poverty line for at least five years (Chronic Poverty Research Centre, 2008). Chronically poor people are mostly economically active but remain poor due to their position within households, communities and countries (*ibid.*). They are often illiterate, speak a minority language, lack assets such as land, livestock or productive skills as well as self-confidence and trust in potential sources of information. In most countries, the incidence of poverty is particularly pronounced in rural areas, where agriculture forms the livelihood base. Chronically poor are often found in regions with limited agricultural potential and far from main national markets. Their livelihoods include subsistence farming, wage labour and production for sale. They typically rely on work which is insecure, low paid, unhealthy and unsafe. Many work in the informal sector.

2. Frameworks for assessing poverty impacts

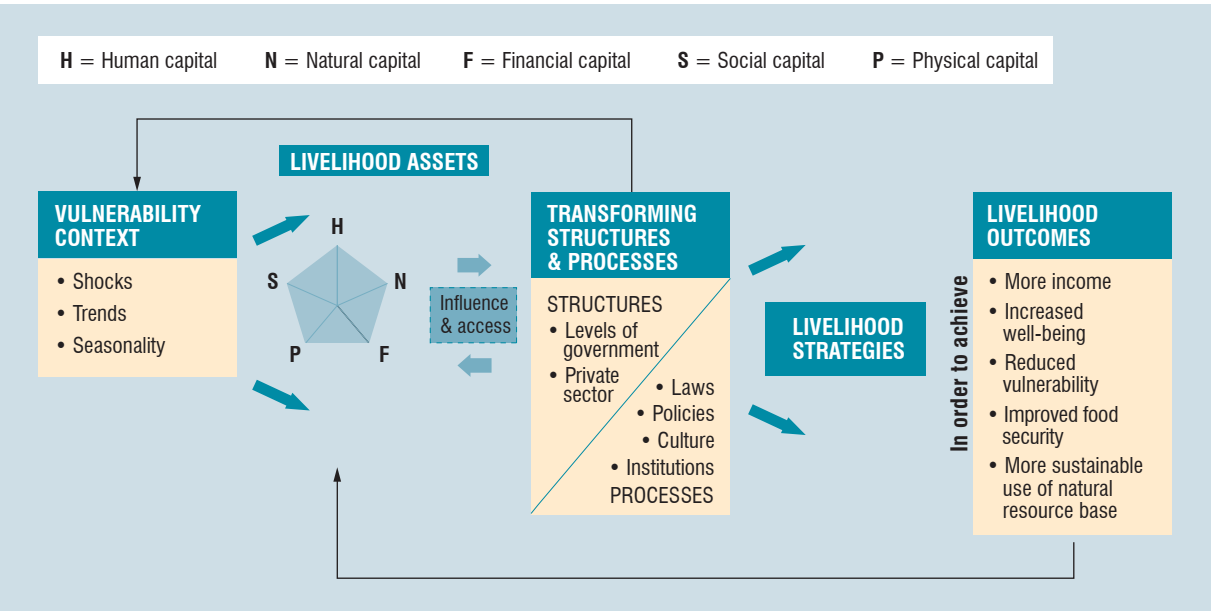
There are different approaches to assessing the impact on poverty. In this Report, most attention is given to poverty reduction through economic growth, improved livelihoods and development as expanded capabilities (see also UNCTAD, 2006; Heeks and Molla, 2009).

A long-standing view of development is to see it as an expansion of production and wealth, typically measured in terms of gross domestic product (GDP) per capita. On this basis, poverty is seen in its simplest terms as a lack of money, and the alleviation of poverty is a strategy for delivering greater income to the poor.

However, if people in poor communities are asked about their own definition of development and their own goals, they go well beyond the economic to encompass social and political issues (Kivunike et al., 2009). The *livelihoods approach* recognizes not just the financial aspect of poverty but also the importance of context (United Kingdom, DFID, 1999). A livelihoods approach addresses issues of poverty from the perspective of the poor producer, recognizing that the poor operate in a context of (often extreme) vulnerability. Within this context, the poor have access to certain assets or poverty-reducing factors (Carney, 1999). These gain meaning and value through the structures and processes of the prevailing environment (including those of the market). This environment influences the livelihood strategies of the poor – ways of combining and using assets – that are open to people in pursuit of their own objectives.

In figure I.3, the *vulnerability context* refers to the external environment that shapes people's lives via shocks (e.g. conflict, disaster), trends (e.g. demographics, changing global prices), and seasonality. This framework identifies *five types of assets*: (a) human (skills, knowledge, health, ability to work); (b) natural (land, forests, water); (c) financial (income, financial savings, non-financial savings – such as jewellery, livestock); (d) physical

Figure I.3. The livelihoods framework



Source: United Kingdom, DFID, 1999.

(infrastructure – such as transport, housing, water, energy – ICTs, producers goods – such as tools and equipment; and (e) social (networks, group membership, relationships). Other elements include the *structures*: public, private and non-governmental organizations (NGOs) that deliver policy, legislation, services, goods and markets; *processes*: forces shaping how organizations and individuals behave (i.e. operate and interact); *strategies*: the range and combination of activities and choices that people make/undertake in order to achieve their livelihood goals; and *outcomes*: what strategies achieve through use of assets via structures and processes within a context.

In many analyses using the livelihoods approach, ICTs are treated as separate physical assets rather than as a resource that cuts across all the dimensions of the framework (Duncombe, 2007; Heeks and Molla, 2009). The highest priority among the poor for using ICTs is generally social (particularly family) contact and protection against vulnerability (including access to financial support). The poor also need information in order to access a broad range of assets: information about access to training and new knowledge, about finance, about technologies, and about the natural resources upon which the poor largely depend. There are also time-dependent roles for information that relate to structures, processes and strategies.[7] Thus, in terms of livelihood strategies, information plays a dual role: (a) informing and strengthening the short-term decision-making capacity of the poor themselves; and (b) informing and strengthening the longer-term decision making capacity of intermediaries that facilitate, assist or represent the poor (Duncombe, 2007; Chapman, Slaymaker and Young, 2003).[8]

Taking one further step away from the idea of poverty as being just about money, poverty can be defined in the sense of lack of opportunity, the lack of abilities and chances to do what is necessary to progress in life. Money will be one part of this. There are also links to livelihoods ideas, such as the various assets of a person, the context in which a person or an enterprise acts, and the strategies that can be adopted. These ideas are encapsulated in the so-called *capabilities approach*, which views development as the expansion of individual freedoms: "what the person is free to do and achieve in pursuit of whatever goals or values he or she regards as important" (Sen, 1985: 203). What a person is free to do represents his/her capabilities; what they actually achieve represents their functioning. If asked, residents in poor communities can often readily explain that they seek greater opportunity from ICTs, particularly to undertake various activities (Kivunike et al., 2009).

A summary of the strengths and weaknesses of the three approaches is provided in table I.2. In this

Table I.2. Strengths and weaknesses of different approaches to assess impact of ICTs in enterprises on poverty alleviation

	Financial approach	Livelihoods approach	Capabilities approach
Strengths	• Simple, quantified and relatively objective summary of ICT4D impact. Analytical results easy to interpret and communicate. • Useful for evaluating the financial performance and/or sustainability of ICT4D projects. Particularly useful for understanding enterprise-related impacts of ICTs, and the development of markets and commerce. Can be used to assess impact on individual micro-enterprises as well as on the macro economy. • Can be applied to different technologies, markets and supply chains. Generic indicators such as price fluctuations can be adapted to the specific context of evaluation. • Interpretation of indicators is mostly straightforward.	• Comprehensive coverage of poverty alleviation-related impacts. • Accepted and well understood by the development community. • Lots of guidance on general methods and implementation (e.g. www.livelihoods.org). • Flexible to different situations as it considers each different context, assets, institutions, etc. • Covers the (often complex) realities of people's actual experiences. • Avoids over-emphasis on technical aspects; focus on social structures and processes. • Allows a causal chain of impacts on and impacts of ICT4D.	• An original and broad perspective on ICTs' relation to poverty. • Recognizes each individual: their aspirations, needs and choices. • Avoids social and technological determinism: recognizes that technology can create new freedoms but lead to other outcomes in different situations. • Framework is recognized by development agencies and practitioners. • Useful focus on non-usage (unrealized functionings) and on constraints to action (un-freedoms).
Weaknesses	• Mainly limited to financial income impact. Fails to account for broader impacts. • Identifying cost and income items, quantifying them, and directly attributing them to ICTs can be difficult and subjective. • Given the need to follow particular sectors/ supply chains in depth, it may be difficult to assess some projects if they have impacts on enterprise in multiple sectors. • Although the types of impacts included can be identified and estimated based on a specific content and context, this does not lend itself to participative evaluation approaches.	• Limited linkage to information and ICTs; difficult to attribute causality as framework contains a set of potential independent, dependent and intervening variables. • Focus is more on broader outcomes and impacts rather than specific causal outputs from ICT4D, at least if moving beyond just asset impact. • Complex overall framework may be costly and time-consuming to implement and hard to conclude and generalize from. • High-level nature of framework requires interpretation to apply for any given project. • More a framework within which impact assessment methods can be slotted than a specific impact assessment method.	• Limited usage to date for ICT4D projects. No consistent approach for impact assessment. • Requires interpretation to apply for ICTs: original framework says nothing explicit and is quite "academic" and flexible. • Would typically require definition (e.g. participative) of what aspects of freedom and capabilities are valued. • Requires understanding of the potential freedoms NOT chosen, as well as the actual freedoms chosen. • Complexity that capabilities are both inputs to and outputs from any ICT4D project.

Source : UNCTAD, adapted from Heeks and Molla, 2009.

Report, when assessing the potential of ICTs in enterprises to help reduce poverty, reference will mainly be made to the first two frameworks (financial and livelihoods approaches), but occasionally also to the third (capabilities approach). Before considering (in section E below) how the frameworks described above can be linked to the role of ICT use and production in enterprises, the next two sections define the scope of the analysis with regard to different ICTs (section C) and different enterprises (section D). Recognizing the diversity of these two domains is essential to assess the impact on the poor.

C. THE EVOLVING ROLE OF ICTs

Rapid evolution of the ICT landscape is creating both opportunities and challenges for enterprises and policymakers. In the past decade, the scope for ICTs to affect development and poverty has expanded in several respects. The relative importance of different ICTs has shifted, as has the role of ICTs in the life of poor people and communities. In this Report, ICTs refer to technologies that facilitate communication

and processing of information by electronic means. Thus, the concept encompasses radio, telephony (fixed and mobile), computers, the Internet, broadband technologies as well as combinations thereof.

There is an element of dualism with regard to how the development community has perceived the role of ICTs. Some development practitioners have perceived ICTs primarily as opportunities to redress past failures of development, by increasing information and knowledge, enabling new modes of production and facilitating the development of new social and economic networks. Others have been more concerned about the threat of the "digital divide", that unequal accessibility and take-up of ICTs will increase inequality between rich and poor individuals, communities and nations (Souter, 2010).

Much has happened since the early days of discussions related to ICT for development (ICT4D). The typical example of ICT4D applications during the 1960s and 1970s involved the internal use of computers within government organizations for data processing and management information system purposes with little relevance for neither enterprises nor poverty (Heeks, 2009b).[9] In the 1970s and 1980s, such uses were joined by similar applications in large enterprises.

In the mid-1990s, the scope for ICTs as a tool to promote various development objectives was increasingly recognized. Around this time, the Internet began to diffuse into developing countries. Much policy attention was devoted to the role of telecentres, which often involved one or two Internet-linked PCs that could deliver information and training to poor communities. However, partly due to slow diffusion and literacy requirements, few at the bottom of the pyramid became direct users of this new technology. Where they did, they were generally consumers of "broadcast" information – searching for and ingesting fairly general information about health, education or government services which might or might not then lead to some development action (Jensen and Esterhuysen, 2001; Etta and Parvyn-Wamahu, 2003). More often – and given the spread of ICTs into local government, civil society organizations and even some community-based organizations – the poor were indirect users, informed by some intermediary acting on their behalf.

In the early years of the twenty-first century, the mobile phone has become the ICT4D conduit receiving the most attention. The spread of mobile telephony has to a large extent been a result of market liberalization in combination with technological and, most importantly, commercial innovation. On the back of greater diffusion, not least in low-income countries, new mobile applications and services are also emerging. In many developing countries, mobile phones are used extensively for voice communication and short message service (SMS), and increasingly also for other data applications. They enable business users to access various kinds of market information. In some developing countries, mobiles now allow people without a bank account to make person-to-person payments, transfers and pre-paid purchases. This trend is only at an early stage.

At the same time, traditional technologies still have a role to play in this new environment. In sub-Saharan Africa, for example, radio has the highest level of ownership and access and usability by the poor (chapter II; AFRRI, 2008; Munyua, 2008; Miehlbradt and McVay, 2005). As a method of information, radio delivery has certain advantages (Grace et al., 2004). It is relatively cheap; radio signals can penetrate remote geographic regions; any person with access to a radio set can receive information, regardless of literacy or education level; and it can provide region-specific information, easily incorporate local concerns and feedback, and can operate in local languages. The main disadvantage with radio is that it involves one-way communication. Initiatives centred around radio may well continue to be relevant for the rural poor (Kenny, 2002).

In addition, the wider spread of both the Internet and mobile telephony opens new opportunities for combining different types of ICTs. Wireless connectivity is making the Internet more accessible and affordable in rural areas and combinations of different technologies are leading to new innovations for interactive communication such as via new radio formats (Best and Kenny, 2009; Parikh, 2007). Similarly, some community information centres have added an SMS-based service that allows farmers to search for information via mobile phones (chapter IV). Thus, the context is shifting, with more possibilities for ICTs to make a difference for development as a result.

In parallel, the involvement of developing countries and poor people and communities as consumers and producers of ICTs is also evolving. There is increased interest in developing countries as potential growth markets. In response, ICT producers are adjusting their goods and services as well as business models to

cater better to low-income consumers. More consideration is today paid to finding ways to reach the "bottom of the pyramid" (Prahalad, 2004). Improved mobile access – partly as a result of cheaper imports of technology – at increasingly affordable rates, and new service models are facilitating access for people without large or predictable incomes. This has furthermore allowed for greater involvement of enterprises in developing countries in ICT-related innovation processes (Heeks, 2009c). Such involvement is likely to enable the adaptation of ICT systems (that were first developed outside these communities) to the specific situation prevailing in low-income economies. It is also giving rise to innovations, such as the development of "simpler" versions of mobile phones and computers, the use of dual SIM cards, new ways of communicating with a phone without having to pay for the call, and using airtime as currency.

Despite these positive trends, inequalities of ICT access and use remain (chapter II). It is therefore important not to be carried away when examining the potential role of ICTs and enterprises for poverty alleviation. At the same time, it is equally important to explore every opportunity to boost the development impact of this new situation. The poor are today interacting with ICTs in novel ways, not only as indirect users or passive consumers of ICTs, but also as active users, workers and entrepreneurs in the ICT sector.

D. THE ROLE OF ENTERPRISES

Enterprise growth can make a significant contribution to poverty reduction resulting from the generation of income through diversification or upgrading of existing economic activity, as well as through the establishment of new enterprises.[10] The contribution of ICTs to poverty reduction through enterprise lies in their power to give poor women and men access to improved information and better communications to help them build livelihood assets.

It is important to distinguish between different kinds of enterprises. The role of the poor varies, as does the nature of ICT use. The following categorization based on scale can serve as a starting point:

- *Micro-enterprises*: these tend to employ 1–5 (or 1–10) workers, and typically provide incomes for one third to one half or more of labour forces in developing countries (Liedholm and Mead, 2002). They are often unregistered or unlicensed informal sector enterprises. Their impact on the wider economy in terms of growth, innovation and income redistribution can be limited. In some countries (in sub-Saharan Africa, for example) they provide greater benefits to women (Liedholm and Mead, 2002; Von Massow, 1999). Access to ICTs varies for such enterprises depending upon their location and the quality and availability of infrastructure. Micro-enterprises located in or near to urban centers are at a significant advantage.
- *Small and medium enterprises (SMEs):* these are one step up, employing 5 (or 10)–25 workers. They are far fewer than micro-enterprises, but typically have greater impact on growth in formal employment within the wider economy. At the same time, their impact amongst the poor is more limited (Duncombe and Heeks, 2002b; McCormick, 1999). The extent of ICT use by SMEs varies according to both sector and size (UNCTAD, 2009a; Chiware and Dick, 2008; Duncombe and Heeks, 2002b). Typically, those SMEs which are export-oriented (or importers and tourist sector enterprises) have stronger incentive to implement ICTs in their business than those that rely on domestic markets.
- *Large enterprises (including foreign affiliates)*: each large enterprise can be a significant employer, a creator of exports and wealth, a provider of longer-term job creation via externalities and indirect employment opportunities both for the better off and the poor. Workers and, even more, managers and owners tend to receive higher incomes than those in smaller enterprises. Large enterprises in developing countries are significant ICT users for internal management functions and external communications.

A second distinction should be made between *subsistence-based* and *growth-oriented enterprises*. *Subsistence-based enterprises* support the livelihoods of the poor pushed into economic activity by the lack of other income-generating opportunities. They form the majority of enterprises in low-income countries: they are commonly located in households, and most are in rural areas making use of natural resource inputs (e.g. farming and fishing). Most poor people operate or work in such enterprises, including in the informal sector, earning relatively small incomes by trading surplus produce for local consumption, or as part of producer or farmer groups reaching distant

markets via intermediaries (Vandenberg, 2006; Ellis, 2000). Poor households step in and out of subsistence-based enterprises depending upon the nature of the activity, the seasonal demand, the availability of resources, as well as for other personal and social reasons (Shepherd, 1998).[11] Most such enterprises have no access to computer-based ICT. There may be a public access phone within reach, and increasingly, they may have access to a mobile phone. Almost all subsistence-based enterprises can access the output of national or local community and privately-owned radio stations.

Growth-oriented enterprises act as a strong stimulus to innovation, exports and enhanced productivity in key sectors of developing country economies (Duncombe and Heeks, 2002b; Liedholm and Mead, 2002). Growth-oriented enterprises can be more accurately described as "entrepreneurial", having taken up enterprise because they see opportunities for growth and profits.

Enterprises have the potential to contribute to poverty reduction in two main ways: (a) through direct income generation and diversified livelihood opportunities (predominantly for subsistence-based enterprises); and (b) through more secure employment opportunities (predominantly in growth-oriented micro-enterprises and SMEs). Micro and small enterprises can contribute to poverty reduction by creating jobs either in new ventures or through the expansion of existing enterprises. In this context, the poor affected by the enterprise activities can be entrepreneurs and business owners, employees, household members dependent on the working poor, unemployed becoming employed, or consumers purchasing from small enterprises goods and services tailored to their needs (Vandenberg, 2006). Evidence indicates that small enterprises are the main engine for job creation in developed and developing countries alike, but they are also the sector with the highest rate of job destruction (Davis et al., 1996; Birch, 1979 and 1987).

Income generated from micro and small enterprise activity is often insufficient to escape from poverty. In many cases, micro-entrepreneurs start an economic activity because they cannot find a paid job. In this sense, the poor are the ultimate entrepreneurs because they need to find alternative income generating activities in order to survive. They may work alone or with help from family members. They often do not earn enough to pay wages. Studies from Malawi (Orr and Mwale, 2001), Sri Lanka (Shaw, 2004) and Uganda (Ellis and Bahiigwa, 2003) suggest that the proportion of earnings from all forms of enterprise are either non-existent or very low for those in extreme poverty, but tend to increase in a fairly uniform manner for those who are less poor, and become important sources of income for those who have climbed above the poverty line. For most poor households (particularly in rural areas) direct earnings from enterprise activity can be considered as supplementary, with larger proportions of household income gained from other sources, which include wage labour through public works, waged employment, as well as other sources including asset sales, remittances and social transfers.

Larger companies are generally the most productive units in an economy. From the perspective of poverty interventions, there is therefore often a trade-off to be made between focusing on enhancing the productivity and conditions for poor in micro and small enterprises or on private sector development in general (Vandenberg, 2006).

E. LINKING ICTs, ENTERPRISES AND POVERTY

Reflecting the information provided above, possible relations between ICTs and the poor as mediated through enterprise can be identified. Two different roles for ICTs in enterprises can be distinguished (Narasimhan, 1983). The majority of ICT applications takes an existing activity and alters it in some way through digitization; perhaps reducing its cost or improving its quality. This involves an intensification of that existing activity. In this Report, it will be referred to the ways in which different *ICTs are used by enterprises along the value chain*. New ICTs can also give rise to activities that did not exist before. The main example would be anything that implies an *expansion of the ICT sector*, from manufacture of hardware to writing software, providing telecommunication services, selling airtime, repairing PCs or providing computer training. It is thus possible to distinguish between the use (demand side) and production (supply side) of ICTs by enterprises. A conceptualization of the relations between ICTs, enterprise and the poor are depicted in figure I.4.

A first distinction can be made between *non-economic* and *economic* types of ICT use involving the poor in a country. *Non-economic* use may relate to health, education and other social dimensions. *Economic*

aspects may involve the poor as consumers, suppliers, workers, entrepreneurs and in making use of ICTs to make financial transactions of some kind.

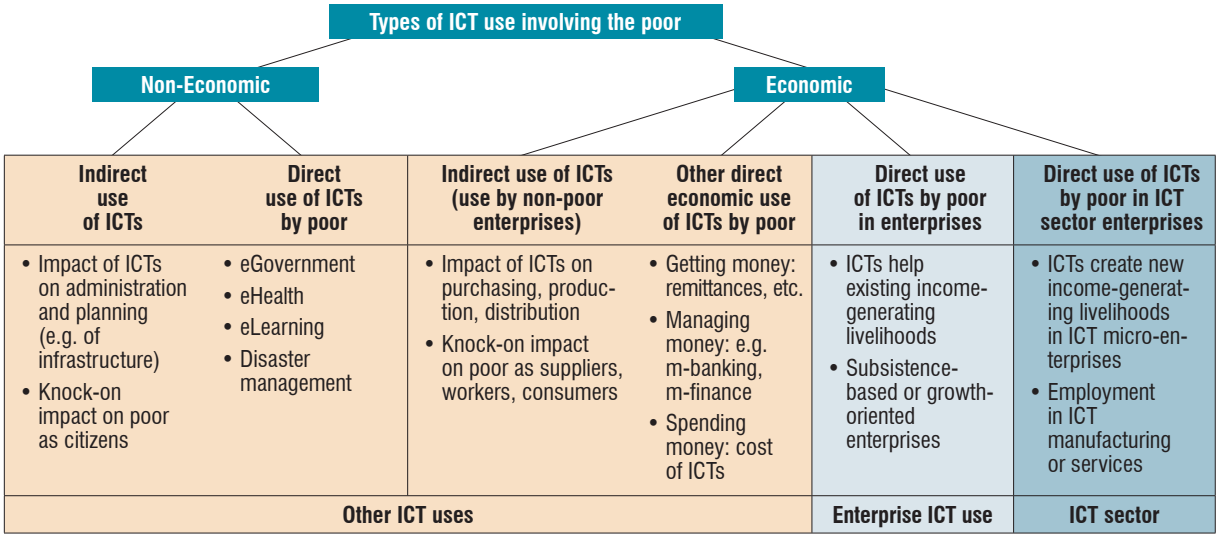
A second distinction can be made between *indirect* and *direct* use of ICTs by the poor. Indirect usage is broad and large-scale. However, the poverty effect of indirect usage forms a distant backdrop and is not the prime focus in this report. For example:

- *Indirect non-economic use* may involve the internal use within a public sector or international agency of ICTs in a way that affects the organization but does not lead to direct usage of ICTs by the poor. For example, it may involve the use of ICTs to assist policymaking within a health ministry.
- *Indirect economic use* may refer to the use of ICTs by an enterprise to lower the cost of the manufacture of goods that are sold to poor communities. One illustration could be the use of ICTs in large firms to improve supply and distribution to low-income markets (Subrahmanyan and Gomez-Arias, 2008). In this case, the poor may benefit indirectly from better supply or lower prices, but they are not direct users of the ICTs.

Direct involvement of the poor as users or producers of ICTs has a potentially deeper impact on individual livelihoods. Three main categories of direct ICT use can be noted:

- *Direct use of ICTs in enterprises:* the use of ICTs by poor people working in or owning subsistence-based or growth-oriented enterprises outside the "ICT sector", aimed at enhancing the productivity. Examples would be the use of mobiles by micro-entrepreneurs to contact their customers (Donner and Escobari, 2009), or use of community radio by farmers to obtain weather forecasts.
- *Direct involvement in the ICT sector:* the production of ICT goods or services involving the poor as workers or entrepreneurs to create new income-generating livelihoods. Examples include poor people becoming employed in large ICT manufacturing firms or telecom companies; the creation of a self-employed ICT-based livelihood, for example, people selling phone calls by the roadside (Anderson and Kupp, 2008); or PC kiosks that provide digital photography, e-ticketing and e-government services (Rangaswamy, 2009a). Poor people or communities may also be engaged in the adaptation of the technology by modifying the technology itself – such as the "street hacks" that alter mobiles to accept dual SIMs (Barendregt, 2008; Chipchase and Burns, 2008).
- *Other types of direct ICT use:* these could be non-economic, typically an ICT-enabled information flow or transaction involving a user from a poor community. An example might be an SMS reminder to poor tuberculosis patients to take their medicine. Economic forms of "other uses" could involve the remittance of "mobile-money" from urban migrants to rural relatives (Duncombe, 2009b).

Figure I.4. Conceptual map of ICTs, enterprise and the poor



Source: UNCTAD.

As noted above, the focus of this Report is on direct economic use of ICTs by the poor, i.e. on the first two bullets above. This is not to imply that other uses of ICTs cannot help reduce poverty. In fact, they may apply to many people and influence a number of livelihood assets. The reason for excluding these types of ICT use is to retain a strict focus on the interface between ICTs, enterprises and the poor.

The implications from direct enterprise use and an expansion of the ICT-producing sector may also differ. While fewer people are likely to be affected by the production of ICT goods and services to improve their income-generating livelihoods, for those that are, the impact on poverty may be significant. By contrast, application of ICTs to existing activities in other enterprises will tend to have a fractional impact on that activity – such as some improvement in productivity or quality – but as it can cover all kinds of activities, the potential is more wide-ranging.

How might increased direct economic use of ICTs by the poor be considered in light of the different approaches to assessing the impact on poverty? In terms of *financial implications,* an expansion of the ICT sector may result in the creation of new employment and associated income is a potentially important impact. Though only indirectly connected to the technology, it might also be relevant to include new livelihoods that are attributable to the ICT sector, such as the ancillary staff who work in ICT enterprises (e.g. Lakshmi Ratan et al., 2009). A further possible extension is to include induced (second-order) employment, for example, those who work as cooks, cleaners or gardeners for households of those employed in the ICT sector. Similarly, greater ICT use in enterprises may imply savings as a result of journey substitution (Jagun et al., 2008). ICT use at different stages of the value chain may also help increase the income earned by entrepreneurs (chapter IV).

Livelihood outcomes have occasionally been considered in terms of ICT impact on the different livelihood assets. Possible impacts can be categorized by an expansion of the ICT sector and an expansion of ICT use. Where ICTs are used to *create a new livelihood*, this has an effect well beyond the financial aspects. It may involve new physical capital (equipment), improved social capital in terms of business relationships, enhanced self-respect (political capital/empowerment), and/or new knowledge (human capital). Expanded enterprise use of ICTs may similarly have various implications on the livelihood outcome. Informal sector entrepreneurs that are typical of poor communities rely heavily on their social capital, with no clear divide between business and social relations – family, friends, neighbours and others may fall into both categories. Through better access to information, communication and transaction, poor entrepreneurs can build their social capital (and so, in turn, improve their livelihoods).[12] ICTs may also play a role in building new socio-economic relations, allowing entrepreneurs to seek out new contacts by phone or web search (Burrell and Matovu, 2009). They thus extend their social capital. Agricultural information obtained via ICTs may furthermore help to strengthen the value of natural capital (IICD, 2008).

The idea of development as freedom takes a broad view of what capabilities are. In impact terms, the interest is mainly in realized "functions" – in this context, what a growing ICT sector or greater use of ICTs in enterprises may enable people to be and/or to do. By tailoring the designs of ICT applications (and projects) to match the realities of poor communities, the opportunities for ICTs to be a technology of poverty alleviation should expand further.

The extent to which technologies are available and used by the poor varies a great deal, with mobile phones and radio appearing as the most widely diffused, and Internet-connected PCs (and especially with a broadband connection) the least (chapter II). Beyond availability, the uptake of certain technologies by the poor also depends on the needs and capabilities of potential users. What matters is whether people have the access that they want and need, not that they have access which is identical to other people with different needs.

As noted above, there are no guarantees that improved access to ICTs leads to poverty reduction. It takes more than processing and communicating information.[13] The information needs to be relevant and appropriately presented to benefit the poor, reflecting the skills and capabilities of the latter. This underlines the importance of policymakers understanding the specific situation and needs of the poor when designing strategies aimed at making ICTs work for poverty alleviation. Policy efforts to enhance affordable access to ICTs thus need to be complemented with broader strategies to foster the development of adequate content as well as raise the capabilities of users of the information.

In summary, this chapter has presented a framework for assessing the impact on poverty of ICT use and production by enterprises. It has stressed the importance of considering different aspects of poverty as well as the diversity of both ICTs and enterprises in the analysis. The remainder of this Report examines the interface between ICTs, enterprises and poverty alleviation in greater detail. It does so by, first, presenting recent trends with regard to connectivity to establish the degree of affordable access and uptake of different ICTs among the poor (chapter II).

Chapter III then turns the attention to the production of ICT goods and services (the ICT sector) and its potential contribution to reducing poverty. It draws on available official data as well as anecdotal evidence from a wide selection of countries. In chapter IV, the focus shifts to the use of ICT by enterprises, with special emphasis on such enterprises that may matter the most for poor people, namely small and micro–enterprises in relevant sectors. Finally, chapter V presents the main policy implications from the analysis.

NOTES

1 "Keeping the promise: a forward-looking review to promote an agreed action agenda to achieve the Millennium Development Goals by 2015", Report of the Secretary-General, 12 February 2010, A/64/665.

2 Ibid.

3 ITU World Telecommunication/ICT Indicators database.

4 See African Union Declaration (Doc. Assembly/AU/11 (XIV)) adopted by the Fourteenth Ordinary Session of the Assembly in Addis Ababa, Ethiopia on 2 February 2010.

5 "Keeping the promise: a forward-looking review to promote an agreed action agenda to achieve the Millennium Development Goals by 2015", Report of the Secretary-General, 12 February 2010, A/64/665.

6 See http://www.globalissues.org/article/26/poverty-facts-and-stats.

7 For micro-enterprises, this type of information is likely to be gained predominantly by building and extending the socio-political capital that facilitate access to (predominantly local) socio-economic networks.

8 The first role concerns information for short-term decision-making. The second is for longer-term capacity-building, through education, training and technical support, such as has been traditionally provided through government-run extension services. To this could be added information for enhancing the long-term rights and entitlements of the poor (their social/political capital) in areas such as health, education, participation and empowerment.

9 First use of communication for development can be traced further back, to radio stations in Latin America and South Asia in the 1940s broadcasting with the intention of assisting rural development (Manyozo, 2006).

10 Research from sub-Saharan Africa shows that new enterprises play an important role in employment creation indicating that 15–25 per cent of any given cohort of enterprises will have started up within the previous year (Liedholm and Mead, 2002). However, most enterprises fail to grow (defined in terms of increased turnover and/or growth in number of employees). Overall, after a 10-year period, only 1 per cent of all newly established enterprises had more than 10 workers.

11 Subsistence-based enterprise can also be understood as survivalist enterprise (Shaw, 2004) – those who have no choice but to take up income-generating activity because they have no other source of livelihood. Income may be poverty-line or even sub-poverty-line. Most "entrepreneurs" of this type have been described as "supply-driven": forced into enterprise by push factors related to their poverty and lack of opportunity (Mead, 1994).

12 One reported impact of ICTs and social capital is intensification of existing socio-economic relations, for example using mobiles or email messages (e.g. Molony, 2007; Donner, 2007a).

13 See also Heeks and Kanashiro (2009) on the "information impact chain".

2 TRENDS IN CONNECTIVITY AND AFFORDABILITY

In order to assess the scope for ICTs in the enterprise sector to contribute to reducing poverty, a natural starting point is to consider the extent to which enterprises have access to different ICTs. The analysis in this chapter shows that the connectivity situation for different technologies varies greatly by country. In addition, the cost of using different ICTs also varies, with obvious implications for enterprise use. With a view to providing a basis for the subsequent analysis, this chapter reviews recent developments with regard to the diffusion of fixed and mobile telephony, PCs, the Internet, fixed and mobile broadband, and radio. The chapter draws on data related to ICT use by enterprises and, where such information is lacking, on infrastructure and household penetration data. Special attention is given to developments in LDCs and other developing countries with a high incidence of poverty.

A. TRENDS IN ICT DIFFUSION

The majority of developing countries are seeking to extend connectivity throughout their nations, including in rural and underserved areas. Policymakers are considering various technologies, depending on different economic and geographic contexts. This section shows that wireless technologies are the most widespread connectivity solution in low-income countries, due to lower costs compared to fixed networks, convenience and growing functionality. Due to a lack of information related specifically to ICT use by enterprises in low-income countries, this chapter relies significantly on infrastructure and household penetration data to gauge connectivity levels. Ongoing work in the context of the *Partnership on Measuring ICT for Development* is seeking to improve the availability of comparable ICT statistics (box II.1).

1. Telephony: mobile connectivity dominates in poor regions

Growth of telephone networks has greatly improved accessibility to voice communications around the world. Whether through personal subscription of a mobile phone, household and community sharing or public access, most people are now able to use telephones. For example, data from selected countries in South and South-East Asia indicate that, by mid-2006, more than 95 per cent of those surveyed had used a telephone in the previous three months (Zainudeen et al., 2007).[1] Even in mountainous Bhutan, an LDC with some of the most challenging geographical circumstances in the world, there has been dramatic improvement in connectivity. In 2007, more than four fifths of Bhutanese households were able to reach a telephone within one hour, either through home telephone ownership or a public facility. Four years earlier, only 39 per cent enjoyed such access.[2] Growth has mainly been noted for mobile subscriptions. Such developments have radically improved the chances of telephony making a difference as a business tool in poor economies.

a. Few of the poor rely on fixed telephony

Fixed-line telephone subscriptions continue to stagnate. At the end of 2009, there were 1.2 billion fixed telephone lines around the world for an average

Box II.1. UNCTAD and the Partnership on Measuring ICT for Development

UNCTAD is a member of the Steering Committee of the multi-stakeholder *Partnership on Measuring ICT for Development*.[a] A key achievement of the Partnership is its list of core ICT indicators for the production of internationally comparable statistics. The collaboration between partner agencies ensures that there is no duplication of work and that resources are utilized efficiently. The main objectives of the Partnership are to (a) facilitate agreement on internationally comparable ICT indicators and develop methodologies to collect these indicators; (b) assist in building statistical capacity in developing economies for the production of ICT statistics; and (c) set up a global database on ICT indicators.

UNCTAD is responsible for indicators related to the use of ICT by businesses and to the ICT sector.[b] Since 2006, UNCTAD conducts an annual survey of statistics related to these areas. Until February 2010, UNCTAD's Information Economy Database covered a total of 68 economies (of which 36 developing) which had provided data on up to 14 core ICT indicators covering some of the years between 2003 and 2008.

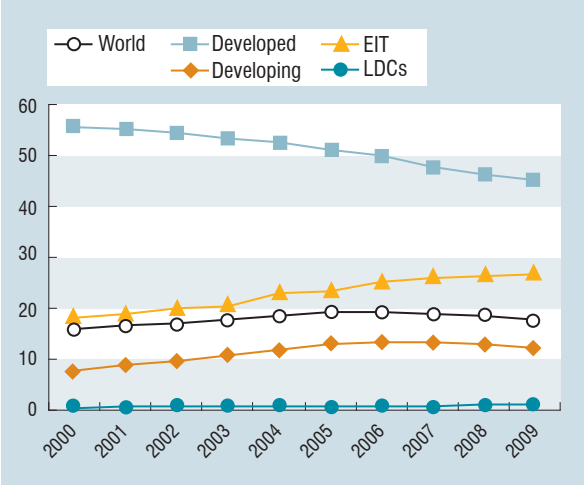
There is a great need for more capacity-building in this area. For example, only one LDC (Lesotho) has so far reported data to UNCTAD on indicators related to the use of ICTs by enterprises. With a view to achieve broader availability of ICT data, UNCTAD provides related technical assistance and training. More information can be obtained from http://measuring-ict.unctad.org.

Source: UNCTAD.

[a] *In 2010, partners included the International Telecommunication Union (ITU); the Organization for Economic Cooperation and Development (OECD); UNCTAD; the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics (UIS); United Nations regional commissions (the Economic Commission for Latin America (ECLAC), the United Nations Economic and Social Commission for Western Africa (UN-ESCWA), the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and the United Nations Economic Commission for Africa (UNECA)); the United Nations Department of Economic and Social Affairs (DESA); the World Bank and Eurostat. The Partnership Steering Committee is composed of ECLAC, ITU and UNCTAD.*

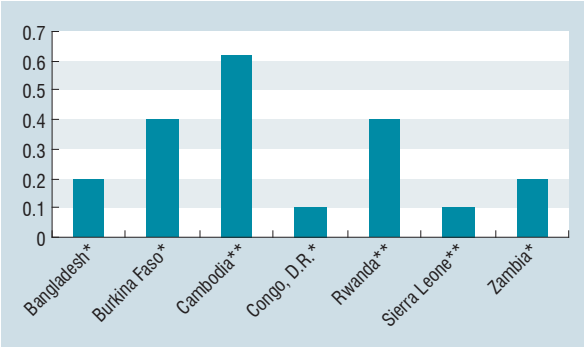
[b] *ITU is responsible for the core indicators on ICT infrastructure, ICT access and use by households and individuals; the UIS is responsible for those on ICT in education; and the regional commissions, DESA and other regional organizations are developing core indicators on e-government.*

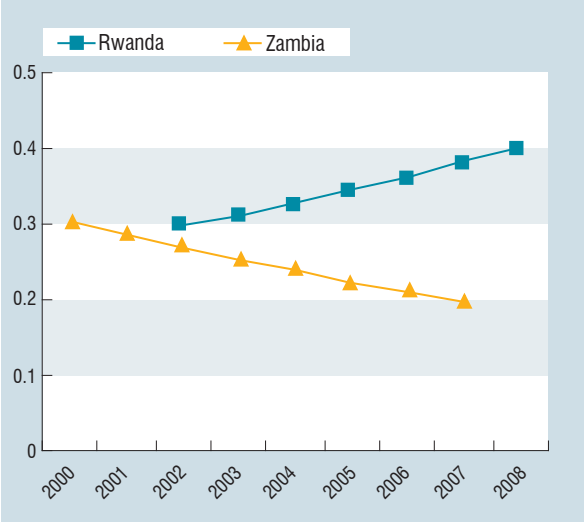
Figure II.1. Fixed telephone subscriptions per 100 inhabitants by country group, 2000-2009



Source: ITU.

Figure II.2 Rural households with fixed telephone lines, selected LDCs, various years (%)





Source: ITU and national sources.

Note: In the bottom chart, figures between survey years have been estimated by the inter-survey growth rate.

**Data for 2007 **Data for 2008.*

penetration of some 18 subscriptions per 100 inhabitants (figure II.1). Fixed telephone lines are decreasing in a number of countries. In developed countries, users are disconnecting conventional fixed-line voice telephony subscriptions to switch to mobile and voice over broadband connections. In developing countries, limited fixed line access infrastructure, particularly in rural areas, and a preference for mobile reduce the demand for fixed telephone subscriptions. Growth in developing countries has recently been attributable mainly to fixed wireless solutions.[3]

Among LDCs, fixed telephone line penetration was on average just 1 per 100 inhabitants in 2009. Although the number of fixed lines in LDCs has more than doubled since 2000, penetration is so low that it is not contributing to wide-scale connectivity. Furthermore, much of the growth has come from fixed wireless rather than traditional copper-wire telephone lines. In some LDCs, fixed-line telephony is practically non-existent[4] and penetration of fixed telephone lines in rural areas is negligible. Generally, less than 1 per cent of rural households in LDCs has a fixed telephone line (figure II.2, top), and there has been scarce improvement over the past decade. For example, in Rwanda, the share of rural households with a telephone line increased from 0.3 per cent to 0.4 per cent, while in Zambia it declined from 0.2 per cent to 0.1 per cent (figure II.2, bottom).

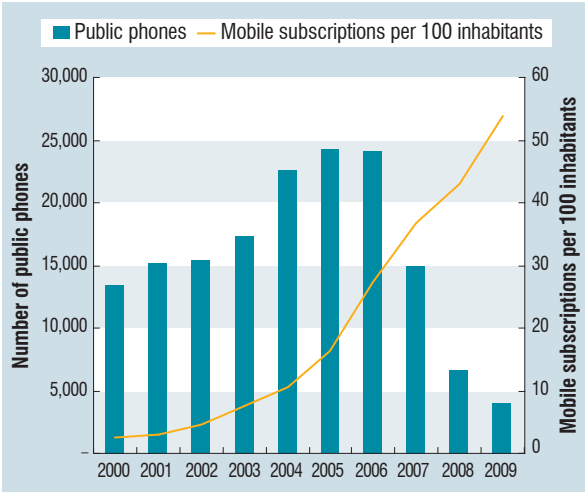
People in low-income countries that lack home access to fixed telephone lines often make use of public phones (table II.1). Mobile users also utilize public phones, especially when they offer cheaper tariffs for calls to other mobile networks. In some countries, there is in fact higher usage of public calling facilities by those with mobile phones. This is typically due to lower off-net prices from a public phone, reflecting large price differences between on-net and off-net calls. While a number of developing countries have adopted pro-public telephone policies by facilitating formalities such as waiving license requirements, when mobile phone penetration reaches a certain level, the demand for public phones is often reduced. In Senegal, for example, the number of public phones has plummeted since 2006, whereas mobile subscriptions have skyrocketed (figure II.3). This development is indicative of the growing importance of mobile telephones for individuals as well as enterprises in low-income economies.

Table II.1. Public phone access and usage, selected African countries, 2007/08

Country	Share of 16+ having used public phones			Public phone use in the last three months			Average monthly public phone expenditure in $
	All (%)	With mobile phone (%)	Without mobile phone (%)	Calling fixed-line phone (%)	Calling mobile phone(%)	International calls (%)	
Benin	16.1	22.9	13.2	78.4	86.6	9.7	1.41
Botswana	27.4	22.4	34.7	38.8	97.8	2.0	1.85
Burkina Faso	29.0	39.7	24.9	74.7	72.6	15.2	1.76
Cameroon	44.1	57.5	36.4	8.6	96.6	4.8	2.47
Côte d'Ivoire	0.8	1.5	0.2	45.2	34.0	35.7	4.92
Ethiopia	14.7	20.9	14.5	96.4	29.4	0.0	0.43
Ghana	6.0	3.5	9.7	25.6	66.4	8.9	2.54
Kenya	24.1	14.8	34.2	24.6	92.4	0.3	1.38
Mozambique	2.7	3.8	2.4	28.1	91.6	4.5	8.06
Namibia	14.5	16.2	12.9	77.5	64.9	7.1	3.02
Rwanda	73.0	43.5	76.2	6.9	98.0	0.3	1.16
Senegal	68.9	74.2	65.4	69.8	61.8	8.3	1.64
South Africa	42.2	41.1	43.8	46.3	88.3	6.7	3.24
United Republic of Tanzania	97.3	96.3	97.6	22.7	70.7	0.0	1.00
Uganda	39.5	42.1	38.9	24.4	96.6	0.7	1.48

Source: Gillwald and Stork, 2008.

Figure II.3. Public phones and mobile penetration in Senegal, 2000-2009



Source: Agence de Régulation des Télécommunications et des Postes.

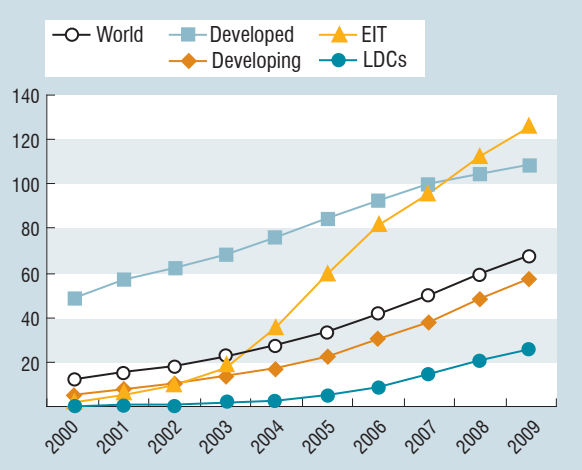
b. Mobile connectivity continues to spread

The rapid diffusion of mobile phones continues to transform the ICT landscape. It is deepening its reach by continually extending access for users also at the bottom of the economic pyramid, creating new opportunities for ICTs in the enterprise sector to contribute to development and to reduce poverty. The use of mobiles for more than voice offers the possibility of a range of mobile applications—from text messaging to financial transactions. Increased ubiquity of mobiles is changing the affordability and access equation for both agricultural and non-agricultural small enterprises (Donner, 2009a).

Average global mobile subscription penetration was estimated at 68 per cent at the end of 2009, up from 60 per cent the year before (figure II.4). It is anticipated that the total number of mobile subscriptions will reach 5 billion in the course of 2010 (ITU, 2010a). Penetration in both developed and transition economies exceed 100 per cent while in developing countries it stood at 58 per cent. In the LDCs, there are now more than 25 mobile subscriptions per 100 inhabitants.

While mobile access is clearly improving, penetration data should be carefully interpreted. They refer to subscriptions and not individual use. They overstate true penetration due to lapsed and duplicate subscriptions. In Benin, for example, multiple SIM card penetration has been observed to be as high as 36 per cent (Gillwald and Stork, 2008). Others estimate that actual mobile *ownership* may be around three

Figure II.4. Mobile cellular subscriptions per 100 inhabitants by country group, 2000–2009

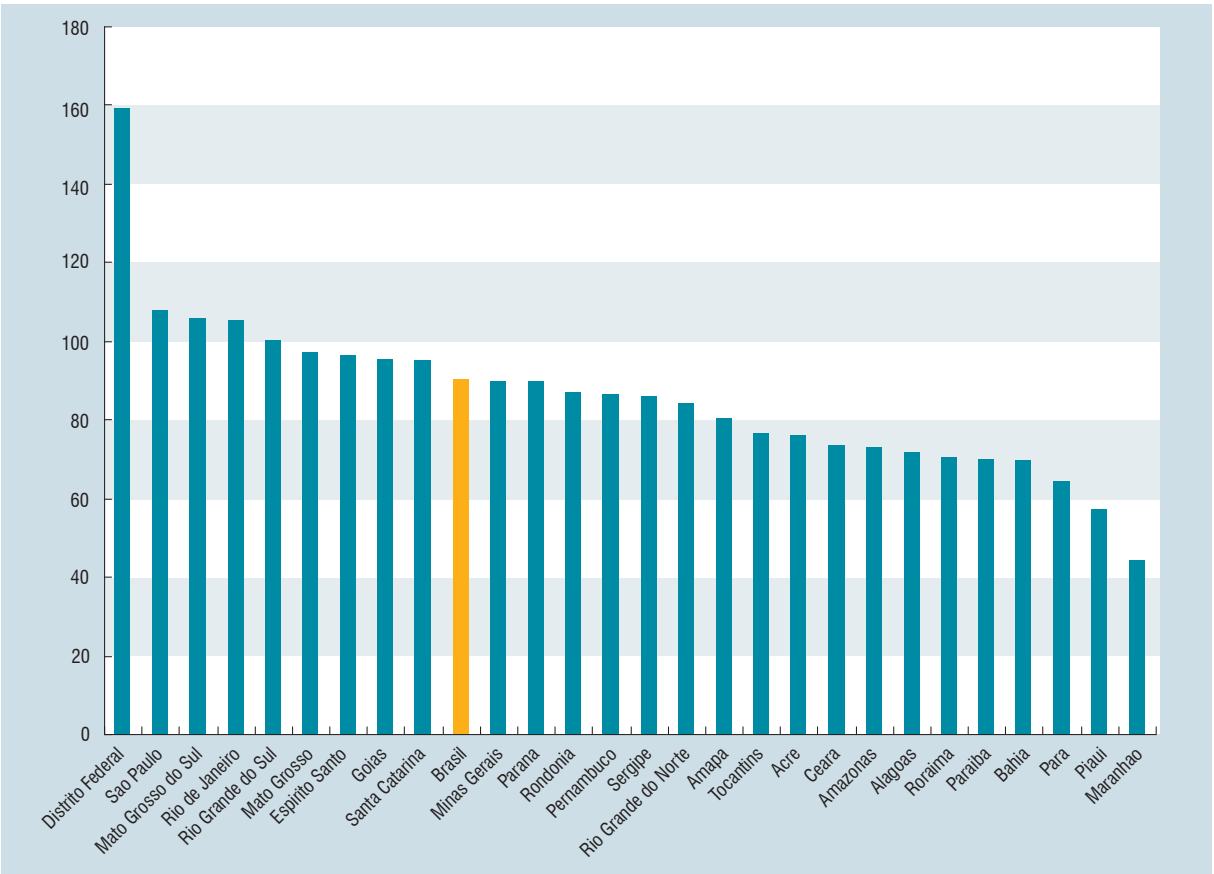


Source: ITU World Telecommunication/ICT Indicators database. See also annex table II.1.

quarters of the subscription rates, but that mobile *usage* might in turn be twice that figure (due to shared usage of mobiles) (Heeks, 2009a). Few countries currently report official data on mobile phone usage. However, among developing economies that do, the proportion of mobile users ranges between 1 per cent (Cuba) and 99 per cent (Bahrain) (ITU, 2010b). National averages can disguise significant in-country variation. In Brazil, for example, while average mobile penetration was about 90 subscriptions per 100 inhabitants in 2009, the situation in different provinces ranged from 44 (Maranhao) to 159 (Distrito Federal) subscriptions per 100 people (figure II.5).

Notwithstanding such caveats, the fact that people in poor regions are gaining better access to mobile communications is confirmed in household surveys (ITU, 2010b). Average household penetration rates in selected LDCs range from just over 10 to 43 per cent; in most instances, more than half of urban households had a mobile phone (table II.2). Rural penetration is also rising, but it is still very low in several African LDCs. In rural areas, increased access to mobile phones and associated applications and

Figure II.5. Mobile cellular subscriptions per 100 inhabitants in Brazil, by province, 2009



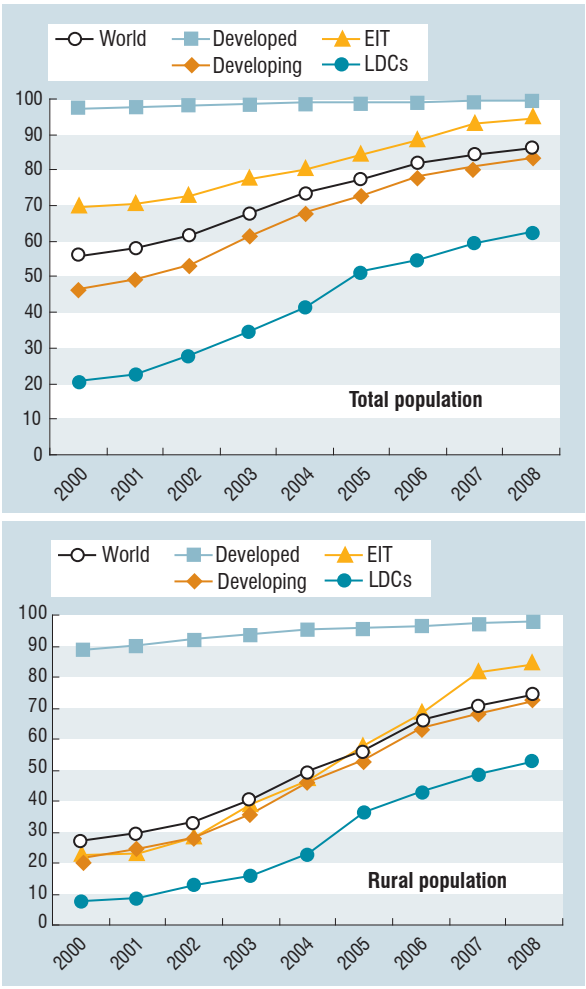
Source: Adapted from ANATEL data.

Table II.2. Households with mobile phones, selected LDCs, 2007–2008 (%)

Country	Year	Share of households with mobile phones (%)		
		Total	Urban	Rural
Bangladesh	2007	31.7	54.7	25.3
Burkina Faso	2007	21.6	63.6	10.2
Cambodia	2008	37.4	76.2	28.8
Democratic Rep. of Congo	2007	20.8	46.9	3.5
Liberia	2007	43.2	69.0	20.7
Rwanda	2008	13.1	42.4	7.7
Sierra Leone	2008	28.1	63.5	9.9
United Republic of Tanzania	2008	28.1	61.4	17.1

Source: ITU and national sources.

Figure II.6. Population covered by a mobile signal, overall and in rural areas, by country group, 2000-2008 (%)



Source: Adapted from ITU, 2010b.

services may have a greater impact on poverty since rural populations typically did not have access to fixed telephony before.

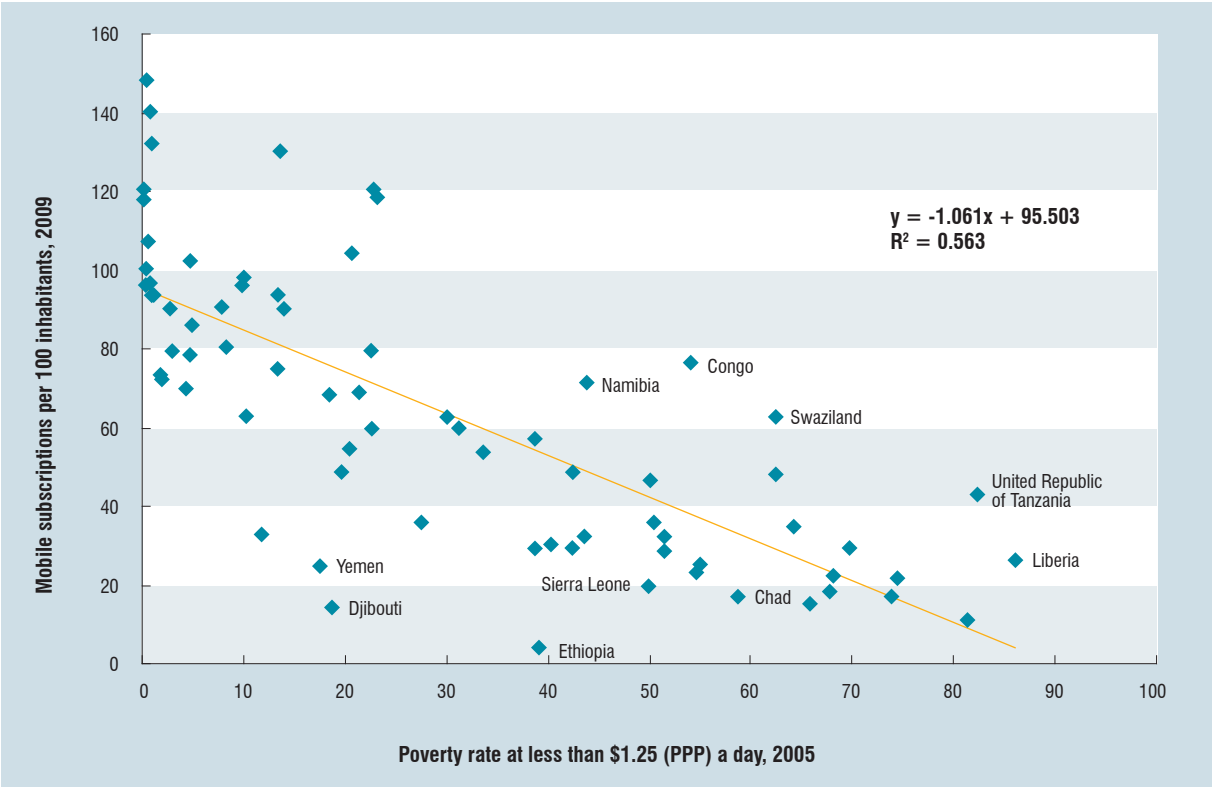
One of the main constraints to higher mobile penetration is service availability. Mobile signal coverage – defined as the share of the population that is within range of a mobile network base station – continues to increase and stood at 86 per cent of the world's inhabitants in 2008, up from just over half of the world in 2000 (figure II.6, top). During this period, rural population coverage grew markedly, from just over 25 per cent of rural dwellers to almost 75 per cent. Despite such improvements, there is still room for further expansion of mobile coverage in the poorest countries, especially in rural areas. At the end of 2008, almost half of the rural population in the LDCs had no access to a mobile signal (figure II.6, bottom).

Mobile penetration is inversely related to poverty rates (figure II.7). However, within the group of LDCs, the link is tenuous. In some countries, mobile penetration is well below what would be predicted by their rate of poverty (e.g. Chad, Djibouti and Ethiopia). Monopoly or duopoly mobile markets characterize a number of countries that are underperforming. The lack of competition generally results in higher prices and less widespread coverage, in turn inhibiting demand. Thus, LDCs with higher-than-expected mobile penetration rates tend to have competitive mobile markets (e.g. Liberia and the United Republic of Tanzania). Here, mobiles are likely extending to those defined as living in poverty.[5]

c. The emergence of new mobile applications

Improved mobile connectivity has triggered growth of non-voice applications and services, including text and picture messaging, Internet access (section A.3), mobile-money and micro-insurance services (see chapter IV). These applications are also spreading to developing countries. For example, a recent study found that some 63 per cent of mobile users in Kenya use their phones to send and receive text messages (i.e. SMS), and 23 per cent conducted financial transactions.[6] SMS is widely used in many developing countries, particularly where voice telephone calls are relatively expensive and when it is cheaper to send an SMS than to call. In Ghana, 85 per cent of mobile users sent text messages, while in the Philippines, mobile users sent an astounding 20 SMS on average every day (table II.3). For low-income users, SMS and "missed calls" have emerged as ways to keep

Figure II.7. Relation between mobile penetration in 2009 and poverty rates in 2005, selected countries



Source: UNCTAD, based on data from ITU and the World Bank.

communication costs down. Such options do not exist in the case of public phone use.

In addition to social texts exchanged with family and friends, a multitude of value added SMS services are available. From financial transactions in the Philippines,[7] to election monitoring in Ghana and Kenya,[8] "agro-messages" in Peru,[9] or earthquake relief in Haiti,[10] SMS is serving as a substitute for e-mail to provide beneficial applications for the poor. Text messaging is a technically relevant solution in many developing countries where Internet access is limited. Barriers to SMS adoption include a lack of knowledge about how to use the service (Galperin and Mariscal, 2007), limited texting support for native languages and alphabets, and low levels of literacy (Bowen, 2010). SMS also has weaknesses including being costly in some places, constraining (e.g. limited to 160 characters), not always reliable (and therefore not ideal for financial transactions) and expensive on a per-bit basis.

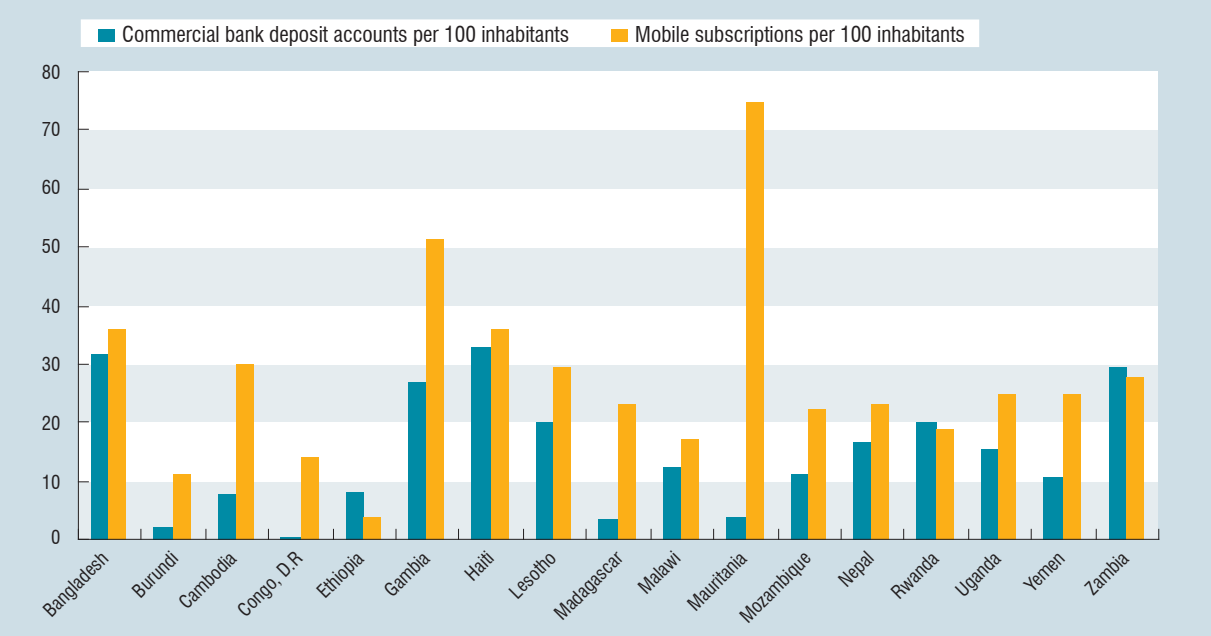
Mobile-money is increasingly filling a void for those without a bank account in the developing world. For those with bank accounts, mobile-money is just a convenience; for the many millions unbanked, it could be much more (Donner, 2009a). The Consultative Group to Assist the Poor (CGAP) estimated that there are around 4 billion unbanked around the world and

Table II.3. Text messaging use in selected countries, various years

Country	Proportion of mobile users who use SMS (%)	SMS per user per month	Note/source
Bangladesh (2008)	-	15	Grameen-phone
Colombia (2007)	44		DIRSI
Ghana (2009)	85	-	Audience-Scapes
Kenya (2009)	63	16	Audience-Scapes, CCK
Mexico	53 (2007)	55 (2009)	DIRSI, COFETEL
Peru	45 (2007)	11 (2009)	DIRSI, OSIPTEL
Philippines (2009)	-	609	PLDT

Source: As listed in the last column of the table.

Figure II.8. Mobile subscriptions and bank accounts per 100 inhabitants, selected LDCs, 2009



Source: Adapted from ITU and CGAP data.

that 1 billion people who do not have a bank account have a mobile phone, a figure set to grow to 1.7 billion by 2010 (Pickens, 2009). CGAP forecasts that 364 million low-income, unbanked people will use some financial service from their mobiles in the next three years. This is of potentially great importance for small entrepreneurs that are operating in urban or rural locations with limited banking services (chapter IV).

As of March 2010, there were 61 known mobile-money services in 35 countries,[11] of which 21 services in 13 LDCs.[12] Many low-income economies are under-banked; for almost all of these, existing data show a higher rate of penetration for mobile telephony than for commercial bank accounts (figure II.8). Somalia is an LDC where mobile-money services are already proving popular. Few people have bank accounts and most transactions are cash-based. With the three largest mobile operators serving 1.8 million subscriptions (20 per cent of the population) in November 2009,[13] mobile-money is becoming a reality for a growing number of Somalis.

Two of the biggest mobile-money services are offered in Kenya and the Philippines. In March 2007, Kenyan operator Safaricom launched the M-PESA service, which supports credits and payments on mobile phones. It is already used by some 9 million subscribers (corresponding to 40 per cent of Kenya's adult population) and processes more transactions domestically than Western Union does globally (Mas and Radcliffe, 2010). In April 2010, Safaricom reported having some 18,103 M-PESA agents across the country who process registrations and cashing in and out.[14]

The Philippines is a pioneer in mobile-money with telecommunications operators Smart launching *Smart Money* in 2001 and Globe launching GCash in 2004. Users can perform mobile-money transfers including remittances, pay bills and purchase goods and services. With some three out of four Filipinos without traditional banking services (Demirgüç-Kunt et al., 2008), mobile-money has stepped in to fill the void with 10 million subscriptions in 2008.[15] Around half of mobile-money users in the Philippines do not have traditional banking services and almost one in four live below the poverty line (annex table I.1); some 90 per cent of the users reportedly feel safe using the service (Pickens, 2009). One barrier has been limited distribution outlets to process cash transactions from mobile-money accounts. This is set to expand dramatically with the country's Central Bank giving approval in 2010 for mobile-money transactions to be processed through a wider number of outlets.

In the case of GCash, this covers some 18,000 outlets including "sari-sari stores, pharmacies, Internet cafes, food establishments, rice dealers, farm and poultry stores, gas stations, and multi-purpose cooperatives..."[16]

The attractiveness of mobile-money was illustrated in a comparison of the cost of using such services with that of using either formal banks or informal services (McKay and Pickens, 2010).[17] Analysing 16 different schemes, the study concluded that mobile-money services were on average 19 per cent cheaper than formal banks. Moreover, the lower the transaction value, the cheaper mobile services were. For example, at a transactional value of $23, they were on average 38 per cent cheaper than commercial banks. Mobile-money transfers were as much as 54 per cent less expensive than informal options. Mobile-money has also been credited with reducing the risk of theft since users do not have to walk around with large sums of cash.[18]

2. Access to personal computers

A PC – desktop, laptop or notebook computer – is an essential tool in order to use information technology software applications. It is potentially important to boost efficiency but not for all enterprises. The PC is also an important device for accessing the Internet. Though the Internet can be accessed from suitably equipped mobile phones, it is a different experience to do so from a PC. Furthermore, the applications on a PC are more full-fledged than those available on a mobile handset. Knowing how to use a PC is thus an essential ICT skill, while electricity, literacy, language and content aspects are other important prerequisites for enterprises in poor regions to benefit from PCs.

In 2009, there were an estimated 1.3 billion PCs around the world.[19] There is scant information on the stock of PCs in different countries. Most countries do not compile data on the stock of PCs, and when such data are available, they are often unreliable. Per capita PC penetration is not among the core ICT indicators identified by the *Partnership on Measuring ICT for Development* (box II.1). However, some indicators measure the use of computers by households and enterprises (Partnership on Measuring ICT for Development, 2010). Although a growing number of developing countries are reporting such information, availability remains relatively limited.

PC penetration varies widely. In developed countries, 7 out of 10 households on average had a computer in 2008.[20] At the other end of the spectrum, many developing countries report low home PC penetration rates. In Mexico, for example, only slightly over a quarter of households had a PC in 2009, with cost the biggest barrier to ownership.[21] In low-income countries, penetration levels are often extremely low and typically negligible in rural areas (table II.4). The cost of a PC relative to income, lack of electricity, limited awareness and illiteracy all hamper PC penetration.

Table II.4. Households with a PC, selected LDCs, 2007 (%)

Country	Total	Urban	Rural
Bhutan	4.7	11.6	1.8
Burkina Faso	1.6	6.3	0.3
Cambodia (2008)	3.7	15.8	1.0
Liberia (2009)	1.0	2.1	0.1

Source: ITU and national sources.

In high-income economies, computer penetration in the enterprise sector is more or less ubiquitous (annex table II.2). However, in developing countries the share of firms that use at least one computer for business purposes remains relatively low, especially among smaller companies. Among countries for which data are available, the largest gap exists between medium and large enterprises, on the one hand, and small and micro-enterprises, on the other. With few exceptions, large enterprises generally show usage levels of close to 100 per cent, even in LDCs.[22] In the case of micro-enterprises, by contrast, the penetration ratio varies from 6 per cent in Egypt to 86 per cent in Cuba. For small enterprises, the corresponding range was between 37 per cent in Azerbaijan and 96 per cent in Croatia (annex table II.2).

Only a few countries report data on computer use by enterprises in rural and urban areas, respectively (table II.5). In some countries, the levels of use are relatively similar in rural and urban areas. By contrast, in Azerbaijan, Egypt and Kazakhstan, rurally based enterprises have much lower levels of computer use than those in urban regions. Computers may well grow in importance in developing countries, especially for growth-oriented enterprises (chapter IV). As noted by one observer (Donner, 2009a: 11):

> *"While smartphones, netbooks, laptops and PCs are not currently affordable by many small farmers or micro-enterprises, they can be shared by*

collectives, or carried from site to site by extension workers, or subsidized by downstream wholesalers (or upstream suppliers) who seek better integration with transaction partners."

Table II.5. Enterprises using computers, by urban and rural location, selected countries, latest year (%)

Country	Year	Urban	Rural
Azerbaijan[a,b]	2007	26.1	5.6
Cuba	2007	95.0	87.5
Egypt[c]	2008	47.3	18.5
India[d]	2004	56.4	45.0
Kazakhstan[e]	2008	78.3	50.3
Kyrgyzstan[a]	2007	78.4	83.2
Mexico	2003	13.8	13.6
Mongolia[f]	2006	38.9	34.4

Source: UNCTAD Information Economy Database.

Notes: Definitions of rural and urban areas differ and can refer to other administrative criteria besides the size of localities.
a. Includes ISIC Rev. 3.1 Section L, "Public administration and defence, compulsory social security".
b. Excludes ISIC Rev. 3.1 Sector A, "Agriculture, hunting and forestry" and trade micro-enterprises.
c. Data refer to the sample and have not been extrapolated to the target population.
d. Includes only ISIC Rev.3.1 Section D, "Manufacturing".
e. Data do not include enterprises with less than 10 employees.
f. Data refer to establishments.

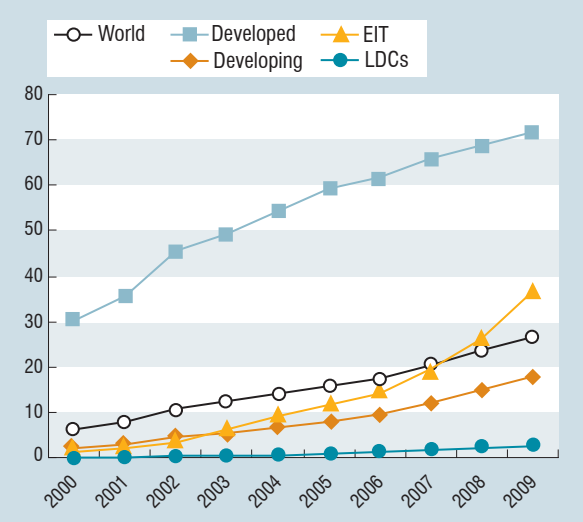
3. Internet use is growing from a low level

Internet use is an essential tool for small, medium and large enterprises that need information to build up their business, a quick and efficient way to stay in touch with suppliers and customers and who want to increase their productivity. According to ITU data, at the end of 2009, there were an estimated 1.8 billion Internet users globally, or just over a quarter of the world's population (figure II.9). In developed countries, the share of Internet users in 2009 accounted for 72 per cent of the population. In developing countries, only 18 per cent of the population used the Internet. In LDCs, the rate was just 2.4 per 100 inhabitants.

Countries with the highest incidence of poverty generally have few Internet users (figure II.10). Low levels of fixed telecommunication, electrification and PC ownership in low-income countries seriously inhibit Internet access and use. In addition, Internet access is generally relatively costly (section B). Furthermore, unlike voice communications or broadcasting, the Internet has skill prerequisites (notably literacy) for its use that many of the poor do not possess.

Indeed, lack of awareness and skills are arguably bigger barriers than costs. In India, for example, a 2008 survey found that the top barrier (mentioned by almost half of the respondents) to Internet use among non-users was lack of awareness. Cost-related factors were mentioned by only 17 per cent.[23] A survey of African countries – taking a cross-section of households rather than a specific focus on poor communities – concluded that, in relation to the Internet "disturbingly few people know what the Internet is and even fewer are using it" (Gillwald and Stork, 2008: 25). In the bottom three income quartiles, only an average of 19 per cent of people older than 16 knew what the Internet was and only 4 per cent were users. In a study of low-income ICT users in Asian economies, the share of respondents using the Internet was less than 1 per cent in Bangladesh and India.[24]

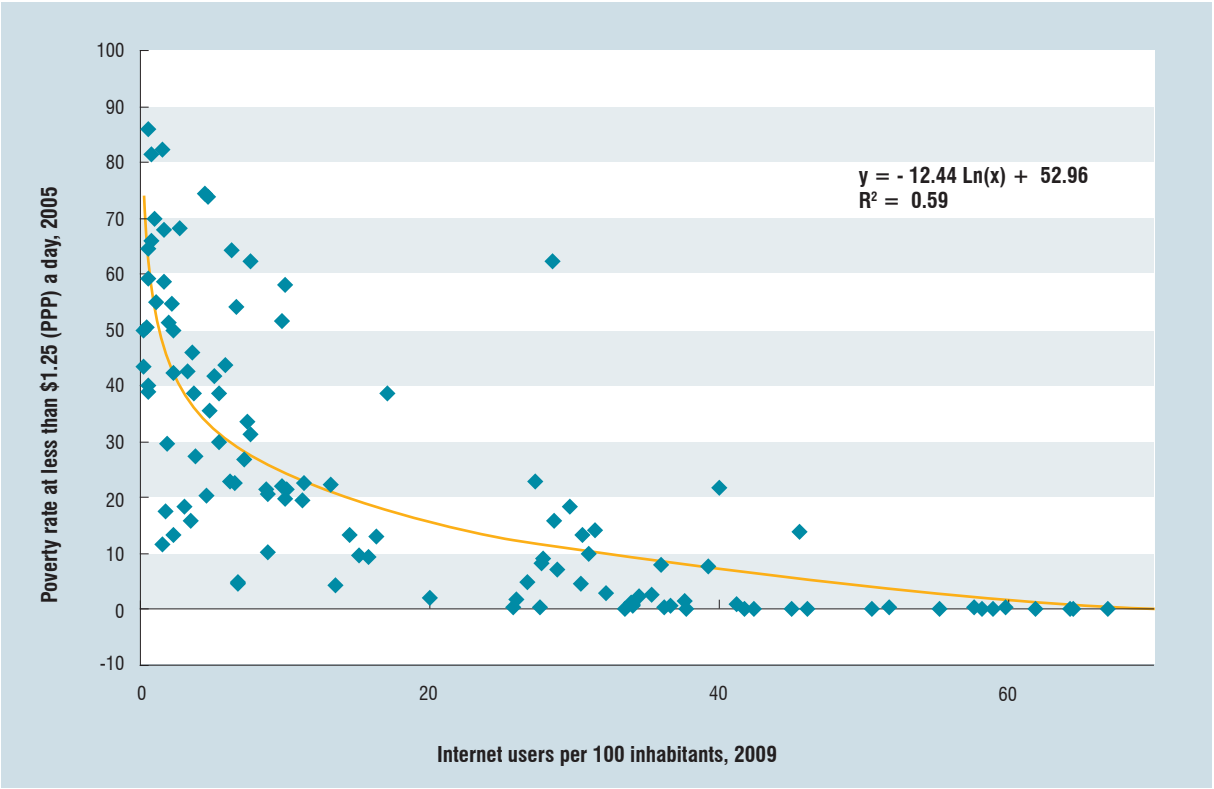
Figure II.9. Internet users per 100 inhabitants, by country group, 2000-2009



Source: ITU World Telecommunication/ICT Indicators database. See also annex table II.1.

Data compiled by UNCTAD show that the extent to which enterprises of different sizes have a web presence and make use of the Internet varies considerably by country (annex table II.4). Among developing and transition economies, few micro-enterprises benefit directly from the Internet. For example, in Azerbaijan, Egypt, Jordan, Lesotho and Mexico, less than 1 in 10 micro-enterprises has access to the Internet. In the same countries, the proportion of micro-enterprises with a web presence was below 4 per cent (figure II.11). Among larger enterprises, usage levels are generally much higher, although considerable variation remains across countries (figure II.12).

Figure II.10. Relation between Internet penetration in 2009 and poverty rates in 2005, selected countries



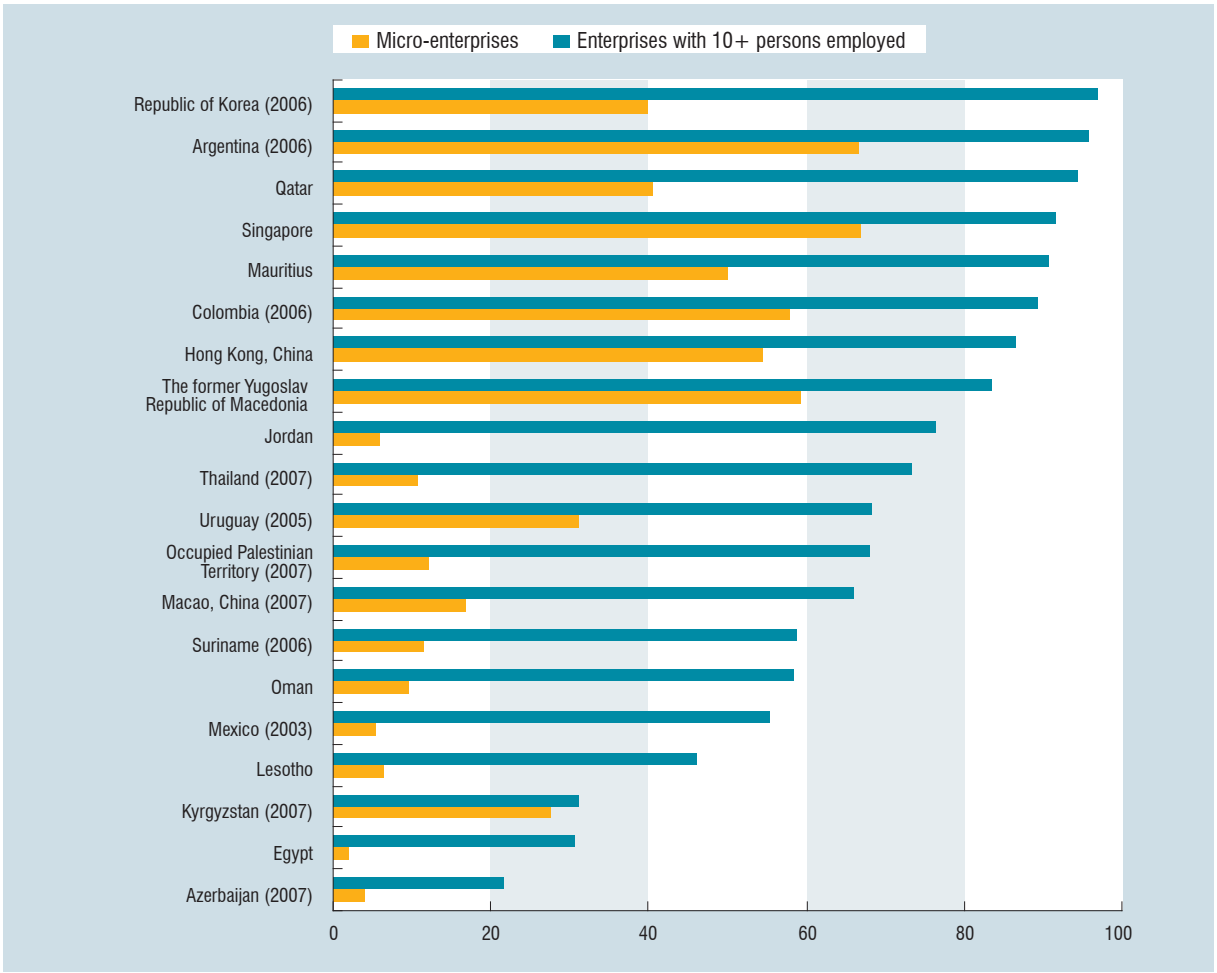
Source: UNCTAD, based on data from ITU and the World Bank.

In most developing countries, users are getting around high costs of individual Internet access through utilization of collective access centres such as Internet cafes. In many African countries, for example, well over half of all Internet users access the web from a cyber cafe, an educational institution or a library (Gillwald and Stork, 2008). Although public access points are a primary source of access for poor and rural users, government-sponsored telecentre facilities have often been criticized as being unsustainable (UNCTAD, 2006).[25] Moreover, Internet cafes in rural areas of low-income countries tend to be utilized by the educated and speakers of major languages rather than the illiterate and unskilled.[26] In China, for example, rural Internet users are mostly young and male, and over 90 per cent have at least a junior high school education.[27]

The use of mobile phones to access the Internet – mobile Internet access – is growing rapidly and is becoming pronounced also in developing nations.[28] Eventually it may well become more prevalent there than in developed countries, where other methods of Internet access are widely available. According to Opera, a company that provides a web browser for mobile phones, it had 46 million users in December 2009; 6 of the top 10 countries using its browser were developing countries and another 2 were economies in transition. [29] The number of Opera browser users increased by 159 per cent in 2009 and the number of web page views rose by 223 per cent.

In Asia, the two largest developing-country markets confirm the rapid growth of mobile Internet access. The number of such users in China reached 233 million by December 2009, up 50 per cent in one year (CINIC, 2010). According to official figures, India had 127 million wireless data users in September 2009, up 44 per cent in one year.[30] In Bangladesh, the largest mobile phone operator is also the biggest Internet Service Provider in the country with 1.2 million mobile Internet subscriptions in 2008.[31] Two of the top ten countries are African (Nigeria and South Africa). In East Africa, Internet access via mobile phones far exceeds fixed Internet subscriptions. In Kenya, for example, 99 per cent of its total Internet subscriptions in June 2009 were accessing the Internet from mobile phones (Kenya, Communications Commission of Kenya, 2009), and in Uganda there were more than 10 times

Figure II.11. Enterprises that use the Internet, selected economies, by enterprise size, 2008 unless otherwise indicated (%)



Source: UNCTAD Information Economy Database. For details, see annex table II.3.

as many mobile Internet subscriptions (310,058) in June 2009 than fixed Internet connections (27,590) (Uganda Communications Commission, 2009).

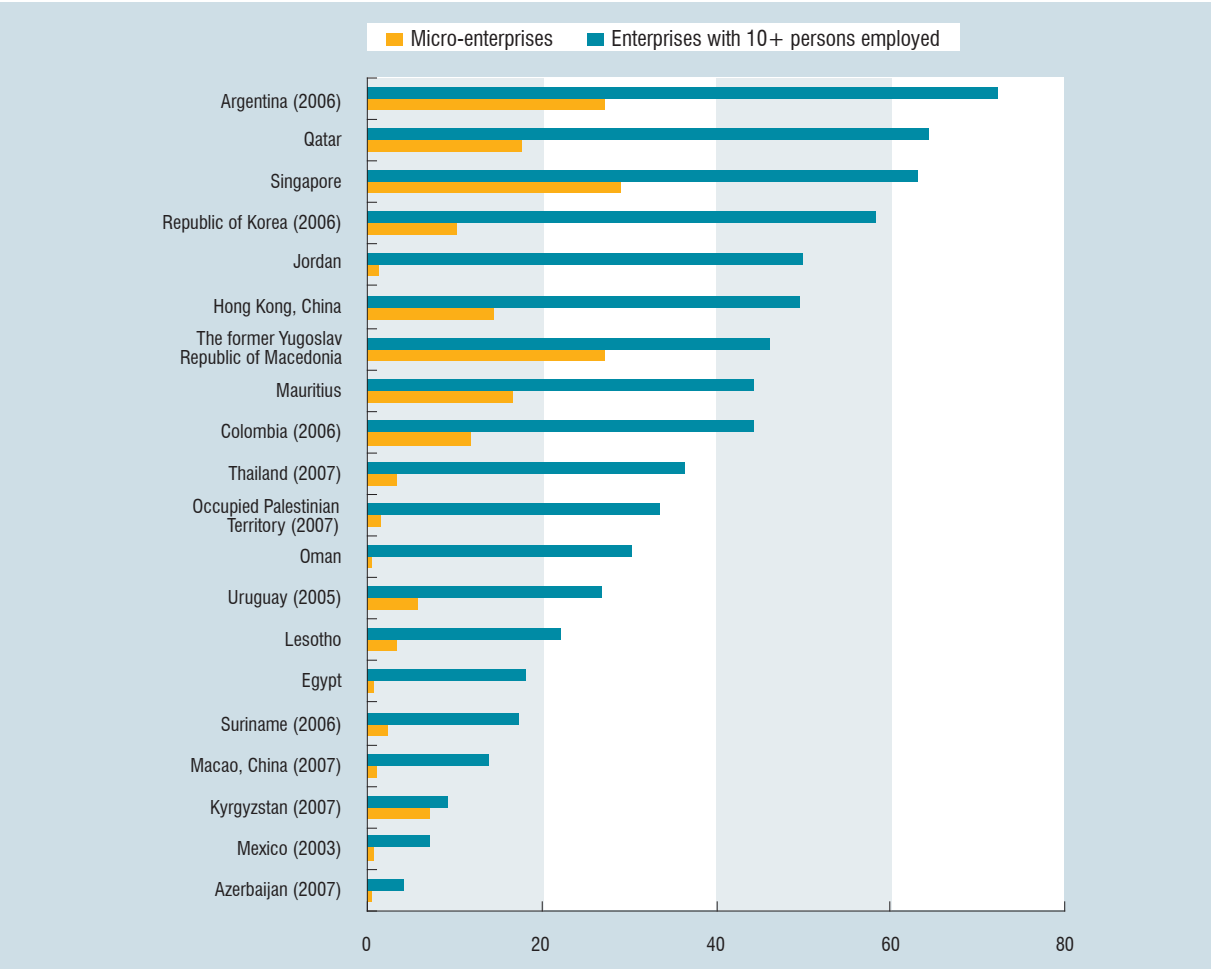
These statistics underscore the potential of mobile phones to transform Internet access in the developing world. While more needs to be done to reduce costs of Internet-enabled handsets and mobile Internet user charges, to amplify the range of services available (i.e. to allow full Internet access) and to expand coverage of high-speed mobile networks, the potential is apparent. With some encouragement, mobile Internet is likely to emerge as a vital transformational tool for the poor and micro-enterprises.

4. Broadband access

The benefits of broadband for social and economic development are well acknowledged.[32] Broadband is important from the perspective of poverty reduction because it provides potential access to employment and business opportunities as well as life-enriching applications in education and health. While some of the benefits of electronic information dissemination can be obtained from narrowband access, the full potential can only be exploited with a broadband connection (e.g. UNCTAD, 2009a).

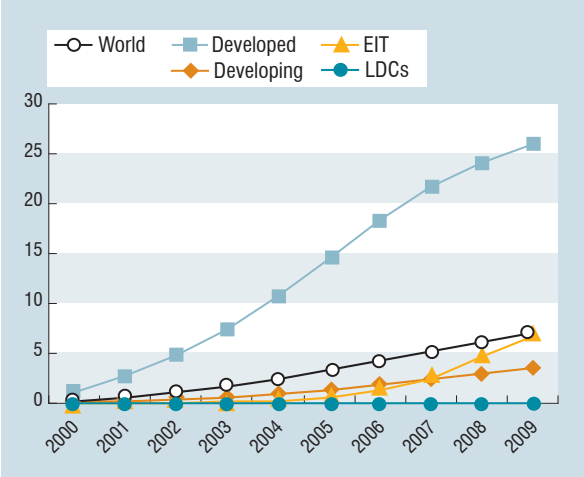
According to ITU, at the end of 2009, there were some 479 million *fixed* broadband subscriptions around the world (ITU, 2010a).[33] Between 2008 and 2009, overall global penetration rose from just 6.1 to 7.0 fixed broadband subscriptions per 100 inhabitants. The gap between developed and developing countries is massive (26 versus 3.5) and in LDCs fixed broadband barely exists; the penetration rate is just 0.04 per 100 inhabitants (figure II.13). In other words, a person in a developed country is on average more

Figure II.12. Enterprises with a website, selected economies, by enterprise size, 2008 unless otherwise indicated, (%)



Source: UNCTAD Information Economy Database. For details, see annex table II.4.

Figure II.13. Fixed broadband subscriptions per 100 inhabitants, by country group, 2000-2009



Source: ITU World Telecommunication/ICT Indicators database. See also annex table II.1.

than 600 times more likely to have access to fixed broadband than someone living in an LDC.

Wireless offers a more practical broadband entry point for developing nations. Installation costs are lower than fixed broadband and for mobile broadband, countries can leverage on existing networks. At the end of 2009, there were 640 million *mobile* broadband subscriptions, corresponding to 9.5 per 100 inhabitants (ITU, 2010a).[34] Penetration rates between developed and developing nations vary tremendously, however. Average penetration in developed countries was almost 13 times higher than in developing ones. According to ITU data, mobile cellular subscriptions with access to data communications at broadband speed in the LDCs was 0.3 per 100 inhabitants in 2009.

Data on mobile broadband subscriptions are plagued by comparability challenges, such as whether

"subscriptions" are *active* or not.[35] International organizations such as OECD and ITU are working on improving data comparability by standardizing mobile broadband definitions to include only active subscriptions (OECD, 2010; ITU, 2010c).[36]

In most countries, mobile broadband take-up is still very low. In the two largest developing countries, China launched the service in 2009 and India auctioned 3G licenses in the second quarter of 2010. At the end of 2009, about a third of the ITU members – almost all developing countries – had yet to launch mobile broadband services (ITU, 2010a). In LDCs, one third (16) had launched mobile broadband networks by the end of 2009.[37] Nonetheless, there are pockets of mobile broadband success in the developing world. For example, in Morocco[38] and South Africa,[39] mobile broadband exceeded fixed broadband subscriptions in 2009. A substantial number of these connections involve data cards and can therefore be seen as a direct substitute for fixed broadband.

The impact of mobile on broadband markets has been significant in some of the LDCs that have launched high-speed wireless networks. In the United Republic of Tanzania, Vodacom launched mobile broadband using HSDPA technology in March 2007. At the end of 2008, there were over 200,000 subscriptions, more than double the number of fixed telephone line subscriptions in that country.[40] The mobile broadband network is also used by Internet cafes in the country extending the benefits of high-speed access to those who cannot afford individual subscriptions.[41]

Mobile broadband has significant potential to reduce the high-speed digital divide, as long as the possible constraint of bandwidth scarcity is addressed.[42] The growth of such networks has been spectacular in developing nations, with one of the main reasons being the relatively low installation costs of wireless networks. For the mobile broadband potential to be fulfilled, low-income countries must license such networks and allocate necessary spectrum, encourage widespread geographic and population coverage using relevant regulatory tools and encourage new market players to widen competition in order to reduce costs (chapter V).

5. Radio access

Traditional communication technologies, such as radio broadcasting, remain potentially important ICT tools as they can help convey important information to enterprises. Though the information flow is one-way, it is inexpensive and it overcomes language barriers. Furthermore, content can be targeted to specific interests such as agricultural advice. Practically all of the world's inhabitants are covered by a radio *signal* (ITU, 2010b).

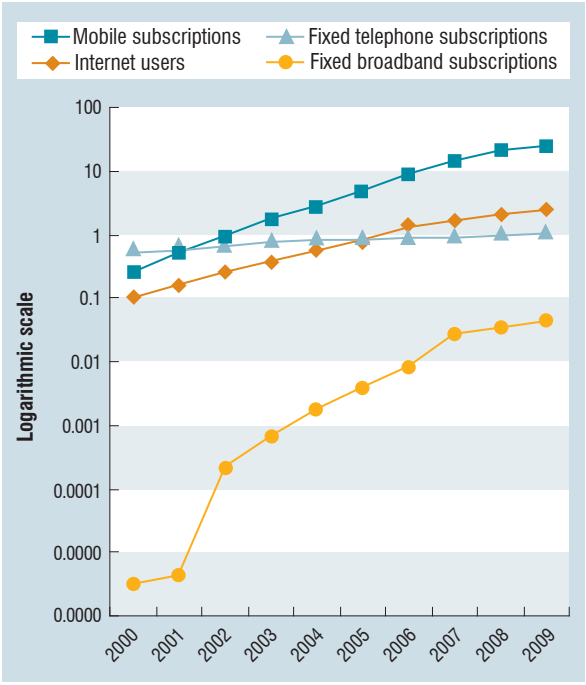
Available data do not allow for a meaningful analysis of radio diffusion. Many developed countries no longer compile such statistics and in developing countries, there are various problems with the interpretation of information collected. According to national survey data, households with a radio declined in both developing Asia–Pacific and Latin America and the Caribbean between 2000 and 2008 (ITU, 2010b). In sub-Saharan Africa, the share of households with a radio rose from just over half in 2000 to 63 per cent in 2008, making it the most widely diffused ICT in that region. Indeed, radio continues to play an important role in many LDCs, particularly in rural areas where electricity is limited.

6. Conclusions

In summary, access to most ICTs continues to grow in poor countries, albeit at different rates depending on the technology (figure II.14). Growth also varies by region and income level. Access to fixed telephone lines in the poorest countries is extremely low and almost negligible in rural areas. By contrast, mobile access deepens each year as networks extend to more of the formerly unreachable. In urban areas in the LDCs, over half of households have a mobile telephone and although the rate is much lower in rural areas, it is growing. Rural access is in some countries inhibited by a lack of coverage and to some extent, a lack of electricity for recharging handsets. Nevertheless, after a radio or a television set, the next most likely ICT device found in poor households is a mobile phone. In particular, African countries that are lagging behind in terms of penetration are the ones that have the highest growth rates. Meanwhile, landlocked and resource-scarce countries are the most penalized as they have the lowest income per capita, and highest supply costs.

Internet use is growing slowly, especially in rural and remote regions. It faces education and skills barriers that inhibit widespread global access. Fixed broadband access is limited in developing regions and extremely low in poor countries. Though it has significant potential, mobile broadband is far from

Figure II.14. Penetration of selected ICTs, LDCs, 2000-2009 (per 100 inhabitants)



Source: ITU World Telecommunication/ICT Indicators database.

widespread in the developing world. However, there are pockets of success in some developing countries where mobile broadband is beginning to have a significant impact on Internet take-up and use.

The convergence of ICT services and applications continues apace. The Internet is increasingly used for making telephone calls and – though less widespread in low-income countries – for video services. Convergence is extending to mobile phones, which are increasingly used to access the Internet. This makes it possible for enterprises, even in remote locations, to use mobile networks to access other ICT resources that are not necessarily directly accessible. Affordability is a major barrier to take-up of ICT services, particularly for the poor and for intensive usage of online applications. The next section looks more closely at the price of fixed, mobile and Internet services.

B. AFFORDABILITY TRENDS

1. The affordability barrier

High costs of ICT services are a significant barrier to take-up and usage, especially among the poor. Low-income users generally have to pay the same price (or higher) as others. Therefore, the relative burden is often higher for them. There is a strong correlation between affordability and penetration (figure II.15). The less affordable the service (measured by the ITU tariff basket divided by per capita income), the lower the penetration (subscriptions per 100 inhabitants). Efforts to reduce the digital divide therefore need to address the affordability barrier as well. A commitment to affordable communications was also made at the WSIS in Geneva, where world leaders stated that:

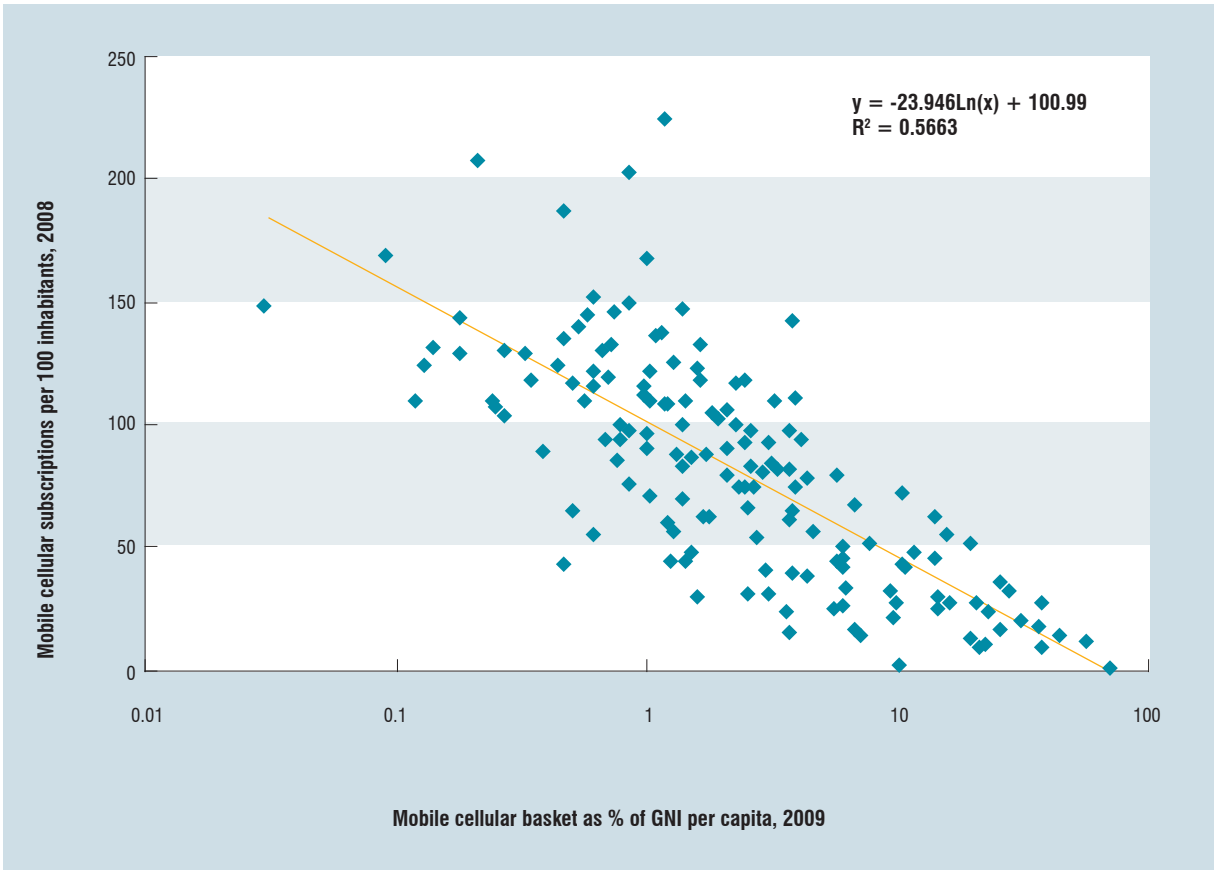
> *"Universal, ubiquitous, equitable and affordable access to ICT infrastructure and services, constitutes one of the challenges of the Information Society and should be an objective of all stakeholders involved in building it."*[43]

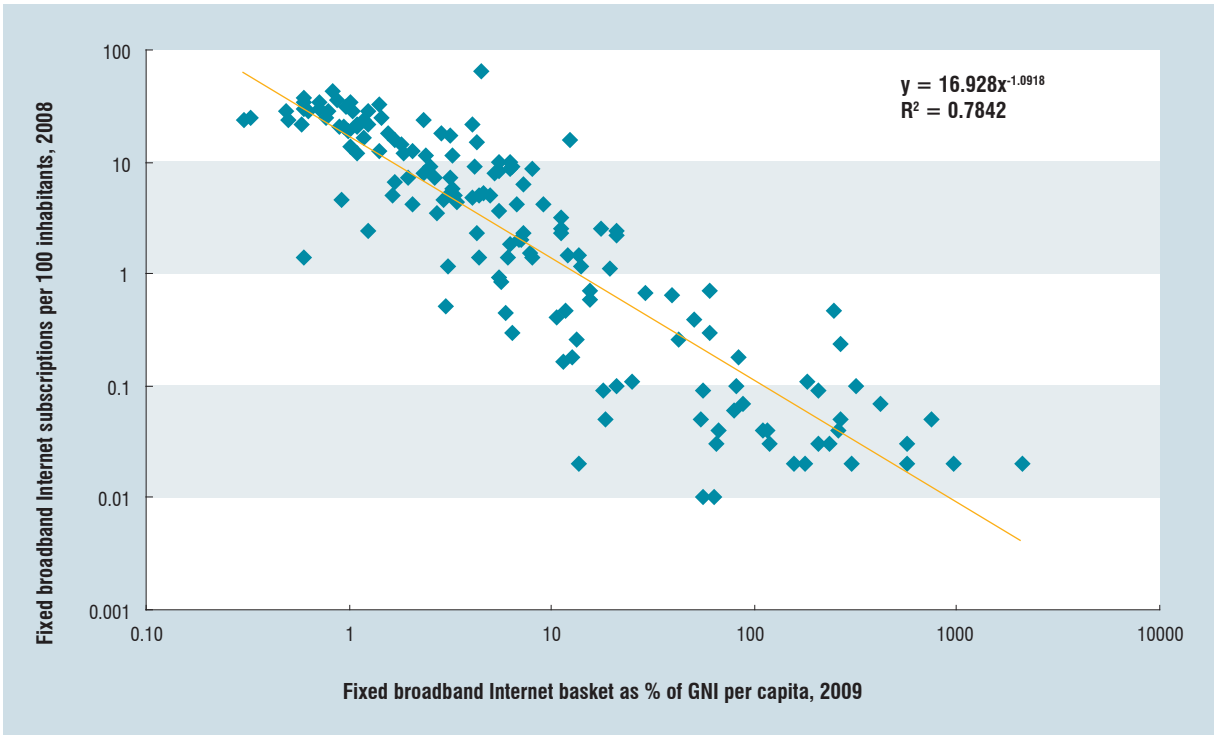
It is useful to distinguish between two types of affordability (see table II.6). First, affordability can relate to the entry costs to enable access to the service. For example, a broadband connection requires an end-user device (either PC or mobile-broadband enabled handset), a connection fee and recurring monthly fees for initial service access (e.g. the telephone line or mobile voice service rental). The second type of affordability concerns the recurring costs. In the case of mobile services, for example, even if low cost new or second hand phones are available, high usage charges may act as a constraint.

There are different approaches to measure affordability. Expenditure analysis—the amount that consumers or households spend on ICT services—can help determine what share of their income consumers are willing to devote to ICT services. Policymakers can then compare expenditure with prevailing prices to see what share of the population could afford the services. Unfortunately, many developing countries lack such information. Also, what consumers are willing to spend does not necessarily indicate whether prices are too high. Price benchmarks represent another option and can help identify differences in pricing among countries.[44] However, cross-country tariff comparisons are far from straightforward and should be interpreted carefully (box II.2).

Household expenditure data can help gauge the amount that consumers spend on ICT services in different countries. However, it too has limitations for making price comparisons and analysing whether cost is a barrier to take-up, since expenditures can vary for a number of social, cultural, technical and

Figure II.15. Relation between mobile cellular and fixed broadband Internet affordability in 2009 and penetration in 2008





Source: UNCTAD analysis of data from ITU World Telecommunication/ICT Indicators database.
Note: Logarithmic scale.

Table II.6. Types of costs associated with telecommunication services and affordability as measured by ITU ICT price basket

ICT service	One-time connection charge	Device needed	Usage charges
Radio	0	Radio set	Free over the air; some countries require a license
Fixed telephone	Varies	Telephone set	Monthly subscription charge. Sometimes charge includes unlimited national calls. Prepaid options require usage charges.
Mobile telephone	SIM card	Handset	Either monthly subscription, sometimes with a number of included minutes and/or SMS and/or usage charges (always for prepaid).
Fixed Internet	Varies	PC, modem	May require a telephone line subscription (for DSL) or cable TV subscription (for cable modem) in addition to Internet charges.
Mobile Internet	Varies	PC or Internet-enabled phone, modem for PC	May require a voice mobile subscription (for handset mobile Internet); usually a monthly subscription with a usage cap or pay on demand (either charged by time or volume).

Source: Adapted from ITU, 2010a.

economic reasons. It is impossible to say whether elevated expenditure on ICT services is because usage or prices are relatively high. Expenditure data can be useful for establishing thresholds in respect to analysing whether prevailing tariffs are affordable for the poorest.

Expenditure on ICT services varies widely between and among countries. In OECD countries, monthly consumer ICT expenditure (on a PPP basis) ranges from $140 in Ireland to less than $60 in Mexico. Overall expenditure for communications services accounts for some 2 per cent of household budgets in OECD countries (OECD, 2009a). While official data that identify amounts spent by households on communications services are often unavailable in developing countries, anecdotal evidence suggests that the relative expenditure is higher than in developed countries. Rural households in some African countries have been found to devote more than 5 per cent of their income to telephone services, suggesting that they are a basic need with low income elasticity.[45] Another study found that consumers in a number of African countries are spending much more than that on mobile services (Gillwald and Stork 2008). On average, most individuals in the countries surveyed spent more than 10 per cent of their incomes on mobile service; among the poorest, that ratio was over 20 per cent in several cases (table II.7).

2. Costs for fixed telephony services

ITU provides a comparison of a basket where use of the fixed telephone line is for voice calls. It includes the monthly rental plus 15 peak and 15 off-peak three-minute local calls and excluding the connection charge (ITU, 2010a).[46] According to these data, there is not a significant difference in affordability between fixed and mobile price baskets.[47] This would suggest that affordability of fixed telephone lines is of limited relevance for the poorest; they have opted for mobile telephones, either because fixed-line infrastructure is not available or because mobile phones are more convenient. Moreover, as noted above, the penetration of fixed household telephones is very low in LDCs and practically negligible in rural areas. Consequently, if poor people are to use a fixed telephone, it will likely be from a public telephone, making public telephone pricing more relevant in an analysis of ICT service affordability for low-income users.

3. Mobile affordability

Mobile cellular prices are also hard to compare. Plans vary between operators with numerous nuances (e.g., subscriptions for students, friends and family options, on-net/off-net calling) and continual promotions (e.g. 100 free SMS with a recharge). Comparisons inevitably have to be based on a particular profile of usage and typically a single operator. According to ITU, in 2009, the average price of a mobile cellular low user (i.e. prepaid) monthly basket amounted to 5.7 per cent of per capita income.[48] In developed economies, the ratio was 1.2 per cent and in developing nations it was 7.5 per cent (ITU, 2010a).

National data disguise variations in affordability for different segments of the population. According to a

Box II.2. Methodological challenges when measuring affordability

International comparisons of the affordability of different ICTs should be interpreted carefully. For example, ITU cautions that "while the ICT Price Basket provides a fair international comparison of relative prices over time, it does not necessarily show the cheapest offers available. Making prices comparable between countries requires a number of limiting assumptions which need to be kept in mind for the analysis and interpretation of the results" (ITU, 2010a: 55). The ITU composite ICT price basket adds up the prices for fixed, mobile and broadband services, provide an approximate overview of the cost of these services across countries, and over time. Tariff data are collected according to specific rules to make results as comparable as possible.[a]

However, while these rules are necessary to make prices comparable, they can lead to distortions and do not always show what subscribers are actually paying. For example, in some countries, so-called special offers are advertised all-year round, although the operator reserves the right to cancel the offer at any given time. Entry-level services tend to be more expensive than more sophisticated packages and in some cases the difference in price is substantial, to encourage users to pay "a little bit more money for much more value". This is particularly true for the growing number of multi-play offers that more and more operators now advertise. In an increasingly converged telecommunication environment, customers can choose to pay a lump sum for broadband Internet access, fixed telephony and television services, all in one. While the availability of converged services today is still limited to some countries,[b] more markets, including in the developing world are expected to join in the coming years.[c] Comparisons will become even more complicated (at least for those trying to track prices) with some operators launching quadruple-play offers, which include mobile cellular services.[d]

Finally, tariff baskets based on household subscriptions for ICT services and pre-defined usage assumptions are not always the most relevant for those with low incomes. It may be more useful to know the minimum outlay required for staying connected to an ICT service such as the lowest monthly payment or the value of the lowest denomination prepaid card. The poor are also more likely to use some ICT services from shared facilities. In that respect, comparisons on community access pricing – e.g. for the cost of a call from a public telephone or the use of one hour in an Internet cafes – may be relevant. In a survey of selected African countries, average public phone expenditure was the lowest in Ethiopia ($0.43) and the highest in Mozambique ($8.06) (Gillwald and Stork, 2008).

Source: ITU, 2010a and UNCTAD.

[a] *For example, tariffs from the dominant market operators (in terms of subscriber numbers) should be used since these are the tariffs that most people are paying. Entry-level offers and packages are used to calculate the ICT Price Basket since this is what low-income subscribers are most likely to use. Also, more sophisticated packages and offers, with more minutes/bytes etc. included, make comparisons more difficult. Special offers, limited to a certain time-period, should not be taken into consideration since they are not likely to be representative over time.*

[b] *For a discussion on triple play services in Africa, see http://allafrica.com/stories/200806161066.html.*

[c] *For example, Telekom Kenya has announced its intention to launch triple play services, http://www.telegeography.com/cu/article.php?article_id=30513.*

[d] *See e.g. http://www.dslreports.com/shownews/Verizon-Offers-Quadruple-Play-Discounts-105043 and http://www.lightreading.com/document.asp?doc_id=185037.*

17-country sample of Africa, the poorest individuals in over half the countries were spending more than the 16 per cent of income on mobile service shown as the African average in the ITU basket (Gillwald and Stork, 2008). Given that poor users are willing to spend a higher share of their income on mobile service and considering that the minimum amount a consumer would actually have to spend on mobile services is less than the basket computation, the cost is arguably within most people's reach. In Niger, for example, the mobile basket ($15) as quoted by ITU is the second highest in the world (56 per cent of per capita income). Yet a user needs only to use the mobile network every 90 days to stay connected and the lowest denomination recharge card is 200 CFA ($0.41) – the equivalent of eight text messages or two calls to one of three designated contacts.[49] The connection fee to obtain a SIM card is 1,500 CFA ($3) including 500 CFA of calling credit.

The average price of mobile services has been declining the past few years. For example, the ITU mobile basket dropped 25 per cent between 2008 and 2009 (ITU, 2010a). The trend can be seen also in statistics compiled by Nokia on the "total cost of ownership" for mobiles during the period 2005-2008 (figure II.16). According to Nokia:

> *"With 2.7 billion people earning less than two US dollars per day, a monthly cost of five US dollars or less is needed to enable the majority of the world's lower-income consumers to join the mobile community. As Nokia research shows, emerging market average total cost of ownership (TCO) is 10.88 US dollars, down from 13.16 US dollars in 2007."*[50]

Table II.7. Monthly mobile expenditure as a share of monthly individual income (%)

Country	Monthly mobile expenditure/ monthly individual income		
	All (%)	Bottom 75% in terms of individual income (%)	Top 25% in terms of individual income (%)
Benin	11.7	18.0	7.9
Botswana	10.4	14.9	6.1
Burkina Faso	14.1	19.3	7.6
Cameroon	10.8	16.0	4.8
Côte d'Ivoire	10.1	14.1	4.9
Ethiopia	7.1	23.3	6.1
Ghana	13.0	16.0	7.1
Kenya	16.7	26.6	7.8
Mozambiaue	11.7	17.9	9.2
Namibia	9.2	13.1	5.7
Nigeria	13.7	17.0	8.2
Rwanda	10.3	16.9	8.5
Senegal	14.2	19.4	9.6
South Africa	7.4	10.9	4.8
United Republic of Tanzania	15.4	22.1	11.5
Uganda	10.8	18.0	7.4
Zambia	10.8	14.4	8.6

Source: Gillwald and Stork, 2008.

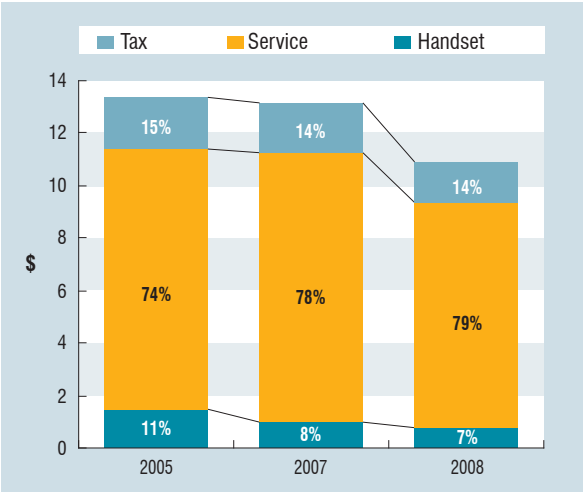
Note: Results for Nigeria and Zambia are extrapolations to national level but not nationally representative.

Given the overwhelming reliance on prepaid mobile services in low-income countries, it is essential to compare data on prepaid prices to understand affordability for the poor. In most countries, prepaid usage charges are higher than post-paid ones, meaning that the poorest pay more for mobile service than better-off subscribers on post-paid plans.[51] The cost structure applied by different operators varies, with implications for the affordability for users with low incomes. India, for example, has some of the lowest prepaid prices (ITU, 2010a). Wholesale termination costs in India (as well as in other South Asian nations) are the lowest in the world[52] and service taxes are lower than in many other large developing countries. While operators in some developing countries generate revenue from high tariffs and low volume, in India, revenues are generated using low tariffs but high volume. Yet earnings from mobile services in India are still relatively similar to high tariff/low volume countries. The main difference is that an Indian subscriber spends much more time talking on the mobile than his counterpart in the other countries.[53]

In addition to low taxes and termination rates, the Indian model is also characterized by low operational costs: "homegrown mobile operators in … India ... have developed new business models and industry structures that enable them to make a profit serving low-spending customers that Western firms would not bother with. Indian operators have led the way…"[54] Indian cost-cutting measures include outsourcing, which reduces operating expenses by around 15 per cent, and implementing capacity increases incrementally. These low costs give Indian operators room to charge less with the result that India has among the lowest average revenue per user (ARPU) in the world. From the perspective of low-income users, it would be desirable if the Indian model spread also to other low-income economies, particularly in Africa, where ARPUs still remain high (figure II.17).

One barrier to the adoption of mobile services has been the cost of a handset. This is particularly an issue for the poor, who typically use prepaid services where handsets are rarely subsidized. This barrier is being overcome through vibrant markets for used handsets in some places and operator-driven

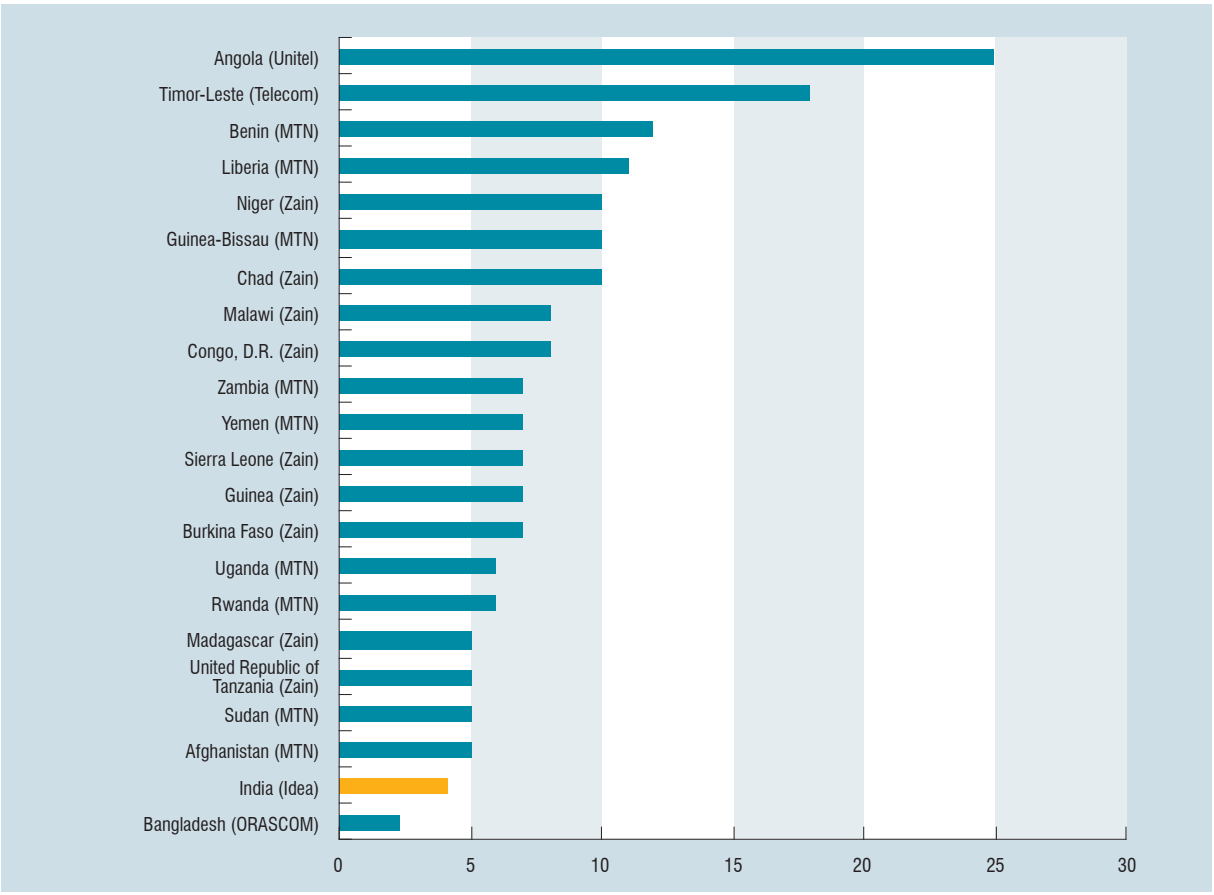
Figure II.16. Average total cost of mobile ownership, 2005-2008 ($)



Source: Nokia Research, 2009.

Note: Based on monthly total cost of ownership for a lower income consumer profile calculated as: cost of handset/36 + a simplified OECD-defined low usage mobile service basket + direct handset and service value added, sales tax and/or specific telecommunications tax + customs or similar fee on handset. The study has assumed a three-year lifetime for handsets, and the same for a prepaid subscription due to churn. The price of the handset is based on the lowest cost globally available Nokia handset.

Figure II.17. Average revenue per user (ARPU) in selected LDCs and India, 2009 ($)



Source: Idea, MTN, Orascom, Portugal Telecom and Zain operating reports.

Note: Data for Zain companies refer to Q3 2009. Data for all other operators refer to Q4 2009. Data converted to United States dollars using annual average exchange rate.

initiatives to lower the cost of new handsets. The "Emerging Market Handset" programme of the GSM Association aims at reducing the cost of entry-level handsets. It reached its goal of a cell phone for less than $30 in 2006, which contributed to a 25 per cent reduction in the wholesale cost of handsets in India.[55] However, even a $30 handset is too expensive for many potential users. The vast majority of would-be mobile users among the "bottom billion" could only afford a handset costing less than $5 (Zainudeen et al., 2007).[56] Recent announcements point to further price reductions. For example, Vodafone announced an entry-level phone for less than $15 at the Mobile World Congress in February 2010.[57] Used handsets also contribute to lowering the barrier to mobile communications services. A study of five Asian countries found that some 30 per cent of low-income subscribers were using second hand mobile phones (Zainudeen et al., 2007).

4. Internet affordability

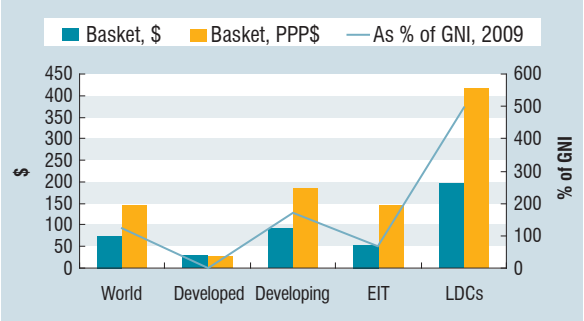
As noted above, there are a variety of ways for users to access the Internet. Options include dial-up versus broadband and fixed versus mobile. Although much focus is on broadband, dial-up is typically cheaper for low usage, and may be suitable for users who are only interested in applications such as e-mail. Dial-up is particularly attractive in countries with flat-rate telephone tariffs since there are no additional usage charges. In countries with per-minute telephone usage charges, there will be a point where it is more economical to shift to fixed broadband, which is typically charged at a flat rate (although some operators place a cap on the volume of monthly data transmitted). This will be a function of how many hours per month a user spends on the Internet.[58]

Broadband price benchmarks are complicated by the variety of speeds on offer and data cap policies.

Even assuming the internationally agreed definition of a minimum speed of 256 kbit/s for broadband poses problems, since entry-level speeds are higher in many developed countries. On the other hand, in some countries, entry-level packages are still below this threshold and the main criterion for broadband is that the connection is "always on". Upload speeds also vary, and there are differences between fixed and mobile broadband. Moreover, a device such as a PC or Internet-enabled mobile handset is also necessary to use the Internet. The device price is included in some mobile basket methodologies. However, in the case of fixed broadband, few price comparisons factor in the cost of the telephone line rental (for DSL) or the device. Such considerations hamper price comparisons.

The ITU Internet price basket, which is based on *fixed broadband*, shows huge variation in the level of affordability (figure II.18). In developed countries, the average basket is only about 2 per cent of per capita income. At the other extreme, there are developing countries in which prices of a monthly fixed broadband basket exceed per capita income. The situation is particularly serious in Africa, where it is on average almost five times higher than the per capita income. Most of the countries in which high-speed Internet access is prohibitively expensive are LDCs (ITU, 2010a). Thus, the wide gap in broadband access is in many cases aggravated by a "broadband price divide".

Figure II.18. Fixed broadband affordability, by country group, 2009 ($, PPP$, as % of GNI)



Source: ITU World Telecommunication/ICT Indicators database.

Note: based on the price of the monthly subscription to an entry-level fixed broadband plan. The price is calculated based on a 256 kbit/s connection and a minimum of 1 Gigabyte of data.

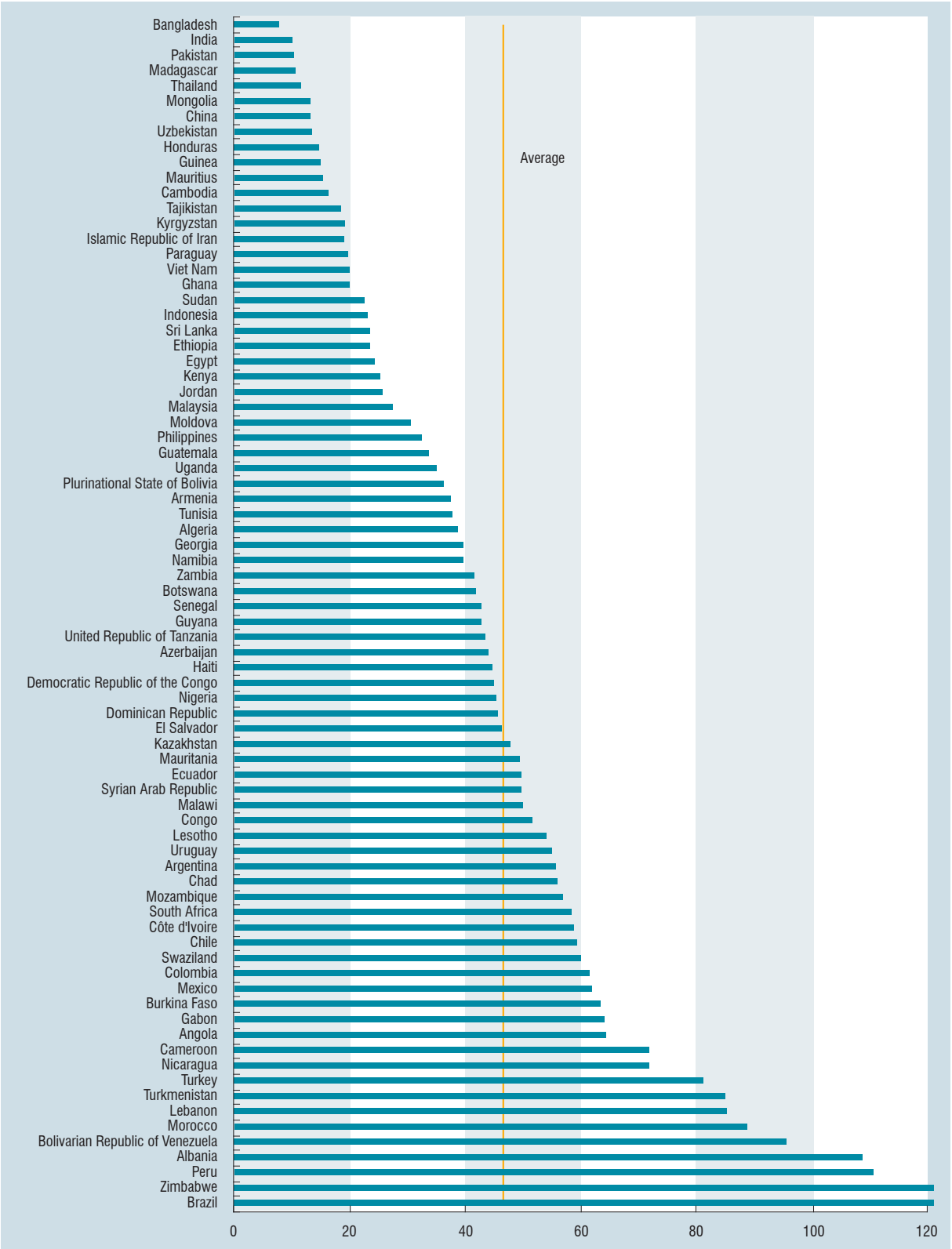
Given that the basket does not include the price of the device or the necessity of renting a telephone line, fixed broadband prices are even more onerous for most low-income people. High broadband prices can be the result of various factors, including a lack of infrastructure competition (at both the wholesale and access path level). Small market sizes (due to education and other social barriers) also result in higher prices due to the absence of economies of scale. The use of broadband and Internet requires a certain level of skills. If the majority of inhabitants lack these skills, it reduces the market size also in large countries.

Mobile data pricing comes in several forms, including per usage, capped flat rate and unlimited plans. Tariffs can also vary by whether a handset or laptop is used to access the service or the subscription is prepaid or post-paid. Speeds again vary widely. Benchmarks are limited since not all countries offer the service. Given these complexities, international mobile data pricing comparisons are not widely available.

Nokia compiles mobile data pricing using the total cost of ownership (TCO) concept. In addition to mobile data charges, it also includes a prorated handset cost, various taxes paid by a consumer associated with the use of mobile handset and services and regular voice and SMS usage.[59] The basket includes 2.1 MB of data that Nokia equates to receiving or sending around 21 e-mails, browsing the Internet for 2.1 hours or downloading eight games. Recent results point to an average monthly price of $46.54, including regular voice and SMS usage charges (figure II.19). There is large variation, with some countries charging less than $20 per month and others more than $100. A mobile voice and data basket would be less than 10 per cent of income in around 30 countries. As in the case of mobile voice services, mobile data TCO is remarkably low in South Asian countries such as Bangladesh, India and Pakistan (figure II.19).

In view of the spread of wireless technology, mobile data pricing will become increasingly relevant in the developing world. There are also fewer up-front cost barriers for mobile data. Prices of Internet-enabled handsets or small netbooks tend to be less expensive than conventional laptop or desktop PCs, and mobile data does not require the extra line rental costs of some fixed broadband technologies.[60] If high-speed mobile data services can be made available and charged on a per use basis, then it could become an attractive solution for less well-off users when there is a need for occasional Internet access.

Figure II.19. Nokia monthly mobile data total cost of ownership (TCO), 2009 ($)



Source: Nokia, Nokia Siemens Network.

Note: The basket is based on the usage profile of a "typical middle-income emerging market mobile data subscriber" and includes: 165 voice minutes, 174 SMS, 1 MMS, 2.1 MB of data traffic, 1 ring back tone download and 3.7 premium SMS, such as alerts.

C. CONCLUSIONS

From the perspective of reaching the poor with ICTs, mobile telephony offers particularly great potential. In practically all low-income countries, wireless is more prevalent than fixed telephone line infrastructure. This applies especially to rural areas. There are ample signs that the use of mobile phones in developing nations has expanded from voice to text messaging and more advanced data applications. Text messaging and the use of "missed calls" are helping to make mobile use more affordable for the poor. There are examples around the world of agricultural-based SMS systems where farmers can get the prices of products (chapter IV). This saves them the expense of travelling to markets to get price information and enhances their decision-making in terms of what products to plant. The spread of mobile phones is also evolving into a new ICT for development model, away from shared telecentres towards personal handsets (chapter IV).

In order to leverage ICTs further as a tool for poverty reduction, it is important to enhance usage and the sophistication of applications, particularly using the capabilities of high-speed wireless data networks, which are likely to have a bigger impact than fixed networks in developing nations. There are positive trends but challenges remain, especially with regard to affordability and knowledge development. Though a growing number of people are gaining access to ICTs, particularly mobile, usage is sometimes constrained by high prices, particularly for the poor. This inhibits the full development of ICTs as poverty reduction tools.

Emphasis should be placed on expanding access to wireless networks by increasing *coverage*, including for high-speed data networks. Steps in this direction include licensing additional operators, reserving spectrum for new operators, and using regulatory tools such as coverage requirements and universal service funding to encourage build-out in rural areas. The market is likely to fulfil a significant portion of the coverage gaps, particularly when pro-competitive policies are adopted. In other areas, private public partnerships can play a role (chapter V).

Usage of ICT services can be improved with greater efforts to reduce incremental costs. Though these reductions may appear slight, when compared to the incomes of the poor they can have a major impact. Some governments may consider lowering their import duties on ICT devices and taxes on usage. Efforts may also be enhanced to align interconnection charges with true costs in order to reduce the price of calling between networks. Operating expenses can be reduced through outsourcing, incremental capacity additions and infrastructure sharing (see chapter V).

The lack of electricity is a significant barrier to ICT take-up for the poor in developing nations, particularly in rural areas. This is less of a problem for some ICTs which use batteries (such as radio) or mobile handsets which can be recharged using car batteries. However, it poses a challenge for computers. A lack of electrical power also raises costs since infrastructure such as wireless base stations must be powered by more expensive diesel generators. ICT access will inevitably be restricted, particularly among the poor and small and micro-enterprises in rural areas until solutions are found for providing stable and affordable electricity.

While coverage, affordability and electricity remain major concerns as barriers to ICT uptake, education and awareness are key bottlenecks, especially for using data services. Lack of skills inhibits greater use of computer and the Internet, especially among the poor and in rural areas. Governments should facilitate demand through developing relevant capabilities, promoting digital literacy and supporting the development of applications by the relevant stakeholders. This can help to foster the necessary expertise among the poor and in micro-enterprises to more fully utilize the potential of ICTs to reduce poverty (chapter V).

NOTES

1 In this study, the target group was defined as those users between the ages of 18 and 60 who had used a phone (their own or someone else's, paid for or free of charge) during the preceding three months. More than 8,600 face-to-face interviews were conducted using a structured questionnaire.

2 National Statistics Bureau. 2003 and 2007 *Bhutan Living Standard Survey*.

3 Comparability of fixed telecommunications is hampered by definitional differences. For example, some countries include ISDN channels rather than subscriptions, and some include Voice over Internet Protocol (VoIP) subscriptions while others count "fixed" wireless subscriptions. See ITU (2010c) for an updated definition of (fixed) wired and wireless broadband services.

4 For example, in Liberia and the Democratic Republic of Congo, civil strife led to the destruction of the limited telephone networks that existed. In the former case, this allowed the country to leapfrog to higher-speed wireless technology, at least in urban areas. See: LIBTELCO. World Investment News. http://www.winne.com/ssa/liberia/reports/2008/cp/libtelco/index.php and "Liberia Telecommunications Corporation goes online." *Liberia Webs*, 27 January 2009.

5 For example, in Liberia 14 per cent of the population was found to be non-poor in 2005. Its mobile penetration was almost twice this in 2009 (26 per cent), suggesting that the poor are also getting access to mobiles. Household survey data confirm the reach of mobile phones to the poor in Liberia: 28.7 per cent of homes had a mobile phone in 2007. See: Liberia Institute of Statistics and Geo-Information Services (LISGIS) [Liberia], Ministry of Health and Social Welfare [Liberia], National AIDS Control Program [Liberia], and Macro International Inc. 2008. *Liberia Demographic and Health Survey 2007*. Monrovia, Liberia: Liberia Institute of Statistics and Geo-Information Services (LISGIS) and Macro International Inc.

6 See: AudienceScapes *National Survey of Kenya*, July 2009, available at http://www.audiencescapes.org . The survey covered 1,809 adult respondents who used the mobile phone within the last year.

7 "GCASH, RBAP, MABS: 5-year solid partnership surpasses P5B mark." *RBAP-MABS* 4 December 2009. http://www.rbapmabs.org/blog/2009/12/gcash-rbap-mabs-5-year-solid-partnership-surpasses-p5b-mark/#more-2038 .

8 For example, SMS was used to help monitor the presidential elections in Ghana. See: http://www.electionwatch.org.na/node/78. Similarly, SMS was used in Kenya in the post-elections as well. The website, Ushahidi.com, allowed people to report post-election violence in Kenya via SMS or email.

9 See http://www.andina.com.pe/Espanol/Noticia.aspx?Id=KrSC5yNqaVE= .

10 Digicel, a mobile operator in Haiti, received over $500,000 of charitable donations for earthquake relief sent via text message from subscribers to its networks in other Caribbean and Central American countries. See: "Digicel procure gratuitement des telephones aux ONGs travaillant en Haiti", Press Release, 17 March 2010. http://www.digicelhaiti.com/fr/about/news/digicel-procure-gratuitement-des-telephones-aux-ongs-travaillant-en-haiti.

11 See GSMA. "Deployment Tracking." Mobile Money for the Unbanked. http://www.wirelessintelligence.com/mobile-money.

12 Afghanistan, Bangladesh, Cambodia, the Democratic Republic of the Congo, Malawi, Mali, Niger, Rwanda, Sierra Leone, Somalia, the United Republic of Tanzania, Uganda and Zambia.

13 "Somali mobile phone firms thrive despite chaos." *Reuters*, 3 November 2009. http://af.reuters.com/article/investingNews/idAFJOE5A20DB20091103.

14 Information provided by Safaricom, June 2010.

15 Smart reported 8.5 million subscriptions to its mobile-money service in 2008 and Globe reported 1.4 million GCash subscriptions See: PLDT. 2009. *Full Year 2008 Financial and Operating Results* and Globe Telecom. 2009. *SEC Form 20-IS*.

16 Globe Telecom Inc. 2010. *SEC Form 17-A.*

17 The study referred to mobile-money services as "branchless banking".

18 See "Mobile transfers save money and lives in Somalia." *Reuters*, 3 March 2010. http://www.reuters.com/article/idUSTRE6222BY20100303.

19 UNCTAD estimation based on Gartner shipment data and assuming PCs are replaced every five years. For the latest Gartner shipment data, see: "Gartner Says Worldwide PC Shipments in Fourth Quarter of 2009 Posted Strongest Growth Rate in Seven Years". *Press Release*, 13 January 2010. http://www.gartner.com/it/page.jsp?id=1279215.

20 See "Households with access to a home computer" available on the OECD Key ICT Indicators web page at: www.oecd.org/sti/ICTindicators .

21 Information from the Instituto Nacional de Estadística y Geografía (INEGI, the Mexican national statistics office) suggests that over half of Mexican households without a computer said that a lack of economic resources was the reason they did not have a computer in 2008. INEGI. 2009. *Encuesta Nacional sobre Disponibilidad y Uso de las Tecnologías de la Información en los Hogares.*

22 In Lesotho, 96 per cent of companies with more than 250 employees use computers (annex table II.2).

23 IMRB International. 2009. *I-Cube 2008*.

24 Information provided by LirneAsia from the 2008 Teleuse@BOP survey findings.

25 "A common problem that has been experienced in the course of many telecentre projects is a lack of sustainability that prevents telecentres from successfully staying operational in the long run and becoming independent from external support and subsidies." (UNIDO, 2004) See also Subba Rao, 2008.

26 "… the typical Ugandan Internet user is a young educated male who not only has the disposable income but also the wherewithal required to be online... The typical cyber cafe user in Uganda is not an 'ordinary' citizen."

27 Almost half (47.7 per cent) of rural Internet users in China make less than 500 Yuan ($66 converted using annual average

exchange rate for year of report) per month compared to around a third (29.6 per cent) of urban Internet users (CINIC, 2007).

28 *Mobile Internet* refers to access to the Internet using a mobile network regardless of whether that network is narrow or broadband. Access to the Internet over a wireless high-speed network (i.e. > 256 kbps in more than one direction) is measured in terms of mobile broadband subscriptions in this report (see ITU, 2010c).

29 Opera Software. "State of the Mobile Web, December 2009." http://www.opera.com/smw/2009/12/. The top 10 countries according to Opera Mini usage are the Russian Federation, Indonesia, India, Ukraine, China, South Africa, the United States, Viet Nam, Nigeria and the United Kingdom.

30 Telecom Regulatory Authority of India. "Telecom Subscription Data as on 31st December 2009." *Press Release*, 27January 2010. http://www.trai.gov.in/WriteReadData/trai/upload/Reports/49/Report7jan10.pdf. See also http://www.nokia.com/NOKIA_COM_1/Corporate_Responsibility/Society_/Expanding_Horizons/Expanding_Horizons_NEW/pdf/Expanding_Horizons_Q1_2010.pdf. It should be noted that other observers estimate far fewer active users, see http://www.iamai.in/Upload/Research/MobileInternetinIndia_39.pdf.

31 Grameenphone. 2009. *Prospectus*.

32 For example, according to some research, every ten points increase in broadband penetration boosts economic growth 1.4 per cent in developing countries (World Bank, 2009).

33 ITU defines fixed (wired) broadband as high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s. Fixed broadband Internet can include for example cable modem, DSL, fibre-to-the-home/building and other fixed (wired) broadband subscriptions. It excludes subscriptions that have access to data communications (including the Internet) via mobile cellular networks. For more details, see ITU, 2010c.

34 Mobile broadband is defined as: "…subscriptions to mobile cellular networks with access to data communications (e.g. the Internet) at broadband speeds (defined as greater than or equal to 256 kbit/s in one or both directions)" such as WCDMA, HSDPA, CDMA2000 1xEV-DO and CDMA 2000 1xEV-DV, irrespective of the device used to access the Internet (handheld computer, laptop or mobile phone, etc.). These services are typically referred to as 3G or 3.5G (see ITU, 2010a). In March 2010, ITU defined two new indicators to measure the uptake of mobile/wireless broadband. These indicators measure active wireless broadband subscriptions and distinguish between standard mobile subscriptions on the one hand, and dedicated mobile data subscriptions on the other hand (see ITU, 2010c).

35 The OECD defines *active* mobile broadband subscriptions as either: "…voice subscriptions which also provide access to the larger Internet via HTTP at advertised speeds of at least 256 kbit/s and which have been used to make an Internet data connection using Internet Protocol (IP) in the previous three months" or "…dedicated data subscriptions on mobile networks advertising speeds of at least 256 kbit/s which are purchased separately from voice services either as a stand-alone service (modem/dongle) or as an add-on data package to a voice service requiring an additional subscription." (OECD, 2010).

36 In the European Union, for example, only 37 per cent of the 173 million mobile broadband subscriptions reported on 1 July 2009 were *active*. See European Commission. *Broadband access in the EU: situation at 1 July 2009*. 18 November 2009. In the United States, the official number of mobile broadband subscriptions dropped by 58 per cent between June and December 2008 after the definition was changed to count only active subscriptions. See Federal Communications Commission, 2010. High-Speed Services for Internet Access: Status as of December 31, 2008. http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296239A1.pdf.

37 UNCTAD analysis based on data from the GSM Association and CDMA Development Group.

38 See ANRT. "Tableau de Bord Trimestriel, Marché Internet au Maroc, Décembre 2009." http://www.anrt.net.ma/fr/admin/download/upload/file_fr1874.pdf.

39 See Vodacom. "South African Operations." Analyst Presentations 2009. http://www.onlinewebstudio.co.za/websites/vodacom/ir/pdf/presentations/south_africa.pdf.

40 Vodacom. 2009. *Pre-Listing Statement*.

41 GSMA. 2008. *Mobile Broadband connects the unconnected in Tanzania*.

42 See: FCC. "Message from the iPad: Heavy Traffic Ahead." Broadband.gov. 1 February 2010. http://blog.broadband.gov/?entryId=138385.

43 WSIS: Declaration of Principles. December 12, 2003. http://www.itu.int/wsis/docs/geneva/official/dop.html.

44 The ITU ICT Price Basket tracks and benchmarks the affordability of ICT services globally. It is a composite basket that includes the following three sub-baskets/tariff sets of equal weight: fixed telephone, mobile cellular and fixed broadband Internet services. Based on the relative price of ICT services, ITU latest (2009) ICT Price Basket ranked a total of 161 countries. For further information on the ITU ICT Price Basket, see: ITU, 2010a.

45 See http://www.ictregulationtoolkit.org/En/Section.3337.html.

46 Many operators offer peak and off-peak tariffs. Although off-peak tariffs are often perceived as beneficial for low-income users, it may not always be the case. Peak rate prices penalize working activities, and more so in rural areas which are highly dependent on communication means due to their isolation from economic activities.

47 Although they are not strictly comparable given that the basket compositions differ and the fixed telephone basket does not include calls to mobile phones.

48 ITU uses a variation of the OECD basket, applying it to 161 economies.

49 Data refer to Zain Niger and were extracted from the website: http://www.ne.zain.com. Conversions from United States dollars were made in March 2010 using www.oanda.com. A Zain prepaid subscriber can designate up to three numbers (i.e., "friends and family") for cheaper tariffs.

[50] Nokia n.d. "Total cost of ownership is the key in bringing social inclusion." Mobile technology for development. http://www.nokia.com/corporate-responsibility/society/mobile-technology-for-development/total-cost-of-ownership-is-the-key-in-bringing-social-inclusion.

[51] In Brazil, the prepaid tariff per minute for one operator is R$1.15 ($0.57) to all networks (see http://www.tim.com.br). An entry level post-paid plan is R$99 per month which includes unlimited calls within the network; off network calls are R$0.99 per minute, 14 per cent less than what a prepaid user pays. The threshold for a post-paid plan is high, however. Users would need to talk 86 minutes a month for post-paid to be less expensive. Brazilian prepaid users also have to pay a surcharge when calls are made or received outside their state of residence. Post-paid users receive free incoming calls when roaming within the country and long distance calls to TIM fixed line are free as are calls to the mailbox.

[52] TMG, Inc. 2010. *Mobile Termination Rate Update*.

[53] For example, in the fourth quarter of 2008, subscribers on Idea India's network spoke for 416 minutes per month on their mobile phones compared to an average of 107 minutes per month in nine Latin American countries. See: Telefónica. *January – December 2008 Results* and Idea Cellular Limited. 2009. *Quarterly Report: Fourth Quarter ended March 31, 2009*.

[54] "Mobile marvels: A special report on telecoms in emerging markets." *Economist*, 26 September 2009.

[55] "GSMA To Accelerate Development Of Mass-market 3G Handsets Under "3G For All" Programme." *Press Release*, 13 June 2006. http://www.gsmworld.com/newsroom/press-releases/2046.htm.

[56] This is based on low-income Asia. The average price non-mobile users would be willing to pay for a handset across 17 countries in Africa was $13 (Gillwald and Stork, 2008).

[57] "Vodafone adds two pioneering ultra low cost handsets to own-brand device portfolio." 15 February 2010. http://www.vodafone.com/start/media_relations/news/group_press_releases/2010/vodafone_adds_two.html.

[58] In some countries, such as Chile, Morocco and Senegal, dial-up has essentially been phased out and virtually all subscriptions are broadband.

[59] The total cost should include all mobile usage since users do not typically only use mobile data (at least from a handset). See: "How affordable is mobile data?" *Expanding Horizons*, 3/2009.

[60] Several initiatives have been launched to develop simple, low-cost, robust terminal devices for use in poor communities. Examples include the One Laptop Per Child project's XO computer and the Intel Classmate. There are also more generalized, commercial products, such the Asus Eee (Kraemer et al., 2009).

3 THE ICT SECTOR AND THE POOR

The poor in a society relate to the ICT sector in various ways – as consumers, producers, workers or entrepreneurs. A growing ICT sector can offer jobs and income-generating opportunities and, in some cases, create entirely new livelihoods for the poor. Moreover, a vibrant ICT sector is important to facilitate and sustain more widespread use of ICT throughout the economy. At the same time, gains are not automatic. The opportunities for the poor to benefit directly or indirectly vary between activities and there are also potential risks to be considered. The net outcome is influenced by government policies.

As few studies have examined the contribution of ICT production to development, livelihoods and poverty reduction, there is a need for more research.[1] This chapter seeks to shed some new light on these issues. It begins by examining the size and composition of the ICT sector in countries at different levels of development and for which information is available. It goes on to consider the role of three areas of the ICT sector: ICT goods manufacturing (section B); the production of IT and ICT-enabled services (section C); and ICT micro-enterprises (section D). The final section concludes.

A. MAPPING THE ICT SECTOR

The magnitude and nature of the ICT sector varies greatly between countries. According to the most widely used definition of the sector, based on the International Standard Industrial Classification (ISIC) Rev.3.1 (table III.1), it comprises both manufacturing and services activities. It contains two principal categories of manufacturing: the manufacturing of information processing and communication equipment (computers, cables, electronic components and telecommunication equipment), and the manufacturing of instruments that use electronic means to measure, test and control physical processes. Telecommunication services, computer services as well as services directly related to ICT manufacturing activities (wholesale and renting) are also included. The definition includes only activities for which the production of ICT products represents the main activity,[2] and it excludes retail activities.[3] Reflecting the rapidly evolving nature of the ICT area, this definition has already been modified on two occasions (box III.1).

For some economic activities in developing countries, it may not be immediately clear whether they should be included or not in the ICT sector. This may apply, for example, to the activities of ICT micro-enterprises that are providing various mobile and PC-related services (see section D). Some of the services provided may be seen as part of telecommunication services (selling airtime), repair services or as part of the retail sector (selling mobile phones and accessories). Sometimes these activities furthermore occur in the informal sector, making it hard to capture them in official statistics. Another borderline case is related to business process services that have been enabled by the improved ICT connectivity (section C). Some of these are squarely in the ICT sector (such as software development and data processing services), whereas others may be less obvious candidates for inclusion (such as accounting, human resources or payroll services provided electronically). In the context of the analysis in this chapter, however, these will all be considered from the perspective of creating opportunities for poverty reduction.

The size and composition of the ICT sector vary a great deal. Two internationally agreed indicators

Table III.1. List of industries included in the 2002 OECD definition of the ICT sector (based on ISIC Rev 3.1)

ICT Manufacturing	
3000	Manufacture of office, accounting and computing machinery
3130	Manufacture of insulated wire and cable
3210	Manufacture of electronic valves and tubes and other electronic components
3220	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
3230	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods
3312	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment
3313	Manufacture of industrial process control equipment
ICT Services	
5151	Wholesale of computers, computer peripheral equipment and software
5152	Wholesale of electronic and telecommunications parts and equipment
6420	Telecommunications
7123	Renting of office machinery and equipment (including computers)
7200	Computer and related activity, which includes:
7210	Hardware consultancy
7220	Software consultancy and supply
7230	Data processing
7240	Data base activities
7250	Maintenance and repair of office, accounting and computing machinery
7290	Other computer-related activities

Source: OECD, 2009b.

Box III.1. An evolving ICT sector definition

In 1998, OECD produced the first definition of the ICT sector. It included a selection of industries classified at the four-digit level according to the ISIC Rev. 3 list. The definition incorporated both manufacturing and services, noting that for *manufacturing industries*, "the products of a candidate industry must be intended to fulfil the function of information processing and communication including transmission and display, or must use electronic processing to detect, measure and/or record physical phenomena or to control a physical process". For *services industries*, the products of a candidate industry must be intended to enable the function of information processing and communication by electronic means (OECD, 2009b). The 2002 definition of the ICT sector was a development of the 1998 version, based on ISIC Rev 3.1. The main difference was the splitting up of the 5150 category (Wholesale of machinery, equipment and supplies) into three sub-industries, only two of which were related to ICTs.

In 2007, the definition underwent a major overhaul to reflect the new ISIC classification (ISIC Rev. 4).[a] With an ever-larger array of products incorporating some electronic components, it became harder to justify limiting the scope of the ICT manufacturing sector to products using electronic processing to detect, measure, record or control a physical process. Consequently, those industries were removed from ICT manufacturing, which thus included only those industries for which the product of a candidate industry is primarily intended to fulfil the function *of information processing and communication by electronic means, including transmission and display*. OECD also chose to exclude fibre optic cables from ICT manufacturing, citing their passive components nature in the transmission of information.

In regard to services, ISIC Rev. 4 identifies two new classes of activities that were included in the new ICT sector definition: repair of computer and peripheral equipment (9511) and repair of communication equipment (9512). The new classification also encompasses a number of ICT-related service activities, such as software publishing, computer programming, data processing and web portals.

As of April 2010, only a few developing countries had yet adopted the ISIC Rev. 4 classification. This means that, in practice, the 2002 ICT sector definition is still in use in most countries that report such data. In 2009, UNCTAD retained the ISIC Rev.3.1 classification for its data collection exercise. This will gradually change over time, however. Moreover, the rapidly evolving nature of ICTs will no doubt require additional transformations of the definition in the future.

Source: UNCTAD, based on OECD, 2009b.

[a] *In parallel to its work on the ICT sector definition, the Working Party on Indicators for the Information Society (WPIIS) established a definition for the Content and Media sector, also based on ISIC Rev. 4. Together, the ICT sector and the Content and Media sector make up the "information economy".*

have been adopted to measure its importance in an economy (UNCTAD, 2009b):

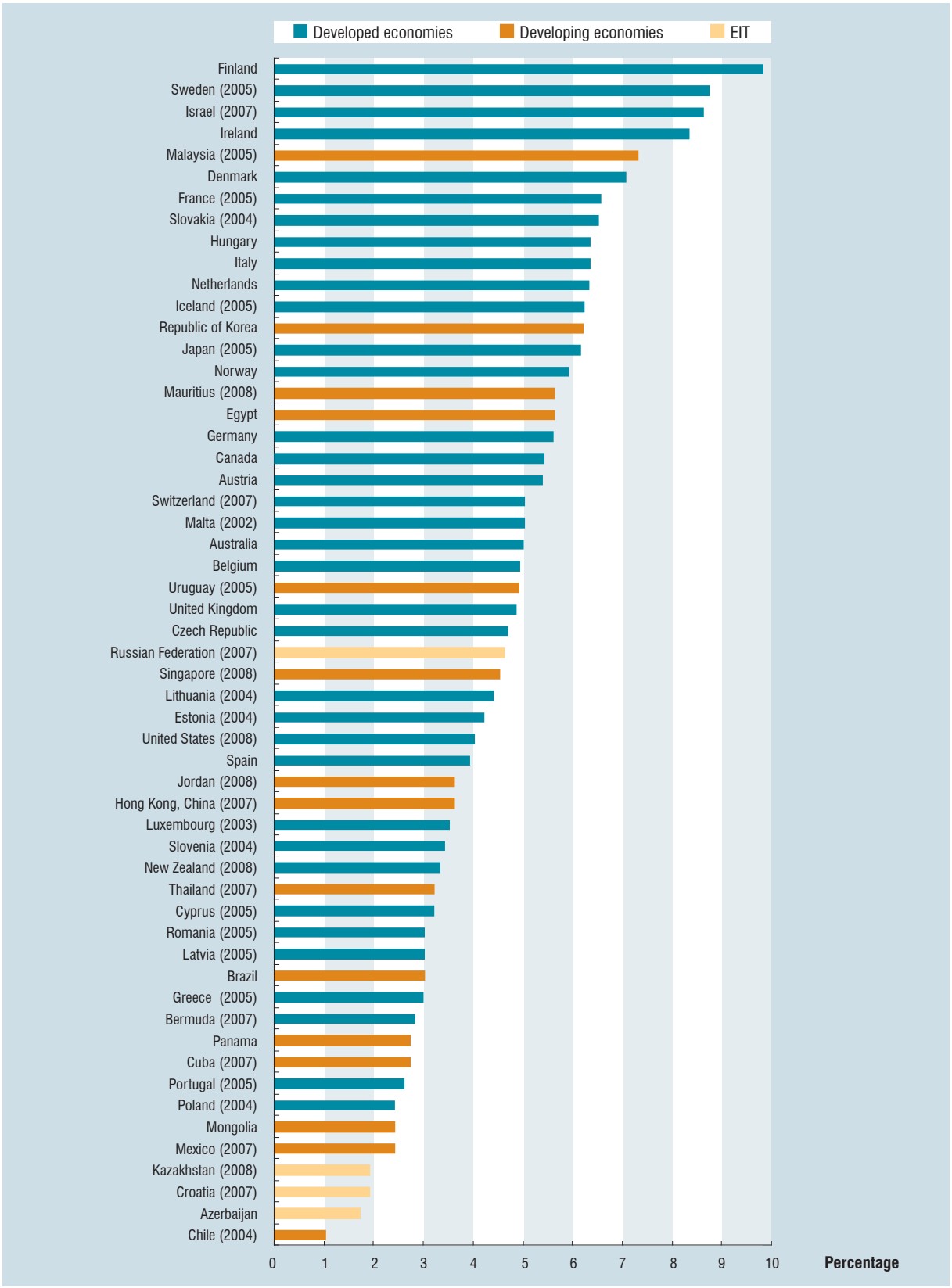
- the share of the ICT sector workforce in the total business sector workforce (ICT-1), and
- the share of the ICT sector value added in total business sector value added (ICT-2).

International coverage of these indicators is still patchy. In particular, data are still missing for the majority of developing countries, including several economies in which the ICT sector plays a prominent role, such as China and India. Moreover, no LDC is currently reporting this kind of information. As of 2009, 55 economies (of which 16 developing ones) reported data on the ICT-1 indicator (figure III.1) and 48 economies (of which 9 developing ones) had data on ICT-2 (figure III.2).[4] The paucity of data for low-income countries is one illustration of the digital divide, and underlines the need for further capacity-building in the area of ICT measurement.

Among the economies included in figure III.1, the share of total business sector employment accounted for by the ICT sector is the highest in some developed countries – notably Finland, Sweden, Israel, Ireland and Denmark – and in Malaysia. In all these cases, the ICT sector's share exceeds 7 per cent. Other economies with relatively large ICT sector employment include the Republic of Korea, Mauritius and Egypt. [5] By contrast, in Azerbaijan, Chile, Croatia and Kazakhstan, the share is below 2 per cent. There is no simple relationship between the level of development and the ICT sector's share in a country. For example, the share is considerably larger in Egypt, Malaysia and Mauritius than in high-income economies such as Luxembourg, New Zealand or the United States.

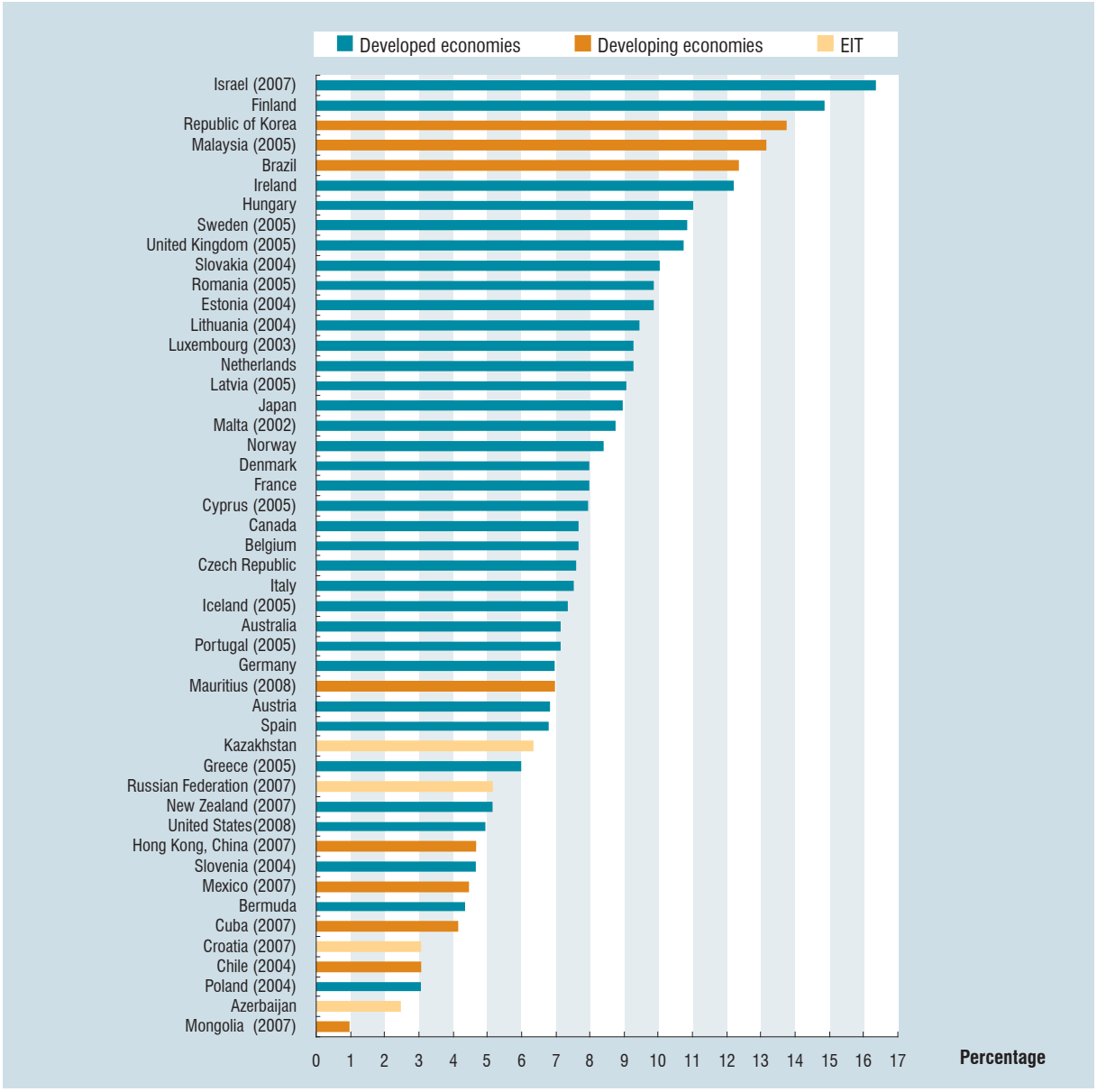
A comparable pattern emerges in the case of the ICT sector's share of total business sector value added (figure III.2). The largest share (more than 16 per cent) is reported for Israel, followed by Finland and the Republic of Korea.[6] In Brazil and Malaysia, the ICT

Figure III.1. ICT sector in the total business sector workforce, selected economies, 2006 unless otherwise indicated (%)



Source: UNCTAD Information Economy Database and OECD. See annex table III.1 for details.

Figure III.2. ICT sector in the total business sector value added, selected economies, 2006 unless otherwise indicated (%)



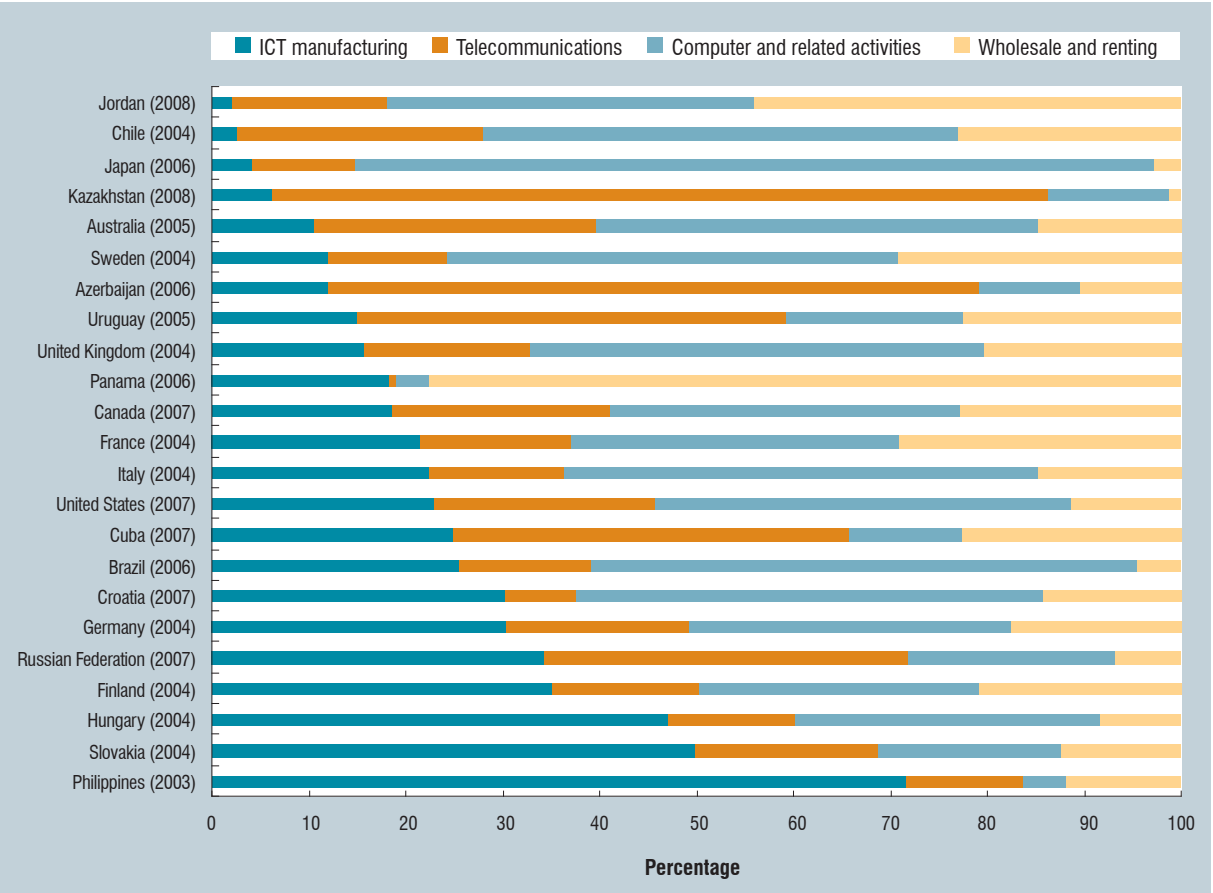
Source : UNCTAD Information Economy Database and OECD. See annex table III.1 for details.

sector's share of business value added is above 12 per cent. Countries at the bottom of the chart include Azerbaijan, Chile, Croatia, Mongolia and Poland, in which the ICT sector contribution is only 3 per cent or less.

Reflecting the high capital-intensity and reliance on skilled labour in many ICT-related activities, the ICT sector generally accounts for larger shares of value added than of employment. For example, while it employs only about 3 per cent of Brazil's business workforce, it represents more than 12 per cent of the total Brazilian business sector value added. The ICT sector's contribution to value-added is more than twice its share of business employment also in economies such as Chile, Estonia, Kazakhstan, Latvia, the Republic of Korea and Romania (annex table III.1).

In terms of the sectoral composition, while relatively few developing and transition economies report

Figure III.3. ICT sector employment, by subcategory, selected economies, latest year (%)



Source: UNCTAD Information Economy Database and OECD.

Note. In this section, sub-industries of the ICT sector were categorized into four subsectors using the ISIC Rev 3.1 classification: manufacturing (3000, 3130, 3210, 3220, 3230, 3312, 3313); wholesale and renting (5151, 5152, 7123); telecommunications (6420); and computer and related activities (72). Reference years may differ from those used in annex table III.1.

disaggregated information, some distinct patterns can still be observed (figure III.3). First, ICT manufacturing accounts for a substantial share of the ICT sector in relatively few of the economies for which data are available. This reflects the strong concentration at the global level of such production into a handful of locations (see section B and UNCTAD, 2009a). Among the countries shown in figure III.3, ICT goods manufacturing accounted for more than 30 per cent in Finland, Hungary, Israel, Malaysia, Mexico, the Russian Federation and Slovakia. In these countries, ICT manufacturing has typically been given a prominent role in the national development strategies, and in strategies to attract foreign direct investment (FDI).

Secondly, telecommunications services account for a significant share of ICT sector employment in many countries. Telecommunications constitute a basic infrastructure and are important even when other parts of the ICT sector are relatively modestly developed. The relative importance of this subsector is most pronounced in countries in which the ICT sector is relatively small. For example, in Azerbaijan and Kazakhstan, where less than 2 per cent of the business employment was in the ICT sector (figure III.1), the share of telecommunications within total ICT sector employment amounted to 67 per cent and 80 per cent, respectively. Telecommunications is the largest ICT sector employer also in Cuba (41 per cent), Mongolia (76 per cent), the Russian Federation (38 per cent) and Uruguay (44 per cent).[7] For most low-income countries, telecommunications services may offer the greatest opportunities for employment creation among the various ICT sector components.

Thirdly, in countries with a high level of ICT readiness, computer and related activities – which involve, for example, hardware and software consultancy services – often represent a significant part of employment in the ICT sector. This applies to developed countries, such as Japan (82 per cent), Israel (49 per cent) and Italy (49 per cent), as well as some developing countries, such as Brazil (56 per cent), Mauritius (64 per cent) and Chile (49 per cent). In all these three examples, the Government has had specific national strategies to develop IT and ICT-enabled services as a growth industry.

Both telecommunications and computer and related services play an important role not only as economic activities in themselves, but also in terms of facilitating greater uptake and use of ICTs in the rest of the economy. From the perspective of reducing poverty, it may thus be important for policymakers to foster these industries. For example, a vibrant maintenance and repair services industry is key to supporting ongoing use of PCs and other ICTs by enterprises and individuals.

As noted above, comparable data are lacking for most low-income economies, limiting the possibility to make international comparisons. This does not, however, mean that ICT-related activities are unimportant in these economies. As will be shown below, the ICT sector has helped to create new livelihoods and has contributed to poverty reduction in several respects. In many low-income countries, some production of ICT services by micro-enterprises is carried out in the informal sector. Consequently, it is necessary to consider sources of information other than official statistics when examining the ways in which an expansion of the ICT sector may affect the poor. At the same time, governments should – with the support of the international community – reinforce their efforts at producing data related to measuring the ICT sector. The next three sections look specifically at three areas of that sector, namely ICT goods manufacturing, IT and ICT-enabled services, and ICT micro-enterprises.

B. ICT GOODS MANUFACTURING

Manufacturing of ICT goods accounts for a significant share of global industrial activity and represents an important part of world trade.[8] At the same time, such manufacturing is highly concentrated into a relatively small number of countries, few of which have high rates of poverty. Contributions of ICT manufacturing to poverty alleviation are thus likely to be confined to those countries – mainly in Asia – that have successfully managed to develop an internationally competitive ICT industry. Within some of these economies, the impact appears to have been substantial.

1. High concentration of exports and employment

The most widely available measure of the relative importance of ICT goods in total manufacturing can be deduced from trade data. These cover most countries and are more up to date than other statistics, such as those related to employment or value added.[9] In 2008, ICT goods represented 12.7 per cent of global merchandise trade. By comparison, the shares of agriculture and automotive products were 8.5 and 7.8 per cent, respectively (WTO, 2009).

ICT goods exports are highly concentrated. The top five exporters – China, the United States, Hong Kong (China), Japan and Singapore – accounted for over half the world's exports of such goods in 2008, and the top 10 for more than 75 per cent (table III.2).[10] With the exception of Mexico, all developing economies included among the top 20 exporters are in Asia. The degree of concentration has increased over time (UNCTAD, 2009a). China is by far the largest exporter, responsible for more than a fifth of the world total, almost 2.5 times the share of the second largest exporter (United States). The share of developing countries in world exports of ICT goods continues to increase. In 2008, it stood at 58.4 per cent, up from 57.4 per cent the year before.[11]

The developing economies for which ICT goods make up the greatest share in total exports are primarily the four Asian Tigers (Hong Kong (China), Singapore, Taiwan Province of China and the Republic of Korea), and China, Costa Rica, Malaysia, Mexico and the Philippines.[12] In all these cases, the share exceeded 20 per cent in 2008. Meanwhile, two of these economies listed had a poverty rate of more than 5 per cent (annex table I.1): China (16 per cent) and the Philippines (23 per cent). Moreover, among countries in which at least 5 per cent of the population lived on less than $1.25 a day, the share of ICT goods in total merchandise exports was greater than 5 per cent in the Republic of Moldova (6.8 per cent), the Dominican Republic (5.8 per cent), Saint Lucia (5.7 per cent) and Viet Nam (5.5 per cent) (annex table I.1 and annex table III.2).

Table III.2. Top 20 ICT goods exporters, 2008 ($ million, %)

Economy	ICT goods exports in 2008, ($ million)	Share of total (%)	Cumulative share of total (%)	Rank
China	430,728.0	22.6	22.6	1
United States	174,864.6	9.2	31.7	2
Hong Kong, China	158,672.3	8.3	40.0	3
Singapore	122,990.5	6.4	46.5	4
Republic of Korea	115,624.7	6.1	52.6	5
Japan	115,239.1	6.0	58.6	6
Germany	111,704.1	5.9	64.4	7
Taiwan Province of China	82,087.1	4.3	68.7	8
Netherlands	73,857.7	3.9	72.6	9
Mexico	61,605.6	3.2	75.8	10
Malaysia	52,060.5	2.7	78.6	11
United Kingdom	37,805.8	2.0	80.6	12
France	34,829.9	1.8	82.4	13
Thailand	34,352.3	1.8	84.2	14
Hungary	26,916.9	1.4	85.6	15
Philippines	26,538.4	1.4	87.0	16
Czech Republic	22,457.0	1.2	88.2	17
Ireland	22,252.5	1.2	89.3	18
Sweden	18,629.9	1.0	90.3	19
Canada	18,572.6	1.0	91.3	20

Source: UNCTAD, based on COMTRADE data.

Employment data compiled by UNIDO confirm that ICT manufacturing accounts for important contributions only in a few developing countries, most of which are in East and South-East Asia.[13] They also suggest that remuneration levels tend to be comparatively high in ICT manufacturing. For a sample of almost 30 developing economies, wages and salaries in this industry were about 25 per cent higher on average than in the manufacturing sector as a whole.[14] In India, for example, they were about 64 per cent higher than in manufacturing in general, and in Indonesia the corresponding figure was 42 per cent.

2. Country evidence of ICT manufacturing and poverty reduction

As noted above, among the main exporters of ICT goods, relatively few are also characterized by a high incidence of poverty. However, in some of these countries, available evidence suggests that such production has had tangible impacts on the poor.

In *China*, the world's largest ICT exporter, manufacturing and exports of ICT goods have contributed in several ways to reducing poverty, even in rural and remote areas.[15] In 2008, its exports of ICT goods reached an all time high of almost $431 billion. An important share of its ICT manufacturing industry is accounted for by foreign affiliates of transnational corporations (UNCTAD, 2002; Liu, 2010). But there are also many domestic producers. For example, there is an entire industry of borderline formal-informal *shanzhai* phone production, which deals in imitated, and increasingly modified and innovative, mobile phone products (Shanzai.com, no date; Fei, 2008; Wu and Zhang, 2009). This industry numbers some 30,000 companies in Shenzhen (Ma et al., 2009) and was expected to ship 145 million units in 2009 (13 per cent of all phones sold in the world) (iSuppli, 2009).

The expansion of ICT-related production has contributed to an expansion of the ICT manufacturing workforce, partly supplied by redundant labour from rural areas. The creation of employment and income for migrant workers has been an important factor in this context. At the end of June 2009, there were about 150 million migrant workers within China, of which 97 per cent had reportedly found a job.[16] It has been estimated that 17 per cent of these jobs have been created in electronics and other ICT manufacturing.[17] In absolute numbers, this would correspond to some 25.5 million ICT manufacturing jobs for migrant workers.

Income from ICT manufacturing has contributed to capital flows from urban to rural areas. Assuming a monthly average income of 1,000 Yuan ($146) per capita, migrant workers from rural and remote areas together earn an estimated 300 billion Yuan from ICT goods manufacturing. Studies have shown that migrant workers tend to remit a large part of their income back home. A survey conducted by the Consultative Group to Assist the Poor (CGAP) found that remittances by Chinese migrant workers in 2008 amounted to between 191 billion and 330 billion Yuan ($28 billion–$48 billion), corresponding to 20–50 per cent of the total income of migrant worker households.[18] Other research suggests that more than half of the migrant workers remit 40 per cent of their income to their home towns.[19] This would translate into about 120 billion Yuan ($18 billion) that could be linked to ICT manufacturing in China and that flow in large part to rural and remote areas.

ICT manufacturing has furthermore helped to raise the quality of skills of migrant workers. Most entry-level workers in this industry have only middle school education, and no pre-job skills training. The ICT goods industry has provided a chance for these workers to become familiar with modern methods of production and urban life, and also to get to know modern ICTs. This has in turn facilitated faster growth in ICT penetration and application in Chinese areas. At the same time, given their disadvantaged position in the labour market and the intense working conditions in ICT manufacturing, the interests and rights of migrant workers are often at risk. This situation may affect the sustainable development of individual workers, illustrated in 2010 by a wave of labour disputes, which affected the ICT among other sectors.[20]

It has become a problem that the Government is currently making efforts to solve. For example, the Government is seeking to protect the interests and rights of migrant workers by strengthening contract, reducing illegal employment, raising awareness among migrant workers of work-related insurance schemes, providing legal service and legal aid, education for migrant worker's children, standardizing wage management, and safeguarding the right for safety and sanitation during the work of migrant workers.[21]

A side effect of the expansion of ICT goods production in China has been a rapid reduction in the price of many ICT goods, which has made such products more affordable for low-income consumers. For example, as of early 2010, Chinese rural people could buy mobile phones for about 200 Yuan ($29). ICT goods makers have paid increased attention to consumers with weak purchasing power, developing products that are oriented to serve rural users and provide preferential offers in terms of prices and services. Some of these efforts are in response to specific government policies (box III.2).

In the *Philippines,* the ICT manufacturing industry employed some 222,000 people in 2005, corresponding to about 22 per cent of the entire manufacturing workforce, and 23 per cent of total wages and salaries paid in the manufacturing sector.[22] ICT goods exports have soared, amounting to $27 billion in 2008, or more than half of the country's total merchandise exports. No study has been encountered that has explicitly explored the direct and indirect effects of these industrial activities on poverty. However, it has been noted that the exports have mainly been the result of assembly activities, with limited added local value beyond wages and salaries. Moreover, although the average wages in the electronics industry are relatively high compared with other parts of the manufacturing sector, they are often well below what has been deemed a "living wage" (Schipper and de Haan, 2005). Thus, the main potential impact on poverty would have come through direct job creation and various indirect and second-order effects.

In *Costa Rica,* ICT goods also make up a significant share (23 per cent) of total exports. The arrival of Intel – the world's largest maker of semiconductors – triggered a rapid expansion of new jobs in the ICT sector (Ernst and Sánchez-Ancochea, 2008). In less than three years, the company created more than 2,000 new employment opportunities, as well as accelerating investments (Larrain et al., 2001). Although semiconductor production is regarded as

Box III.2. Interventions in China to expand ICT use in rural areas

Chinese Government at all levels has actively sought to leverage ICTs in the process of reducing poverty in rural areas. Interventions have been undertaken in several areas. Some initiatives are aimed at promoting greater access to ICT devices among users in rural and remote areas. Since 2008, the Government of China has implemented a scheme entitled *Home Appliances Going to the Countryside* to encourage enterprises to sell electronic products to rural subscribers at a subsidized price. Mobile phones, computers and other ICT terminal devices are among the products promoted. In the first quarter of 2009, the Ministry of Commerce started the project of *Computers Going to the Countryside* and required that enterprises winning a bid should provide farmers with computers for about 3,000 Yuan ($439) against which the Government would provide a 13 per cent subsidy. In the industry that was stimulated by this project, final sales amounted to 5 million computers.[a] Together with the roll-out of infrastructure, the initiative has enabled more rapid diffusion of ICTs in rural areas.

Source: Information provided by the Chinese Academy of Science and Technology Management, Tongji University.

[a] *See "Liu Chuanzhi: 5 million Legend Computers going to countryside in 3 years", Beijing Daily, available at http://d1.it168.com/show/12427.html.*

a high-tech industry, the activities undertaken by Intel in Costa Rica primarily involve testing and assembly work, which does not require many highly trained workers (Ernst and Sánchez-Ancochea, 2008). Costa Rica's success in creating employment in ICT manufacturing contributed to an annual increase in labour productivity in that industry of 25 per cent between 1991 and 2005. However, this was not accompanied by equally fast growth in real wages. As in the Philippines, domestic value added has primarily been in the form of wages and salaries; local backward linkages have been limited (Paus, 2005; Gamboa et al., 2006).

The ICT goods industry is highly competitive, leading to constant efforts at reducing prices to win market shares. Whereas it has seen a rapid increase in the number of people employed, especially in selected Asian economies, the working conditions have often not reached internationally acceptable standards. While some improvements have been noted in various regards in recent years, serious issues remain, including with regard to discrimination, excessive overtime hours, low wages and exposure to health, safety and environmental risks (see e.g. Nordbrand and de Haan, 2009; SACOM, 2006).

3. Conclusions

ICT goods manufacturing currently constitutes a significant production activity in only a few developing countries. Among countries with relatively high rates of poverty, it is currently significant only in China and the Philippines. Global production is characterized by large economies of scale and high barriers to entry for new companies and countries. Although no studies have been encountered that deal directly with the poverty impact of ICT manufacturing, limited empirical evidence from China, Costa Rica and the Philippines, suggests that it has made various contributions in this regard.

Available information does not permit a full assessment of the impact on all aspects of the livelihoods framework presented in chapter I. However, contributions involve job creation, including for workers with relatively low initial levels of skills. Secondly, in the case of China, remote areas have seen increased capital inflows through remittances from migrant workers back to their home villages. Thirdly, second-order effects are also likely to have played a role, for example through increased spending by workers employed in the ICT manufacturing industry on goods and services, with trickle-down effects on domestic workers and local enterprises. These effects are likely to have improved the financial assets of both the workers and their families. In addition, working in ICT-oriented manufacturing enterprises may have offered some opportunities for learning and skills upgrading, thus also developing human capital assets. At the same time, examples of discrimination, excessive overtime, low wages and exposure to health, safety and environmental risks have also been observed, with negative consequences for the people concerned. Thus, more detailed research is needed to obtain a better picture of the full effects of ICT manufacturing on poverty.

C. IT AND ICT-ENABLED SERVICES

A growing number of developing countries view the outsourcing and offshoring of services as a potential source of job creation and export revenue. Inspired by the success of, notably, India and the Philippines, other developing countries are eager to jump on the bandwagon and benefit from the "tradability revolution", which has been facilitated by the roll-out of high quality broadband connections (UNCTAD, 2004b). Meanwhile, few studies have examined the impact of the production of IT services (such as software development) and ICT-enabled services (such as contact centres and various business processes) on poverty. Such an analysis is hampered by the lack of data and by the absence of detailed empirical studies. This section sheds some light on this issue by drawing primarily on the experience of India and the Philippines, highlighting recent developments of particular relevance for the poor.

1. Outsourcing and offshoring of services

Increased broadband connectivity in a rising number of countries has facilitated the reorganization of the production of many business functions. Activities that once required face-to-face contact can now be split up into smaller components, which in turn can be undertaken in places offering the best locational advantages. Fragmentation of different services into separate processes can result in outsourcing (the process being undertaken by another company) and

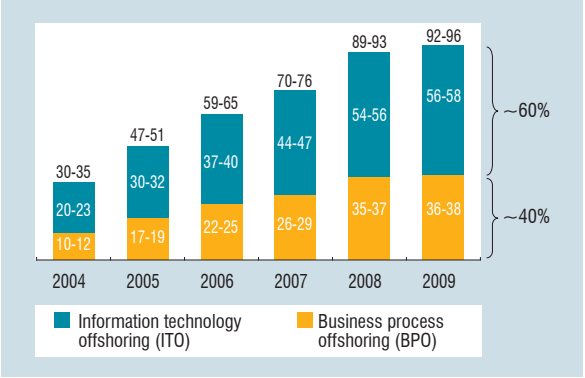
offshoring (the process being undertaken in another country) or both. The trend started with domestic outsourcing in developed countries (especially the United States). Subsequently, companies started to exploit opportunities for offshoring IT services and other ICT-enabled services to developing countries, which could offer lower labour costs, additional supply of human resources as well as the possibility to provide services round the clock.

The global market for the outsourcing of services was estimated to be worth $785 billion–805 billion in 2009, of which 88 per cent was domestic and the remainder international (i.e. offshore sourcing).[23] Two thirds of the global outsourcing market is related to information technology services (such as programming, systems integration, application testing, IT consulting, software development and IT support services). The rest involves outsourcing of various business processes. As mentioned above (section A), some of these services are clearly captured by the ICT sector definition, while others are borderline cases. The trend towards outsourcing and offshoring is still at an early stage, and is expected to continue to expand geographically and sectorally as well as across business functions (UNCTAD, 2009a). Recently, there has been growing interest also in developing countries to undertake domestic outsourcing.

Despite the economic crisis, the offshoring of services was relatively resilient (UNCTAD, 2009a). This was partly because many companies saw the offshoring of service activities to low-cost locations as one way to cope with a more competitive environment. Thus, even in 2009, the value of IT services and ICT-enabled services sourced in a foreign location continued to expand, albeit at a slower pace. Global exports resulting from the offshoring of IT services and business processes has been estimated at $92 billion–$96 billion in 2009, up from $30 billion–$35 billion in 2004 (figure III.4). However, these estimates do not include all cross-border sourcing occurring among high-income countries and therefore underestimate the total value of offshoring.[24]

Judging from market analysis data, the economic crisis led to both geographical consolidation and diversification in the case of ICT-enabled services. For the front-runners, India and the Philippines, their combined share of the world market for business process offshoring remained stable at about 50 per cent (figure III.5).[25] By contrast, the share of the

Figure III.4. Global market for offshoring of services, 2004-2009 ($ billion)

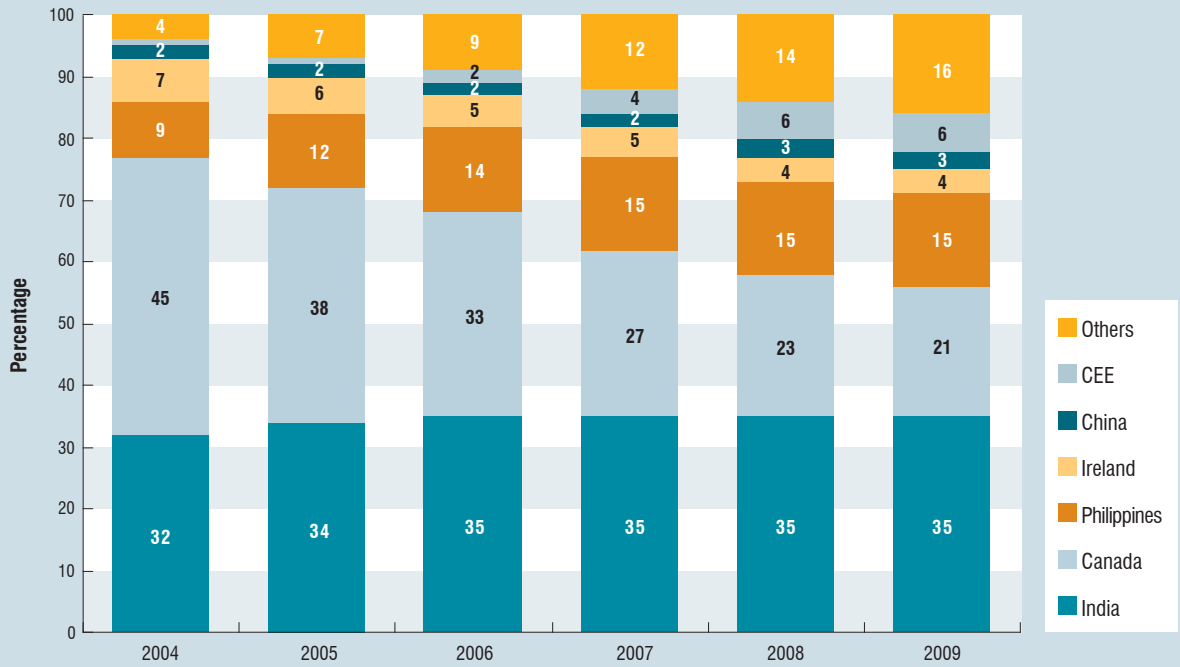


Source: UNCTAD, based on information from the Everest Research Institute.

second largest exporter, Canada, continued to shrink to 21 per cent. Beyond these top three locations, several economies from all continents are making inroads as offshoring destinations. The group of "other destinations" in figure III.5 surged from 4 per cent in 2004 to 16 per cent in 2009. The main such locations in 2009 included China, Thailand and Sri Lanka in Asia;[26] and Argentina, Brazil, Costa Rica and Mexico in Latin America. On the African continent, Egypt, Mauritius, Morocco and South Africa all have more than 10,000 offshore jobs in the IT and ICT-enabled services sector (Everest Research Institute, 2009). The share of countries in Central and Eastern Europe was unchanged at 6 per cent between 2008 and 2009.

Many more developing countries are aspiring to benefit from the opportunities created by better connectivity. This applies not least to those African countries that recently secured access to new submarine fibre-optic cables. In Kenya, for example, the Government has set a target for the number of jobs in the business process outsourcing (BPO) sector to increase from the current 8,000 to 120,000 by 2020, and Ghana aims to create 40,000 new BPO jobs by 2015.[27] Some LDCs have also started to eye this area, including Nepal (box III.3). However, it is worth noting that it takes more than affordable broadband to succeed in attracting offshoring activities. In particular, latecomers need a pool of appropriately trained and skilled human resources, reliable power supply and a conducive legal and regulatory environment. In view of the expanding interest in services outsourcing and offshoring, it is relevant to consider its potential for poverty reduction.

Figure III.5. Global market for business process offshoring, 2004-2009 (%)



Source: UNCTAD, based on information from the Everest Research Institute.

Box III.3. Offshoring of animation services to Nepal

The ICT-enabled services industry is at a nascent stage in Nepal, with $10 million–$15 million in export revenues in 2007. Nonetheless, in January 2008, Incessant Rain Animation Studies (IRAS) chose to set up a state-of-the art animation facility in Kathmandu. IRAS has been able to win some high profile animation and visual effects projects from Hollywood. For example, IRAS produced Disney Diwali, a 50-second piece which introduces the classic Disney characters, Mickey Mouse, Minnie Mouse and Donald Duck, in an Indian setting.

Specializing in computer graphics, visual effects and 3D stereoscopic animation, IRAS' production services include concept, storyboarding, designs, layout, modeling, texturing, animation, lighting, special effects, post-production and visual effects. It is producing for international clients such as Walt Disney Studios, Zoic Studios, RVK Studios, XLT Productions, Multi Plane Productions, Pipsqueak Films and Sun Animatics. At the same time, it has also been contracted by such organizations as the United Nations World Food Programme and the Ace Development Bank.

The founder and CEO is a native of Nepal. Before moving back to Kathmandu, he had spent 17 years at Walt Disney, producing and supervising movies such as "Beauty and the Beast" and "The Lion King". On one trip to Nepal, he was exposed to local talented youngsters and their love for art. This motivated him to leave his career at Disney and to open a studio in Nepal. With BPO and IT outsourcing drifting towards South Asia, he saw an opportunity for animation in Nepal. He established IRAS together with two Nepalese professionals, both with extensive experience from the IT and BPO industry.

The production facility currently holds 85 artists with an IT support team. In addition to creating employment and incomes, the company has brought in skills and knowledge from abroad. It presents an opportunity for young Nepalese to work for the international market without leaving the country.

While Nepal offers low labour costs, several other areas need to be addressed in order for the IT and ICT-enabled services industry in Nepal to take off. Key issues include political stability, skills development and better financing of start-up companies. The design and implementation of an effective strategy to boost Nepal as an offshoring destination will require close collaboration between the Government and relevant industry and civil society organizations in the country.

Source: UNCTAD, based on information provided by Nepal's High Level Commission for Information Technology.

2. Possible implications for poverty alleviation

There is little doubt that outsourcing and offshoring have contributed to economic growth and wealth in some of the leading supplier countries. In India, for example, revenue earnings of the IT services and ICT-enabled services industry grew from less than $1 billion in 1990 to almost $60 billion in 2009 (Nasscom, 2009). The industry's share of total Indian exports (merchandise plus services) increased from less than 4 per cent in 1998 to 16 per cent in 2008 and is expected to reach at least 18–20 per cent in 2009/10 (Mitra, 2009). In 2008, the IT and ICT-enabled services contributed about as much to India's GDP growth as did the agricultural sector.[28] In the Philippines, BPO export revenues rose from $100 million in 2001 to $6 billion in 2008 (Philippines, BPAP, 2009). In fact, on a per capita basis, its IT and ICT-enabled services sector is bigger than India's (Mitra, 2010).

Despite the proven wealth generation potential,[29] few studies have focused on the implications of this sector for poverty reduction. Potential channels for poverty reduction include overall economic growth, direct and indirect employment, worker remittances, taxation and corporate social responsibility (CSR). Most of the empirical evidence presented below relates to India, which has the longest and most widespread experience from this industry.

a. Direct and indirect employment

In the leading developing-country exporters, the IT and ICT-enabled services sector has emerged as a significant generator of jobs. In India, direct employment in this industry was estimated at about 2.2 million in March 2009, of which 1.7 million catered for the export market (Nasscom, 2009).[30] In the Philippines, the Government estimates that the BPO sector employed about 400,000 people in 2008 and expectations are for this number to grow to more than 900,000 by the end of 2010 (Bird and Ernst, 2009; Philippines, BPAP, 2009).

In addition, this expansion has had multiplier effects on other parts of the economy with additional job creation. In India, for example, it is estimated that every new job in IT services or ICT-enabled services generates another 3.6 indirect jobs in related areas (Nasscom, 2009 and 2010). In the Philippines, it has similarly been found that each new job results in two to three new jobs in other industries (Philippines, BPAP, 2009). Opportunities offered outside the IT-BPO industry itself include formal or informal sector work in facility maintenance and security, transportation and other communication services, restaurant, shops, construction and various small business vendor entrepreneur operations, as well as domestic workers. For example, in Bangalore, India, the number of maid servants and construction workers has surged.[31]

In contrast with ICT goods manufacturing, people who seek employment in this industry generally need to meet certain requirements in terms of language skills, ICT skills and other more specialized capabilities to be hired. In the Philippines, for example, most call centres expect employees to have at least a two-year college education, besides possessing excellent oral and written English language skills (Bird and Ernst, 2009). Those working in the IT-BPO sector are typically paid 50–100 per cent more than in other service jobs, and tend to fall into the top income quintile (Roxas-Chua, 2008). Consequently, the entry barrier to be employed is relatively high, making it difficult for poor people with limited or no education to be hired. Most direct job generation in the IT and ICT-enabled services industry has benefited the middle class but not so much the very poor (Krishna and Brihmadesam, 2006). The greatest chances for poor people to find direct employment are in segments with the lowest entry barriers and the lowest compensation levels, such as facility maintenance, security, transports and low-end data entry. There may also be greater opportunities to find employment in companies servicing the domestic rather than export markets (Crisil-Nasscom, 2007; Nasscom 2010, interviews).

b. High level of urbanization starting to change?

A common feature of this industry is high concentration into a few large cities. In India, 91 per cent of employment in the industry is found in so-called "tier 1 cities", such as Bangalore, Chennai, Hyderabad, Kolkata, Mumbai, the New Delhi area and Pune (Nasscom, 2009). In the Philippines, as much as 80 per cent of all BPO activity is concentrated in and around the capital, Manila. One effect has been more migration into the rapidly expanding cities.

For the expansion of the ICT sector to have a significant impact on the rural poor, linkages between the urban and rural areas are important (Tiwari, 2006). Earlier studies pointed to virtually no links between IT and ICT-enabled services and the rural economy (Pigato, 2001). However, similar to the example of

ICT manufacturing in China, migrant workers typically remit significant amounts of money to their dependants, some of whom belong to poor communities in rural areas and smaller townships (Desihingkar and Akter, 2009). Moreover, there appears to be – albeit starting from a low level – growing interest among companies in seeking out outsourcing opportunities also outside the main metropolitan centres. In both India and the Philippines, companies have begun to spread to second and third tier cities, and some ICT-enabled services are even being established in rural areas. For example, the Tata Group has stated that it aims to hire 5,000 people for rural BPO activities over the coming years, and other companies are voicing similar plans.[32] In India, employment in tier 2/3 cities has increased by 50 per cent since 2007, and the rural BPO segment is set to grow by over 10 times until 2012. In fiscal year 2008/09, rural-based BPOs contributed an estimated $10 million in sales (Nasscom, 2010). If the expansion into new cities and smaller towns continues, it may create new direct and indirect employment opportunities for the poor.

c. Tax revenues and corporate social responsibility initiatives

Although the IT and ICT-enabled services sector has emerged as one of the biggest employment and income generators in India, its contributions to government tax revenue remain modest. In fiscal year 2008/09, the industry and its employees contributed about $4.2 billion in taxes (Nasscom, 2010). As part of the Government's strategy to promote the sector, most of the industry has been exempt from paying corporate tax since the early 1990s. Tax revenues generated are mainly the result of direct taxes paid by employees. There is a debate as to whether the tax exemption should be maintained, given the very high profit levels achieved in recent years (e.g. Murthy, 2010). Greater tax revenue could, if wisely spent, provide more funds for investment in poverty reduction projects.

Some Indian and foreign companies with operations in this industry in India have established CSR programmes. Activities include education and training, health care and food programmes for the poor. Overall, industry contributions to social development exceeded $50 million in fiscal year 2008/09, and almost two thirds of companies in this industry reportedly undertake some socially or environmentally relevant activities (Nasscom, 2010). For example, the "Akshaya Patra Foundations" programme, sponsored mainly by Infosys Technologies and others, in 2009 provided free daily meals to more than 1 million poor children and aims to reach 5 million children by 2020 (Akshaya Patra, 2010). Infosys has committed to set aside one per cent of its gross total revenue to charity mainly to the poor (Infosys, 2009). Similarly, the activities of the Nasscom Foundation aim at helping the poor and other underprivileged groups (Nasscom Foundation, 2008). With the continued growth in the wealth of entrepreneurs in the Indian IT and BPO industry, charitable work in this sector is expected to increase (Bain and Company, 2010).

d. The case of social outsourcing

Another representation of the intersection between business and society is the relatively new phenomenon called "social outsourcing". It refers to the targeting of outsourcing contracts to poor communities in developing countries with an explicit aim of poverty alleviation or the achievement of other socio-economic development objectives (Heeks and Arun, forthcoming). A number of such initiatives involve outsourcing of IT or ICT-enabled services. This kind of outsourcing can be done by governments, the private sector or civil society organizations and is an interesting way to encourage greater linkages between rural and urban areas in the context of ICTs. As in many other related activities, India and the Philippines have been pioneers.

In Kerala State in India, the State Government saw a need to outsource some of its IT activities to promote computerization and to find skills that were not available inside the government offices (box III.4). Other examples have been noted elsewhere in India, such as in Rajasthan (box III.5), as well as in the Philippines (OrphanIT)[33] and Cambodia (Digital Divide Data) (Leonard et al., 2007).

e. Potential downsides

From a poverty reduction perspective, the limited number of cases reviewed above point to potential opportunities from outsourcing and offshoring. However, it is clear that benefits to the poor segments of society are not automatic. For example, concerns that the expansion of the IT and ICT-enabled services sector in India will lead to a more polarized and uneven development should not be brushed aside (D'Costa, 2003).

In India, the expansion of IT and ICT-enabled services has also had certain adverse effects. It has contrib-

uted to attract more migrants from rural to metropolitan areas, fuelling the development of urban slums. Social critics have argued that poor persons who have migrated to large urban centres from rural areas or smaller towns would sometimes have been better off not doing so as they lose out on social interactions and other aspects important for overall quality of life.[34] The trend observed above of companies setting up ICT-enabled services also outside the metropolitan centres may lead some people to seek out job opportunities locally rather than migrating to urban areas.

Moreover, the expansion of the industry has led to higher prices for land, housing and various services. In some cases, land has also been taken away from the poor with compensation below actual market prices (Benjamin, 2000; Dittrich, 2007). Urban poor living in central locations have thus been forced to move to more remote or less attractive places where land, housing and other services are more affordable.[35] Finally, some observers have noted that the rapid change in the socio-economic context spurred by the expansion of the IT and BPO industry in certain cities in India has resulted in greater focus on individual profit-maximizing behaviour and the erosion of traditional community ties and value systems (Raghunathan, 2006).

3. Conclusions

The outsourcing and offshoring of services are still at a nascent stage in most developing countries. Nonetheless, many governments have their eyes set on this phenomenon and are eager to tap the opportunities created by better broadband connectivity. In general, due to the often demanding skills requirement for the production of related services, there are limited opportunities for the poor to enter this industry. Most activity in the leading suppliers among developing countries has concentrated into a few urban areas.

The poor classes whose livelihoods are most likely to be affected by IT and ICT-enabled services production include those who live in major cities or their urban peripheries (or who are willing to migrate to a major city), and those who command at least basic education and English language skills. Parts of the population with little or no chances to benefit directly include those who are illiterate, and those who are culturally or otherwise marginalized in modern society. Probably the most important effect on the poor in the short term is linked to indirect job creation and other second-order effects from an expanding ICT services sector.

Some recent developments of potential relevance for poor people are worth highlighting. First, in both India and the Philippines, there is a trend among companies to explore also second- and third-tier cities. This may extend the possibilities for more people to be affected directly. Secondly, there are examples of BPO services being established in some rural areas. This is particularly interesting in light of the fact that the bulk of poor people lives in rural locations. However, as illustrated by the all-woman-run Source for Change, in order to succeed, rurally based companies may have to defy existing prejudices and prove to potential clients that it is possible to deliver high-quality services from a rural location. Thirdly, the trend towards

Box III.4. Social outsourcing in Kerala State

Instead of turning to the private sector, the State Government of Kerala, India, chose to support the creation of IT-oriented social enterprises as part of its poverty eradication strategy. The project started with a couple of pilot enterprises in 1999, whereby a group of about 10 unemployed women from below-poverty-line households were brought together to form a social enterprise. The women had to possess certain skills and be able to invest at least $30. The Government supplied a grant of 10 times the group's investment and then helped secure additional bank loans if necessary. Since 1999, more than 200 such enterprises have been formed to provide IT training, data entry, digitization or PC assembly and maintenance.

The results are promising. An in-depth assessment of the poverty alleviation effects of working in these enterprises found that the women concerned saw gains in all livelihood assets. They reported increased earnings corresponding to an average of 43 per cent of household income (financial capital); all women had obtained new technical and entrepreneurial skills (human capital); 90 per cent of them had invested in physical capital such as gold, housing and equipment (physical assets); 96 per cent could demonstrate improved social capital in relation to business, community and/or institutional linkages (social capital); all reported growth in self-confidence, and two-thirds reported greater respect, recognition and acceptance in their families and communities (political capital/empowerment).

Source: Heeks and Arun, forthcoming.

social outsourcing is promising. Although still small in magnitude, governments and other stakeholders may view social outsourcing as a development tool.

In order to reduce the risk of polarization and social tensions linked to widening income disparities, policymakers can focus on skills development, rolling out infrastructure and exploring possible ways of catalysing the emergence of enterprises that can provide outsourced services to potential public and private clients, and market themselves as BPO providers. People who work for such enterprises, especially in IT services, have a chance of upgrading skills that are generally in high demand in society. There is also evidence that working in this industry has contributed to empowerment and an improved status in the local community. Finally, governments also need to be aware of the difficulties involved in entering this market. While there are clear opportunities emerging –as the trend is likely to grow in scope and size–in order to succeed, countries need to meet stringent requirements in terms of infrastructure quality and cost, availability of skills and the regulatory framework.

Box III.5. BPO opportunities for women in rural India: the case of Source for Change

Growing demand for BPO services in India is generating new jobs outside metropolitan areas. In the western State of Rajasthan, rural women with modest education are earning new income from employment opportunities in the BPO industry. Since 2007, the company Source of Change is providing ICT-enabled services to clients in other parts of India as well as abroad.

Source for Change was founded on the idea that social values can be achieved through the private marketplace. It provides BPO services from its data entry centre in Bagar, a town of about 10,000, most of whom speak only Hindi or Rajasthani. Bagar has one of the lowest rates of female school attendance in India. This all-woman, rural enterprise addresses both business and social needs. For its clients, it competes in the marketplace with high-quality services, such as data entry, web research and local language call services. It has given some rural women the chance to gain technology skills and employment in a location with few similar options.

The company interviewed 27 women, of whom the 10 best candidates were hired. Following two months of training in English and computer skills, they began working as business process associates. For admissions into the training programme, candidates had to have completed 10th grade at school. They also needed to pass a test related to English writing, critical thinking, problem-solving and professionalism.

There are 25 computers and a server in the office. Internet services are provided by Bharat Sanchar Nigam Ltd. (BSNL), through which the company enjoys broadband access to the Internet at the speed of 1.2 Mbps. The company has reliable electricity for 20–22 hours per day. If the electricity is out during work hours, a generator ensures uninterrupted work flow.

As of early 2010, the operation had grown to 25 employees in Bagar, and there are plans for further expansion. Source for Change aims to have about 500 employees at the end of 2012. But one day it hopes to offer various IT-based careers to some 5,000 women in rural India. The idea is to set up more small centres in other rural areas. The company intends to develop a "hub and spoke" system comprising centres with 30–50 employees. With the planned configuration, different centres should be able to share resources. For instance, an IT specialist may serve multiple centres.

The success of Source for Change has led people in Bagar to accept the radical notion of rural women producing high-quality IT services. A challenge for the company has been a general lack of trust among urban-based corporate clients in high-quality BPO services being provided from a rural location. In spite of this scepticism, some clients have been found both inside India and abroad. As of 2010, the main clients of Source for Change included Pratham (India), the University of California–Los Angeles (United States) and Piramal Water (India).[a]

For the women concerned, working for Source for Change has led to a stronger social standing in their families and communities. Initially, local people in Bagar were sceptical to the idea that women would be able to perform the required IT-enabled work. Those employed soon rose from the status of oddities to community leaders. Women are often also more likely than men to invest their incomes to the benefit of their families.

The experience of Source for Change suggests that there is scope for more BPO based in rural areas. Policymakers should identify existing bottlenecks to be removed to foster further BPO dissemination in rural areas.

Source: UNCTAD, based on company interview.

[a] *Pratham is a large NGO working to provide quality education to underprivileged children in India. Piramal Water Private Limited is a social enterprise that develops sustainable drinking water solutions for rural and urban populations in India.*

D. ICT MICRO-ENTERPRISES AND THE INFORMAL SECTOR

As noted in chapter I, the majority of the poor operates or works in micro or small enterprises, including in the informal sector.[36] Micro-enterprises[37] provide significant employment in many developing countries, not least for those in poor segments of society (Mead and Liedholm, 1998). They act as a crucial "safety net" by providing small income and jobs, complementing the formal sector. Micro-enterprises are typically connected with small goods trading and clusters of industrial production (Brown, 2006; Nadvi and Schmitz, 1999). In recent years, new micro-enterprises have emerged around ICTs in developing countries (Foster and Heeks, 2010). This trend may have a non-negligible effect on economic development and poverty alleviation. The notion of "ICT micro-enterprises" here refers to those for which ICTs represent the key input for the selling of new products and services.[38] Examples may include local ecosystems of mobile services and sellers, international telecoms and VoIP providers, cyber cafes, IT training and ICT repair services. Some of these fall squarely in the ICT sector definition (section A), while others may not.

ICT micro-enterprises offer potential through their ability for service modification and innovations connected to the inherent flexibility and reconfigurability of ICT products. Although their potential is similar to that of other micro-enterprises, the flexible and dynamic nature of ICTs provides additional potential for adaptive survival and dynamic growth from their often lowly origins. Informal sector entrepreneurs are likely to be better placed to understand and cater for the poorest groups. There are furthermore many examples of women that have found new livelihoods in ICT micro-enterprises (see e.g. Arun et al., 2005).

1. The expansion of ICT micro-enterprises

Various new job opportunities in micro-enterprises have emerged as a result of the growth of ICT use and especially of the mobile phone revolution. However, judging the size of new employment generated is difficult. Such industrial activity in developing countries tends to be under-reported, not least because much of it takes place in the informal sector. Systematic data to account for this phenomenon is generally scarce, but there is growing anecdotal evidence.

An estimate of the telecommunications sector in Pakistan found that it was responsible for the creation of some 1.4 million jobs (PTA, 2007). Only 12,000 of these were directly employed by mobile operators. About 270,000 were classified as "indirect" mobile jobs involving installation, retail, repair; and 450,000 as being "induced" by mobile telephony (i.e. counting the broader impact). Of the remaining jobs, 480,000 were related to payphones, and 120,000 to long-distance telephony. While the precise share of micro-enterprises is not known, some 70 per cent of the total – around 900,000 – were payphone operators and airtime retailers of the type found in poor communities (PTA, 2007). According to another study, one sixth of all new registered enterprises in Benin City, Nigeria, were PC/Internet-related micro-enterprises, i.e. involved in IT training, software, Internet services, cyber cafes, etc. (Agboma, 2010). How many of these that draw entrepreneurs and employees from poor communities is unclear, however.[39] Micro-studies of the urban slum in Mumbai, India, have documented a wide range of ICT-based enterprises engaged in many different activities (Rangaswamy and Nair, 2010: 9):

> *"Arguably, the slum quarter houses around 20 PC assembling and repairing units, 17 on-line agents mostly engaged in on-line railway ticketing and utility e-bill payments, and 100+ mobile phone stores, some selling small re-charge coupons to those selling handsets and accessories and around 50% of them graduating to hardware/software repairing and servicing units."*

The mobile sector provides probably the most dynamic source of ICT micro-enterprises. In many parts of the developing world, ecosystems of mobile entrepreneurs have sprung up to serve local demand for mobiles and for associated applications and services. In many cities, there is a proliferation of shops and market stalls selling used and new mobile phones; kiosks that offer mobile phone applications, ringtones, wallpapers and content, and services such as installation and setup; device repair services ranging from swapping out components to re-soldering circuit boards to reflashing phones in a different language; and repairers who rely on informal social networks to share knowledge on common faults and repair techniques (Chipchase, 2009). Selling airtime on the streets employs large numbers of people in low-income countries. Such services can play an important role in sustaining the use of ICTs, especially among poor segments of the economy.

In some countries, ICT micro-enterprises have also played a role in extending connectivity to remote areas not well covered by established operators.

According to Grameen Bank, there were more than 350,000 village phone ladies in Bangladesh by the end of 2008.[40] The additional income from selling telephone service and Internet-based facility through the electronic recharge system of village phone ladies was at one time almost double that of the national per capita income. In some stages of this project, these ladies earned an income averaging around $300 per year, representing 24 per cent of their household income on average (Richardson et al., 2000). Similar developments have been witnessed in other countries, including Ghana (Sey, 2008) and Uganda (Kyomuhendo-Bantebya, 2009). As will be discussed below, however, the sustainability of this business model has gradually been eroded with the rapid diffusion of mobile phones.

In Kenya, mobile-money is creating jobs and a new source of income in both urban and rural areas. The M-PESA system allows for the deposit and transfer of money, through the interventions of agents which are often small shops which also engage in other retail activities. As noted in chapter II, in April 2010, there were some 18,000 M-PESA agents in Kenya.[41] These agents are paid through a commission for facilitating the mobile-money operations. According to a study of M-PESA retailers in Western Kenya, this activity translated into additional post-tax daily incomes of $5 for rural stores, and up to $30 a day in the case of an urban store in a city centre (Eijkman, Kendal and Mas, 2010). These amounts constitute a significant additional source of income in a relatively poor region. Interestingly, the same study found that the mobile-money operations typically resulted in net cash flows from urban centres to rural areas, in effect from the better-off to poorer regions.

2. Features of ICT micro-enterprises

a. Using niche strategies to compete

ICT micro-enterprises often service a need that is not well catered to by larger enterprises in the formal sector. Rather than being in competition, there is typically a level of co-existence and complementarity between the informal and formal service providers. For example, the "cyber-informal" centres in the Bolivarian Republic of Venezuela (Lugo and Sampson, 2008) sell mobile cards, phones, accessories, repair and unlocking services. Services are provided by individual entrepreneurs or small organizations who, for various reasons, operate in the informal sector. These micro-enterprises actively connect into the local ecosystem, which allows them to provide services even when they do not have the skills, as well as using interconnected networks of wholesale supply when required. Oftentimes, the centres are located next to formal government-owned (CANTV) mobile shops. Many of the cyber-informal centres are exploiting "niche markets" (Lugo and Sampson, 2008), differentiating themselves by providing modifications and services better suited to a certain segment of the population.

Informal mobile entrepreneurs often provide a price advantage over other, more formal outlets. This is achieved, for example, by splitting products – such as phone top-ups – into smaller portions to fit better with the cash flows of less affluent customers (Rangaswamy, 2009b) or through providing cheaper alternatives to formal products, for example by selling unbranded Chinese phones (Rangaswamy, 2009b). In Mumbai, India, established suppliers have been observed to protect their reputation by avoiding certain activities – for example, provision of "pirated" phones – and rather call upon informal "partners" (Rangaswamy 2009a). Similarly, in Indonesia, micro-enterprise repairers offer services that modify the innards of mobile phones to allow customers to use dual SIM cards for cheaper calling (Barendregt, 2008; Chipchase, 2009).

The informal and formal sectors thus appear to co-exist in an unstable equilibrium of coordination and competition, where one influences the growth of the other (Ilahiane and Sherry, 2008). Connections between larger formal enterprises and ICT micro-enterprises can provide potential benefits to both parties. In the long term, local innovations made in micro-enterprises can be leveraged into wider contexts, and challenge existing capabilities developed in more sophisticated market segments (London and Hart, 2004). For example, street level phone operators are increasingly employed by formal mobile companies in developing countries. These operators provide a similar customer-oriented niche originating from the informal sector (Sey, 2008). Similarly, the dual SIM card mobiles, first added to phones in backstreet mobile repair shops, are now becoming commercial products, produced by TNCs like Nokia and Samsung (Chipchase, 2009). Mobile-money services have also

grown out of informal schemes of mobile-money transfers in developing countries (Donner, 2007a; Tall, 2004; Chipchase and Tulusan, 2007).

Global transnational corporations (TNCs) such as Nokia and Vodacom, and mobile telecom operators such as Gamcel or Grameen Phone, work through ICT micro-enterprises in developing countries, allowing space for local innovation and adaptation of business models (Rangaswamy, 2008; Chipchase, 2009; Chipchase and Tulusan, 2007). In Ghana, micro-enterprises in the form of mobile payphone operators, helped to uncover a demand for very small quantities of airtime that was hitherto hidden and thereby helped extend mobile connectivity to remote parts of the population (Sey, 2008).[42] In one sense, locally emergent enterprises are being powered (and empowered) by large formal enterprises, but are acting in different ways.

Meanwhile, there is also a more critical view of the potential of ICT micro-enterprise, particularly in relation to its supply chains. In value chains spanning both formal and informal players, the larger partners are likely to extract much of the profits, thus limiting the transformational potential of poor micro-entrepreneurs. There is still little hard evidence beyond anecdotes which points towards poverty alleviation and best practices for poverty alleviation within the bottom of the pyramid (London, 2007). The growth paths of mobile and other ICT entrepreneurs may be limited in the longer term and entrepreneurs may be destined to remain in a marginal position.

b. Opportunities for entry, growth and upgrading

From the perspective of contributions to poverty alleviation, an important aspect of ICT micro-enterprises is that the barriers to entry as well as skills requirement can be very low. The entry paths taken by entrepreneurs involved in the mobile sector are diverse, but often connect into other ICT industries, as well as parallel activities where similar technical skill sets can be observed. The simplest mobile card selling or vending jobs can be conducted by people with limited formal skills and capabilities. In Gambia, for example, disabled street beggars were offered the opportunity to start working for Gamcel, one of the mobile telecom operators (box III.6).

Entrants into the mobile sector come from different backgrounds. In the Bolivarian Republic of Venezuela, mobile entrepreneurs are documented as often being former IT workers turned unemployed (Lugo and Sampson, 2008). In India, many mobile sellers have come from the electronics repair and media distribution industries popular in the 1990s (Sundaram, 2009). In Morocco, some entrepreneurs have been documented as moving from car repairs to the mobile sector (Ilahiane and Sherry, 2008), and in China there are many connections between the *shanzai* mobile companies and those Chinese companies at the bottom of the TNC supply chains for mobile phones (Wu and Zhang, 2009).

Many mobile micro-enterprises work also in other sectors, notably PC refurbishment and repair, skills training, media distribution and digital photography services (Sundaram, 2009; Rangaswamy, 2008 and 2009b; Lugo and Sampson, 2008). In part, this reflects the typical diversification of informal sector entrepreneurs, keenly aware of their own vulnerabilities seeking to reduce these by spreading risks. The cluster around mobiles often blurs with other sectors, many of which are ICT-related. Entrepreneurs need to be able to quickly shift between different ICT activities as either threats or opportunities emerge (Foster and Heeks, 2010). Indeed, it is only through niche-serving adaptations that they can survive (Rangaswamy and Bombay, 2007). ICT micro-enterprises tend to make only small profits. Owners of Internet cafes, at present, do not see great profits from their ICT-related activities, but see them as a sideline supported by other enterprises or products (such as book selling or family trades). In Mumbai, ICT micro-enterprise is articulated as a future more risky investment which produces only a small profit, insufficient to make a living at present (Rangaswamy, 2008).

Financial improvements can sometimes have both positive and unwanted side effects. For example, in a study of women running mobile payphone businesses in Uganda, all cases studied had resulted in impressive financial success (Kyomuhendo-Bantebya, 2009). All women involved reported not only improved abilities to meeting domestic, personal and other expenditures, they were also able to save and reinvest profits in the business. The women were empowered in the sense that they were given greater opportunities to make strategic life choices. At the same time, the business success frequently triggered tension between spouses, as the husbands felt that their identities and social status were undermined. The way in which different women were able to handle such situations defined their sense of empowerment.

Box III.6. Location, location, location: the role of disabled people in the Gambia's mobile sector

The Gambia is a small LDC in West Africa with a population of 1.7 million, of which about one third is below the poverty line at $1.25 per day (annex table I.1). In 2008, mobile penetration stood at about 70 per cent (ITU, 2010). In this small economy, disabled people who previously had to rely on begging in the streets have found employment opportunities in the mobile sector, with tangible effects on their poverty situation.

Many disabled people in the Gambia are confined to a life as street beggars. Largely due to the specific locations of tourist destinations they had identified the "good spots" for begging. One of the country's mobile telecom operators, Gamcel, recognized their potentially favourable locations and offered the disabled a chance of part-time employment selling SIM cards. The disabled were provided umbrellas with the Gamcel logo on to show that they were "authorized resellers" of Gamcel subscriptions and top-ups.

The former beggars had various serious disabilities. Some were blind and others did not have any legs. With such handicaps, they were easy targets for robbers. As single disabled individuals with low status, they had not benefited much in terms of police protection. The big telecoms company approached the police department and asked it to extend protection to Gamcel's new members of its "dealership network". Almost overnight, after a few highly publicized arrests and prison sentences, crimes towards the disabled almost vanished.

In a short time, the disabled former beggars in their known spots in a given street corner picked up a regular set of clients. Accustomed to working long hours begging, they were prepared to serve clients late into the night.

They also organized themselves into an association with paying dues. This association now offers, for example, a basic social services care system, which can assist with the costs of death and burial, if a member dies.

The situation has improved in several ways. First, while this form of micro-employment would at best be seen as part-time jobs of supplemental income in most circumstances, for these disabled people, it has helped to raise the income level above the national average. They now earn more than a dollar per day, out of their commissions. Secondly, they can afford to have their own phones, allowing them to connect with other phone users. Thirdly, they have gained "a voice" and the official protection of the police, reducing the risk of attacks in the street. As a result, their freedom has been enhanced. Finally, the new association is looking after their interests and helping to construct the basics of a social safety support system.

Most important, these former beggars have gained employment and a sense of accomplishment. It has given them a greater feeling of pride and self-respect. As authorized dealers, part of a national association, rising in the economic stature and earning above average wages, they feel empowered to participate in society. A simple activity as selling mobile subscriptions has thus helped to reduce poverty from an economic, livelihoods as well as capabilities perspective.

Source: Ahonen, 2009.

If the right conditions are in place, the path of mobile ecosystems might potentially act as more widespread vehicles for longer-term economic development and the creation of technological capability, beyond aiding a few scattered entrepreneurs. Given the low entry barriers, there is room for individuals to learn and move into higher value positions once entered. For example, in India, this knowledge and skills upgrading occurs through unpaid apprenticeships, friends or small uncertified IT training entrepreneurs (Rangaswamy, 2008; Rangaswamy and Kumar, 2008; Rangaswamy, 2009b; Chipchase, 2009). In the Mumbai slum, various examples have been noted of enterprises moving between and combine services based on factors like skills, resources and market demands (Rangaswamy and Nair, 2010: 10):

> *"A general store began a mobile phone re-charge service moving to selling handsets, accessories and repair services phasing out the original business. Similarly, several mobile recharge start-ups among the 100+ graduated to stocking the entire range of mobile re-charge options, handsets, accessories and hardware repair."*

Moreover, some PC-aided enterprises have managed to add value to their operations by (ibid.: 20):

> *"Gravitating towards acquiring more complex computer-based skills, such as repairing and servicing, and training institutes evolved into small but locally impacting consumer servicing nodes, employment and skill-learning centers."*

The most successful cases of upgrading are associated with ICT micro-enterprises in urban settings. This is because ICT micro-enterprises rely heavily on dense connections between organizations and relative efficiency of the connections and flows

in local networks that one finds in such locations. This applies to both connections between similar enterprises, and those that allow a flow of goods, services and other resources along the business value chain. Those "other resources" particularly include knowledge that allows micro-entrepreneurs to identify new opportunities and threats; to serve their customers appropriately; and to solve problems, sometimes collectively. Because of the proximity and informality of the connections, they can be understood as both social and business networks.

By contrast, there may be fewer upgrade paths for mobile entrepreneurs based in rural areas, where entrepreneurs are less well inter-connected, and where opportunities for diversification are more limited. The village phone project in Bangladesh was originally articulated as a viable model of rural development through phone ownership. This seemed to have been true for those "phone ladies" who initially took Grameen Bank credit and started phone businesses (Aminuzzaman et al., 2003). However, changes in the mobile market (increasing numbers of phone ladies, and the move from shared to individual mobile phone ownership in rural areas) have made these schemes less viable as an enterprise over time (Shaffer, 2007). Similar problems arose for mobile payphone operators in Ghana (Sey, 2008) and Uganda (Burrell, 2008).[43] The comment of a village phone operator in Uganda is representative (Burrel, 2008: 14):

> *"I used to get more than 100 customers a day on only the MTN network on this Village Phone. They used to come from different areas to come and make phone calls, but ever since they brought the Celtel network people started buying phones in the village and my customers reduced, they are not as many as it was in the past".*

There is little evidence that the phone ladies have been able to shift into new niches in the same way as outlined by mobile entrepreneurs in certain urban settings. It has been suggested that phone ladies were generally owners but not operators of their phones, due to gender issues (Aminuzzaman et al. 2003; Kyomuhendo-Bantebya, 2009). This might be linked to a lack of knowledge and connections: factors that have allowed other ICT micro-entrepreneurs – perhaps particularly those in urban areas – to shift focus when appropriate.

In general, micro-enterprises are highly volatile, affected by the livelihoods of entrepreneurs, the local institutions and increases in competition (Mead and Liedholm, 1998). In addition, ICT micro-enterprise sectors also have to deal with changing trends and policy relating to technology and competition. While it may be possible for an ICT micro-enterprise to find a successful model or mix of business models at one point of time, it is important that they are dynamic and can evolve in response to changes in the surrounding environment. This makes the capacities and resilience of entrepreneurs and their adaptability important determinants of their success, or even survival.

E. CONCLUDING REMARKS

An expanding ICT sector offers various new opportunities as well as potential risks for the poor. Although very few empirical studies to date have examined this issue – and most are micro-studies – the evidence at hand suggests that the ICT sector's contribution to poverty alleviation depends on the nature of activities involved. The conceptual framework outlined in chapter I stressed that the direct involvement of poor people in the production of ICT goods and services can have a positive effect on their livelihoods. On the other hand, it also emphasized that direct participation is likely to be relatively narrow in terms of the number of people concerned. The review in this chapter supports this notion.

Within the ICT sector itself, there are various ways for poor people to get involved. ICT manufacturing is characterized by a high concentration of global production and exports, significant economies of scale and high barriers to market entry for new countries and companies. However, available information, for China in particular, indicates that the expansion of ICT manufacturing has helped generate millions of jobs for migrant workers and significant transfers of funds from urban to rural areas. Entry barriers for new workers to join low-end manufacturing and assembly activities are typically low. The main obstacles for most low-income countries to exploit successfully ICT manufacturing for poverty alleviation are rather associated with the stringent requirements that must be met from a logistical point of view and the high economies of scale in production.

In the case of outsourcing and offshoring of IT and ICT-enabled services, relatively few countries have so far succeeded in developing sizable activities. Moreover, the cases of India and the Philippines suggest that certain skill requirements need to be met for work-

ers to enter. While most direct and indirect job creation has occurred in major urban agglomerations, companies are beginning to spread activities to second- and third-tier cities, and some ICT-enabled services are even being established in rural areas. There are also encouraging developments related to social outsourcing, which may create new livelihoods for some people in rural areas. While outsourcing and offshoring may contribute to poverty reduction, it is clear that benefits to the poor segments of society are in no way automatic. The most important potential contributions to the poor are likely linked to second-order effects, such as indirect job creation. At the same time, newcomers who wish to enter this market need to meet stringent requirements in terms of infrastructure, skills and costs.

The part of the ICT sector with arguably the greatest direct involvement of poor people, and which is spreading rapidly in many low-income countries, is related to ICT micro-enterprises. The review in this chapter showed that there are relatively low entry barriers into some of the activities conducted by ICT micro-enterprises, making it possible for people also with limited formal skills to participate. Certain activities appear to offer better opportunities for growth and development. However, ICT micro-enterprises are exposed to volatility and risk, and returns on investment are often low, forcing entrepreneurs to draw on other sources of income as well. ICT micro-enterprises in the informal sector often complement enterprises in the formal sector by selling goods and services that are better adapted to low-income consumers.

When considering ICT micro-enterprises as a new source of livelihood, the sustainability of different business models should be kept in mind. By the time a particular technology, intervention or business model has proved successful in one context, its relevance elsewhere may have been overtaken by events. The "village phone" service developed by Grameen Phone in Bangladesh (and which has been replicated in other countries) illustrates this point. While it initially allowed rural women to establish micro-enterprises reselling capacity on mobile phones, the business model has become less sustainable as more and more people have their own mobile phones. As summarized in a detailed study of mobile payphone developments in Ghana (Sey, 2008: 319–320):

> *"As cycles of appropriation progress, mobile phones are more effective as a livelihood resource (communication tool) than as a source of livelihood (income generation) for the poor. This is because micro-entrepreneurs (such as mobile payphone operators) are particularly susceptible to industry shocks... In an industry that changes as rapidly as the telecommunications industry does, the vulnerability of poor entrepreneurs is heightened; this is contrary to the goal of securing livelihood sustainability. The involvement of the poor in the mobile phone industry may best be approached as part of a livelihood diversification strategy, than as a primary means of livelihood."*

Coping with such changing business environments requires the ability of the entrepreneur to adapt and identify other, sometimes related, opportunities. Thanks to the importance of networks and close interaction with other informal and formal enterprises, the opportunities for ICT micro-enterprises are greater in urban settings. In rural areas, which host the bulk of the world's poor, the scope for creating livelihoods around such activities appears to be more limited.

It should be noted that some ICT-related activities in the informal sector may have negative effects on the livelihoods of the poor. The recycling of the increasingly expanding mountain of e-waste is particularly worrisome (UNEP, 2009).[44] Uncontrolled discarding or inappropriate waste management/recycling can generate significant hazardous emissions, with severe impacts on both health and environment. Locations that appear to have been badly affected by exports of e-waste include Guiyu, China; Accra, Ghana; Ahmedabad, Chennai, Mumbai and New Delhi, India; Lagos, Nigeria; and Karachi, Pakistan (Kuper and Hojsik, 2008). There is a need for responsible action on the part of both public and private sectors to ensure that the collection, sorting/dismantling and pre-processing as well as end-processing in the recycling chain is conducted in a sustainable way (UNEP, 2009).

From a policy perspective, it is necessary to address both opportunities and potential risks associated with an expansion of the ICT sector. As already stressed, given the cross-cutting nature of ICTs, the supply of ICT goods and services has implications for the economy as a whole. A vibrant ICT sector is important not least to facilitate and sustain more widespread use of ICT in enterprises across sectors and industries – the focus of the next chapter.

NOTES

1 For example, in a 2006 review of 50 articles in three recent complete volumes of *Information Technology for Development*, only one was directly focusing on ICT production (Heeks, 2006).
2 Other industries may produce ICT products as a non-core activity, such as in the case of a financial firm producing software either for internal purpose or for resale.
3 It has been considered that too few retailers deal uniquely in ICT goods.
4 By comparison, only 34 countries reported such data in 2006 (UNCTAD, 2006).
5 The comparability of these data across countries is limited by the fact that countries report different years, and because the definitions of the ICT sector may differ slightly across countries.
6 One study of India's ICT sector (excluding wholesale trade in ICT goods), estimated that the sector accounted for almost 6 per cent of GDP in 2007-2008 (Malik and Godavarkar, 2010).
7 See also annex table III.1.
8 For a definition of ICT goods in trade statistics, see e.g. UNCTAD, 2009a.
9 For example, the latest data from the United Nations Industrial Development Organization (UNIDO) on ICT manufacturing employment refer to the situation in 2005 or earlier years in many developing countries, and they do not include some important countries, such as China. See http://data.un.org/Browse.aspx?d=UNIDO.
10 ICT goods imports are less concentrated than exports of such goods; the top 10 importers accounted for close to 64 per cent of world imports in 2008.
11 It should be noted that the introduction of the Harmonized System (HS) 2007 led to several modifications and updates regarding the coverage of ICT goods, which means that comparisons over time should be interpreted cautiously. See note to annex table III.2.
12 The *Partnership on Measuring ICT for Development* has identified two core indicators related to trade in ICT goods: imports of ICT goods as a proportion of total imports (ICT-3) and exports of ICT goods as a proportion of total exports (ICT-4) (see annex table III.2).
13 For example, in 2005, ICT goods accounted for more than 15 per cent of total employment in the manufacturing sector in Malaysia, the Republic of Korea (2006), the Philippines and Singapore (2006). See INDSTAT: http://data.un.org/Browse.aspx?d=UNIDO.
14 It was higher than in the manufacturing sector in 77 per cent of all the countries in the sample.
15 The information presented here on China draws primarily on a background paper prepared by the Chinese Academy of Science and Technology Management at Tongji University, March 2010.
16 Xinhua News Agency, "Ministry of Human Resources and Social Security of China, Ministry of Statistic Bureau: 97% of 150 million migrant workers employed", available at http://www.xmpp.gov.cn/view.asp?id=6016.
17 Duan Xiaoli, Zhang Liqiang, "Involuntary Unemployment of Migrant Workers in Electronic Manufacturing Industry under the Background of the World Financial Crisis", Economic Research Guide, 2009.9.
18 "Report on Remittance of Migrant Workers: Remittance- Major Channel for Migrant Workers to Send Money Back Home", *Financial Times*, 4 December 2008, available at http://www.gzxw.gov.cn/Xncjs/Jcwg/200812/8443.shtm.
19 Li Qiang, "Research on Chinese Migrant Workers and their Remittance", *Journal of Sociology* (2001.4).
20 See, for example, "Foxconn raises pay by 30% in China", *Financial Times*, 2 June 2010, available at http://www.ft.com/cms/s/0/46edc9aa-6e03-11df-ab79-00144feabdc0,dwp_uuid=eced8d08-6d64-11da-a4df-0000779e2340.html.
21 Information from the Chinese Academy of Science and Technology Management at Tongji University.
22 UNIDO database.
23 Everest Research Institute analysis and Nasscom, 2009 and 2010. Offshore sourcing here includes both offshore outsourcing and offshoring to a foreign affiliate (also called captive offshoring).
24 Everest Research Institute does not include all types of cross-border exports. While new European Union (EU) member countries (e.g. the Czech Republic or Romania) exports of services to countries into other European countries are captured, Everest does not include, for example, the Austrian shared services centre of a company exporting to Germany and Switzerland.
25 See http://www.outsourcing-buzz-blog.com/2010/02/interview_of_sa.html.
26 In 2007, the IT and ICT-enabled services sector in Sri Lanka had become the fifth largest export value generator. The software industry alone employed more than 17,400 people and the BPO industry another 5,200 (Samarajiva, 2009a).
27 See "The world economy calls", *Economist*, 25 March 2010.
28 "IT sector growth set to fall to single digit", *Business Standard*, 21 April 2009.
29 Some of the world's richest people – such as the chairpersons of Wipro, HCL Technologies and Infosys Technologies – have developed their personal wealth from offshoring of software and other services. Infosys alone has produced more than 2,000 millionaires (Murthy, 2009).
30 By comparison, ICT manufacturing employed 183,000 people in India in 2004, according to UNIDO data.
31 "Illegal Bangla immigrants under lens", *Times of India*, 12 March 2010.
32 See "It takes a village: the rise of rural BPO", *IndiaKnowledge@wharton*, 11 February 2010.
33 See http://www.orphanit.com.
34 See www.ruralshore.com.
35 Interviews with IT-BPO industry leaders and employees, educational and research institutions, employment agencies, industry associations, news media, NGOs and government officials.

[36] This section draws significantly on Foster and Heeks, 2010.

[37] There are multiple definitions of a micro-enterprise, based on size, number of employees, sector and market type. In general, they are typically small in nature (less than 10 "employees" including family labour) and their products are predominantly oriented towards the market rather than intra-, inter- household redistribution (see e.g. Mead and Liedholm, 1998; Levy et al., 2010).

[38] Thus, the definition does not encompass micro-enterprises that merely use mobile phones, PCs or other ICTs as tools to improve their business performance. Such ICT use is discussed in chapter IV.

[39] In the case of Benin City, most entrepreneurs were university graduates who were able to draw on family sources for investment capital.

[40] See http://www.grameen-info.org/index.php?option=com_content&task=view&id=681&Itemid=676.

[41] Although this may seem like a relatively small increase in employment, given the high level of unemployment in these areas, it is very noticeable to the community members (Plyler, Haas and Nagarajan, 2010).

[42] As stated by the author: "thanks to the observed success of payphones, network providers have been driven to rethink their perception of viable target populations and to develop relevant products to meet demand within these populations" (Sey, 2008: 230).

[43] In Rwanda, similarly, the leading mobile phone operator, MTN, in partnership with a local company, Business Communications Solutions, introduced a GSM public phone called Tuvugane. Designed for low-income earners who could not afford to buy handsets and pay the standard tariffs, Tuvugane used per-second billing to allow users to make calls for a minimal fee. After a successful rollout, the initiative suffered setbacks due to increased availability of cheap Chinese-made handsets and the introduction of per-second billing in the standard tariff structure of all telecom operators (Nsengimana, 2009).

[44] It has been estimated that 20-50 million tonnes of e-waste is produced globally every year (UNEP, 2005).

4

ICT USE BY ENTERPRISES AND POVERTY ALLEVIATION

Improved access to ICTs and related services has created new opportunities for enterprises with direct involvement of the poor to access information and other inputs. This is especially important to subsistence-based enterprises that were previously devoid of access to ICTs. Enterprises using ICTs can benefit from reduced transaction costs, overcoming various information market failures and improving communication along value chains. There is also evidence to suggest that ICT use can empower entrepreneurs and bring other social gains. But benefits are not automatic, and the outcome varies considerably between different types of enterprises, reflecting their respective needs and capabilities.

Based on a review of the available evidence, which mainly exists in the form of micro-studies from a range of countries and industries, this chapter examines how ICT use has affected the performance of enterprises and the livelihoods of the poor. Special attention is given to how different ICTs may help address the various information and related needs that enterprises face along their respective value chains. The chapter is organized as follows. Section A makes brief reference to the literature on the impact of ICT use in enterprises and introduces a value chain framework. Section B reviews available evidence related to the impact of ICT use at different stages of sectoral value chains. Section C draws out the main findings and points to some implications for policy.

A. ANALYSING THE IMPLICATIONS OF ICT USE BY ENTERPRISES

1. Impacts of ICT use in enterprises

It is well established that enhanced use of ICTs by enterprises can help reduce transaction costs and improve productivity and growth (OECD, 2004; Eurostat, 2008). ICTs have played an important role in advancing productivity for developing countries across sectors when measured at the national level. A review of the evidence concerning the relationship between investment in IT and productivity across developing countries concluded that (Indjikian and Siegel, 2005: 696):

> *"The overwhelming majority of researchers have found a positive correlation between some proxy for IT investment and some proxy for economic performance at each level of aggregation (e.g. plant, firm, industry and country). Furthermore, there was evidence suggesting that complementary investment in IT-related labour and organizational factors that provide a supportive work environment for maximising the returns on IT investments also contribute to improvements in productivity growth."*

Available firm-level evidence indicates that the use of ICTs by businesses has a positive effect on labour productivity also in low-income countries (UNCTAD, 2009a). In an examination of 13 African countries, ICT use was positively correlated with productivity in all types of enterprise, and mobile phone use was identified as the significant correlating factor (Esselaar et al., 2007). Another review of 14 different studies led to the conclusion that mobile phones were helping small enterprises to become more productive, particularly in relation to marketing, sales and customer relations (Donner and Escobari, 2009). However, the authors also noted that benefits from ICT use can be unevenly distributed (ibid.: 8):

> *"Not all enterprises will prosper from increased access to telecommunications, and among those that do, their uses of mobiles will vary across industries and positions in value systems… current evidence suggests that the benefits of mobile use accrue mostly (but not exclusively) to existing enterprises, in ways that amplify and accelerate material and informational flows, rather than fundamentally transform them."*

In order to better understand the precise reasons for such improvements in productivity, it is necessary to open the "black box" and examine developments at the micro-level. Whether a business derives gains from the adoption of ICTs depends on several factors, such as the business skills of managers, the availability of personnel trained to use and maintain equipment, and the availability of additional information sources that enable improved decision-making in procurement and other business processes. Thus, the extent to which individual enterprises gain from enhanced access to ICT depends on their size, industrial sector, location, workforce skills, availability of relevant content and whether their suppliers and customers are frequent users of ICTs.

Benefits from ICT use are not an outcome of the technology itself but of what technology enables, for example, access to information which may reduce transaction costs and improve the quality of customer relations, or use of software to manage inventory and labour. The challenges facing enterprises vary, as do their needs for ICTs (Barton and Bear, 1999; Duncombe and Heeks, 2002b; Oyelaran-Oyeyinka and Lal, 2006). All micro and small firms do not need to become intensive ICT users to be effective. While all enterprises have a need for effective communication and for accessing information of various kinds, the extent to which an enterprise could benefit from using ICTs for making transactions or for processing information varies greatly.

The costs related to obtaining, selecting and using information are significant barriers for most small enterprises (Pingali et al., 2005). Enterprises need information to decide what, when and how much to produce. They also need to decide when and to which market to sell. Finding the answers to such questions is associated with significant costs. As a result, it is important to consider what role ICTs can play, and when, in helping enterprises to reduce information costs and asymmetries. As the needs for information and other inputs are different, a distinction should be made between *subsistence-based* and *growth-oriented* enterprises (chapter I) as well as between sectors when examining the impact of ICT use by enterprises on poverty.

2. Enterprise value chains

Within a sector, the scope for ICTs to help improve the productivity of enterprises also varies at different

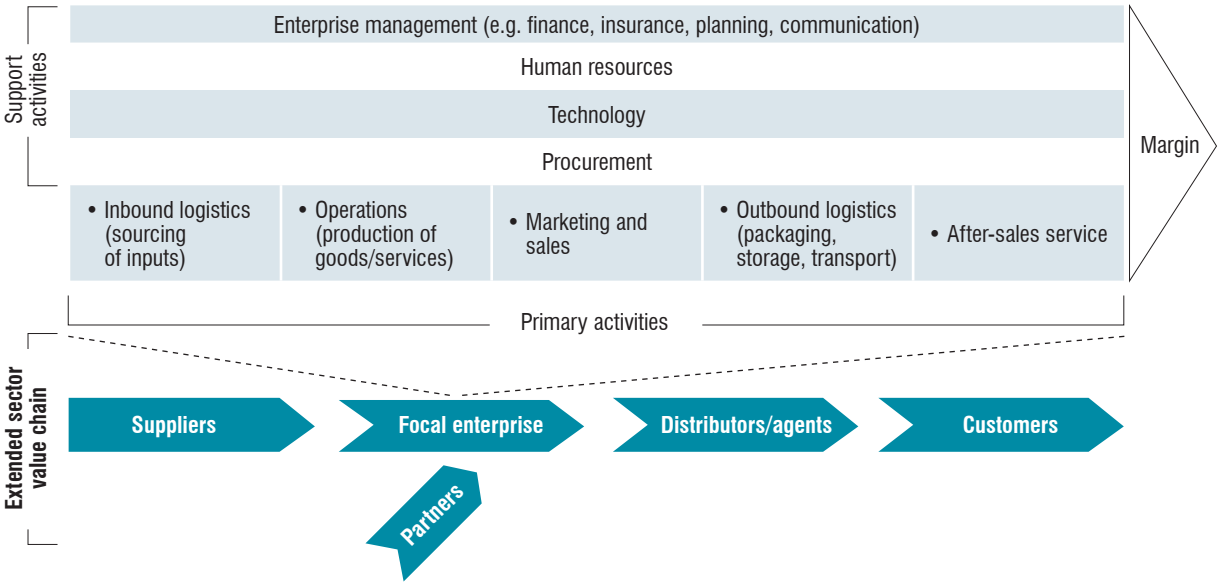
stages of the production process. The value chain concept provides a useful basis for systematic analysis of all the linkages and interactions that are required for an enterprise to operate and trade in a market (Laudon and Laudon, 2010; Porter, 1985). It describes the full range of activities that are required to bring a good or a service from its initial conception to its end use, and even beyond, in terms of customer feedback or the recycling of products (see figure IV.1). Although the value chain framework was developed with larger enterprises in mind, it can be applied also to smaller firms, even if the same person carries out multiple business-related activities (Donner and Escobari, 2009). The framework serves as a useful basis for understanding and assessing the needs of enterprises and then showcasing how ICT use can address them.

Activities can be categorized as being conducted either internally (primary and support activities) or in relation to other partners and agents in the extended sector value chain (figure IV.1). *Primary activities* are largely managed internally and they relate directly to production and distribution. *Support activities*, such as human resources, technological support and procurement are internal business functions that are required to enable primary activities. The *extended sector value chain* (or supply chain) comprises enterprises or agents located *upstream* – supplying raw materials or intermediate goods (prepared inputs for further processing, for example); and those located *downstream* – responsible for possible further processing, marketing and distribution. In addition, an enterprise may interact with various "partners" to advance its interest, obtain inputs or information of various kinds (box IV.1). Both internal activities and external linkages can be supported through the expansion of ICT-based networks.

In this context, it is important to consider whether ICT use can also improve efficiency along the value chains of enterprises in which the poor are directly involved. Each enterprise has varying needs of information and other inputs depending on the complexity and sequence of activities involved.

Needs differ for value chains that reach into local, regional and global markets. For *subsistence-based enterprises* (i.e. those which provide the most direct livelihood support for the poor) accessing client markets (especially distant markets) represents a particular challenge, requiring interaction with market intermediaries.[1] For most such enterprises, markets may be restricted to their immediate community, for some they may extend to district centres of population. Enterprises serving local markets are typically reliant on information delivered informally through local networks of communication, where trust and risk reduction are major factors that govern

Figure IV.1. The enterprise value chain



Source: Adapted from Porter, 1985; Heeks and Molla, 2009; Laudon and Laudon, 2010.

Box IV.1. Enterprise linkages

- *Inter-enterprise linkages with suppliers:* of raw materials/production inputs/equipment/ maintenance as well as providers of power, water, transport and telecommunications.
- *Linkages with other input providers:* human, financial and information resource inputs that allow the enterprise to function.
- *Inter-enterprise linkages with distributors/agents:* intermediaries that can link smaller enterprises into supply chains.
- *Inter-enterprise vertical production linkages:* between different types of enterprise in a chain, such as via sub-contracting (or outsourcing) from a larger enterprise or government institution to a small or micro-enterprise.
- *Inter-enterprise horizontal production linkages:* where sub-contracting linkages are formalized between similar enterprises in the same sector. These include producer groups, cooperatives, social enterprises, and linkages formed with trade associations or marketing agents.
- *Inter-enterprise exchange linkages:* for example, where enterprises can share tools, labour, machinery or exchange information and knowledge – often informally.
- *Linkages with customers:* Consumers (predominantly local) who purchase the outputs from the enterprise and make final use of them.

Source: UNCTAD.

their dependence on networks. Lack of timeliness of information is a serious failure of the information delivery system currently used, and a significant aspect of the vulnerability of subsistence-based enterprises to changes in the surrounding environment (Duncombe and Heeks, 2002a). The quantity and range of information received through traditional channels are also an issue, with barriers including literacy and language. Weaknesses in informal information sourcing should also be recognized. Studies from Kenya (Moyi, 2003) and Botswana (Duncombe and Heeks, 2002a) found considerable gaps in the information needs for enterprises across all sector and size ranges. Enterprises relied on informal information sourcing which was largely inadequate for their needs and which resulted in high search costs and poor quality information.

Growth-oriented enterprises frequently seek to extend their market reach. Their sectoral value chains often reach beyond the district locality to main centres of population and sometimes across national boundaries.[2] A higher degree of integration of enterprises into market systems requires more formalization of information systems (Gelb et al., 2009; Duncombe and Molla, 2009; Murphy, 2002). Particular characteristics of the transition towards greater formalization include (a) demand for an increased volume and complexity of information as the value of information is better recognized; (b) reduced information needs gaps as internal capacity to meet information needs rises;[3] and (c) greater emphasis on external communication. This transition may be accompanied by a move from a manual paper-based information system to the use of ICTs for internal processing of information (with PC applications), and from face-to-face contact or telephony (pre-existing landlines/payphones) to ICTs for external communication (using mobile phones or e-mail/Internet).

There has been much emphasis on the new opportunities created for developing-country producers through integration into global value chains (GVCs) (e.g. Altenburg, 2007). By linking into GVCs, enterprises in developing countries can potentially access relatively secure and high volume markets for a broad range of primary products (e.g. timber and minerals), agricultural produce (e.g. cotton, tobacco and coffee) and manufactured products (e.g. textiles and garments). In recent years, the evolution of these global markets has tended to be buyer-driven with a high degree of control exerted by developed-country lead firms (Pietrobelli, 2007). However, in order for developing country firms to participate in such value chains, they need to have the capacity to handle large-scale production for exports and to conform with strict product, process and environmental quality standards. This often in turn requires a far higher degree of formalization of information systems (including use of ICTs) than is needed to serve domestic markets (Parikh, 2007). Those who lack the capacity and opportunity to comply tend to be marginalized and excluded from global value chains (Kaplinsky and Morris, 2001; McCormick, 1999).

How does this value chain framework connect with the question of poverty reduction? When markets work

effectively, they generally provide the most efficient primary mechanism for exchange, coordination and the allocation of goods and services and other resources within an economy. However, for the poor majority in developing countries, markets often fail to deliver the desired benefits. Such market failure is sometimes linked to information failure – in that information is almost always incomplete, asymmetrical, and costly to acquire and to use (Eggleston et al., 2003). An important question is therefore to what extent information failures along the value chain can be overcome with better use of ICTs (see section B). As mentioned in chapter I, in terms of livelihood strategies, information can both improve the short-term decision-making capacity of the poor and strengthen the longer-term decision-making capacity of intermediaries that facilitate, assist or represent the poor.

For markets to work better for the poor, however, they must not only address information failures but also livelihood objectives – to build and acquire assets and reduce vulnerability (United Kingdom, DFID, 2005; chapter I). In addition to providing a means to transact goods and services, markets should enhance the empowerment, opportunity and security of the poor. In other words, understanding the impact on poverty requires a focus on both markets and livelihoods (InfoDev, 2008c; Doward et al., 2003).

B. CASE EVIDENCE ON ICT USE IN VALUE CHAINS RELEVANT TO THE POOR

This section reviews the available evidence on the impact of ICT use, with a view to illustrate how different ICTs may support key enterprise activities relevant to the poor. Special attention is given to agriculture, fishing and small-scale manufacturing and service activities. As comprehensive and systematic evidence is scarce, the analysis presents selected success and failure cases concerning ICT use to support primary activities and interactions throughout the extended value chain, involving networks of relationships with various stakeholders. In this context, it considers the various enterprise needs that are being addressed, the role of different technologies and the types of impact observed, including where possible the achievement of livelihood objectives.

1. ICT use in agriculture

Rural enterprise is of particular relevance to the poor. Many poor households produce for their own needs, earning relatively small incomes by trading surplus produce for local consumption, or as part of producer or farmer groups reaching distant markets via intermediaries (Ellis, 2000). There are also examples of growth-oriented rural enterprises among poor communities. Earnings from growth-oriented "off-farm" enterprise tend to increase for those who become less poor, and become an important source of income for those who have climbed above the poverty line (Shaw, 2004; Ellis and Bahiigwa, 2003). Case study evidence from various developing countries suggests that use of ICTs – especially mobile phones – is increasing among rural enterprises, and is contributing positively to enterprise growth in rural areas (Frempong, 2007; Esselaar et al., 2007; Goodman, 2007).

In the case of small farmers, diverse information needs can be identified along the value chain in connection with their primary and support activities (de Silva et al., 2008):

- *Inbound logistics:* information concerning the sourcing and purchasing of seeds for a specific crop.
- *Operations:* information concerning seeding, preparing, planting, growing and harvesting.
- *Marketing and sales:* information that helps identify customers for the output. It is also important for the farmer to know when and in which markets to buy and sell.
- *Outbound logistics:* information concerning packaging, storing and transport.
- *After-sales service:* feedback from customers.
- *Support activities:* information on access to extension services, credit and insurance.

Information needs in rural enterprises directly linked to the poor can be considerable. A study of the value chain of poor vegetable farmers in Sri Lanka measured the information search costs for all core enterprise operations, such as land preparation, growing and harvesting, as well as for seed purchase and selling (de Silva and Ratnadiwakara, 2009). It found that the relative proportion of information search costs in the total costs of production, were highest in the early decision stages and the latter selling stages. Overall, information search costs amounted to 70 per cent of all transaction costs (the transaction costs themselves were recorded at 15 per cent of total costs incurred).

The main information search costs were related to (a) transport costs (time and money); (b) time expended in meetings and visits to elicit materials (such as fertilizer); and (c) costs of comparing prices and those associated with transporting produce to the market. Costs were accounted for in both direct financial expenditure and the opportunity costs of time expended (de Silva, 2008). The study concluded that better quality and more timely information, combined with faster and cheaper communication, would help to reduce operational costs.

There is growing evidence that enhanced access to ICTs has helped farmers address some or all of these needs. In many instances, this has been achieved through the spontaneous uptake of mobiles by farmers; in other cases information supply has improved as a result of deliberate assistance by government or other actors. There are also many examples of ICT initiatives aimed at improving relevant information that have failed to produce the desired results.

a. Mobile phone use

Mobile phones are increasingly used by farmers to obtain relevant information and coordinate their activities with other participants in the value chain.[4] In Rwanda, for example, mobile phones have made some farmers into traders and improved overall market efficiency (Nsengimana, 2009). Another study measuring the impact of mobile phones on grain markets in Niger made similar observations. It found that transaction costs were lowered for traders in the value chain, due to a 50 per cent reduction in information search costs (Aker, 2008). This in turn led to a reduction of price differences across markets. Five years after the mobile phones were introduced, grain traders operating with cell phones were searching for customers and prices across a far greater number of geographically-dispersed markets, and had built up a much larger number of market contacts than traders without such phones.

Dairy farmers in mountainous Bhutan also saw benefits from the introduction of mobile phones. Farmers in the eastern part of that country first bought phones to stay in contact with family members and friends, not thinking that they could also have implications for their income-generating activities. However, it soon became clear that mobile phones could support their livelihoods. The phones helped them reduce transaction costs related to travel and waiting time to reach customers, strengthened their bargaining power, reduced their reliance on intermediaries, increased their income and improved their linkages with different stakeholders (box IV.2). Other studies have confirmed that mobile phones can help farmers to avoid intermediaries (see e.g. Boadi et al., 2007; Dholakia and Kshetri, 2002).

The coordination of multi-local activities in agricultural value chains that are geographically extensive and

Box IV.2. Mobile phones and dairy farming in Bhutan

Bhutan is a land-locked LDC with a population of about 690,000, 27 per cent of whom live on less than $1.25 per day (annex table I.1). Of these, 98 per cent reside in rural areas (UNDP, 2010). In recent years, the country has seen a rapid uptake of mobile phones. In some regions, their use has significantly improved the livelihood of dairy farmers. A small initial investment on the part of farmers has generated multiple benefits.

Dairy farming in Orong geog

In Orong geog in eastern Bhutan, dairy farming is the major source of income for its 467 households. Traditionally, individual dairy farmers sold their products to travellers on the highway between the districts of Trashigang and Samdrup Jongkhar. It was only in 2008 that a farm road was built to connect Orong with that highway, and even today, some houses are a long way from the end of the farm road, making transportation very cumbersome and time-consuming.

In the past, the community managed to sell about 5kg of butter and about 20kg of cheese per day. Milk was hardly sold at all. Demand was hard to predict as it depended on who passed by on the highway. To sell the produce, the farmers had to walk far; the nearest house is three hours walking distance from the highway. Without storage facilities, farmers were reluctant to produce more butter. Fermented cheese was the main product, which was sold when farmers went to towns, but generated small incomes.

In October 2009, a milk processing unit (MPU) was established with financial support from the Governments of India and Bhutan. By April 2010, the MPU had 72 members. The sale of cheese and butter has increased with positive impacts on farmers' incomes.[a]

/...

Box IV.2. Mobile phones and dairy farming in Bhutan (concluded)

In December 2009, the MPU's monthly income averaged Nu 119,647 (about $2,600). By April 2010, it had increased by some 40 per cent according to interviews with MPU representatives. Greater sales have allowed farmers to buy a power tiller and a mobile storage van. Thus, products can now be distributed to more distant locations. The success has been facilitated by the new farm road and by the introduction of mobile phones.

Mobile phones and dairy farming

In less than six years, Bhutan moved from no mobile phones to almost 50 subscriptions per 100 inhabitants (annex table II.1). The rough terrain and high mountains have not deterred mobile connectivity, on the contrary. A tower on one mountain can provide a signal to all surrounding regions. As of early 2010, there were two operators: B-Mobile (State-owned) and Tashi Cell. The villagers of Orong are subscribers of B-Mobile.

Farmers in Orong first bought phones to stay in contact with family members and friends. They did not predict that it could also enhance their incomes. However, it soon became clear that mobile phones could support their dairy farming livelihoods in several ways:

- *Access to market information.* Farmers can now find out the prices that apply in different markets and nearby districts.[b] This has given them more choice and greater bargaining power.
- *Avoid intermediaries.* Better price information allows farmers to deal with customers directly, especially those who procure larger quantities (e.g. boarding schools and hotels). Farmers supply these organizations directly without intermediaries. Their income has increased as a result.
- *Increased direct sales and less waiting.* In the past, farmers living 1-2 hours walking distance from the main highway could wait for hours (sometimes a day) for travellers to come and buy their produce. Today, public transport agencies (mainly bus services) call them to inform how far the bus or van has reached. This has reduced farmers' waiting time.
- *Collective pricing/organization.* Farmers stay in touch with each other via their mobiles. It has enabled better organization of the farmers and better decisions on the price to charge. Enhanced organization has given farmers the choice of selling to the MPU or to other clients.

Almost all farmers can afford a cheap mobile. Recharging the phones with new airtime can be a problem in remote areas where there are no shops.[c] In such cases, farmers often call their relatives asking for a recharge, often using "missed calls" to ask the other party to call back.

The Government's role

The Government now sees dairy farming as a priority for income generation and acknowledges the advantages of mobile phones. The Ministry of Agriculture has, among other things, launched a mobile-based information system, which helps farmers find the best market. Information is provided in four languages (Dzongkha, Sharchop, Lhotsham and English) and reads out a range of prices.[d] The service is free of charge but available to B-Mobile subscribers only. Prices are updated on a weekly basis. Mobiles might in the future also be used by the Government to inform about outbreaks of cattle diseases, improved breeds and fodder seeds.

Future prospects

Commercial dairy farming and processing is set to increase. The MPU is expected to turn into a viable rural enterprise fully managed and owned by the people through adoption of scientific dairy production, management, processing and marketing. This will not only increase the self-help capacity and bargaining power, but also create employment opportunities. Competition from Tashi Cell is expected to reduce the cost of mobile use. Today, missed calls and SMS are used to keep costs down.[e]

Source: UNCTAD.

[a] *The MPU sells about 850 litres of milk every day, and 200 kg of butter and 500 kg of cheese per week.*
[b] *Farmers do not have to supply to the MPU. Members have to supply a certain minimum amount. This has led to some competition between the MPU and individual farmers. While the MPU supplies large quantities, individual farmers cater to smaller customers.*
[c] *In Orong, there are five shops but only one sells vouchers and it frequently runs out.*
[d] *Farmers dial 2009 and press 1 for Dzongkha, 2 for Sharchop, 3 for English and 4 for Lhotsham. The system tells the rates at different places, enabling the farmers to get the best price. Dzongkha is the national language and the dialect of western Bhutan. Sharchop is the dialect of people from eastern Bhutan (who form the majority) and Lhotsham is the dialect of people from Southern Bhutan of Nepali origin.*
[e] *The number of missed calls by a customer has been used to indicate the quantity of milk required. SMSs are also employed by customers to indicate their demand. Conversely, farmers send back missed calls to confirm that supply is insured. If a farmer has not responded within 15 minutes, the supply will not be made. Customers can then contact other farmers. So far, mobiles have not been used for advertising or marketing, but this is expected to change.*

organizationally complex has been highlighted in the case of onion trading in Ghana (Overå, 2006).[5] Both producers and traders benefited considerably from the use of mobile phones after their introduction in 2001. Speed of communication allowed for more efficient information flows within the network of value chain actors, which, in turn, saved time and reduced transportation costs. This led to better matching of supply and demand, and improved monitoring of compliance with the terms of trading contracts (Overå, 2006: 1309):

> *"When Bawku obtained GSM coverage in 2001, it immediately became worthwhile to acquire a cell phone, and both Mohammed, his uncle, and the two other traders bought one. Since they are moving around most of the time, coordination has become much easier. Mohammed says: 'I can now quickly call my uncle and say that the market in Accra is good so he should send onions at once. Or when there is a glut, I ask him to hold back.' This allows the traders to improve their profit potential, to save time and transportation costs, and to monitor whether their workers and trade partners are performing tasks according to agreements. They can more easily ensure that jobs are done on time and obtain information quickly about why jobs are sometimes not done according to agreements."*

One effect was that early adopters of mobile phones in this market strengthened their existing trader relationships and networks which were built on strong lineage-based social structures. New market entrants managed, through using mobile phones, quickly to cement good trading reputations to facilitate the building of more efficient trading networks. By contrast, existing traders and new entrants without phones were not able to attain these advantages, although it is not clear whether they were financially worse off as a result (Overå, 2006). In Northern Ghana, subsistence farmers were able to borrow mobile phones from neighbours and gather agricultural guidance information or market price information (Smith, 2010). Even those who did not themselves use the phone benefited from information passed on from phone owners, including more frequent meetings with agricultural extension officers; meetings that were coordinated by phone owners. Unsurprisingly, though, phone owners benefited more.

New opportunities are also emerging for mobile phones to improve the effectiveness of support functions and to achieve sustainable market efficiency gains. The most obvious of these, and where the potential may be the greatest, is the delivery of money transfers (Duncombe and Boateng, 2009) and, with time, micro-insurance.[6]

Several mobile phone applications for the delivery of financial transfers are already commercially implemented (e.g. through Globe Telecom's GCash in the Philippines, Wizzit in South Africa, and Safaricom's M-PESA in Kenya). The infrastructure and service platforms are sufficiently scaled to provide the potential for all types of enterprise – including small farmers – to receive money or to make payments. Mobile-money transfer services have been quoted in the literature for achieving two effects: they extend banking-like services to the unbanked, including poor people (Comninos et al, 2008) and therefore, by transferring small savings to where they are needed quickly and at a low cost, they improve the allocation of resources (Jack et al., 2009). Mobile-money services seem to have been taken-up quickly by farmers and are used extensively to facilitate trading in rural areas. Anecdotal evidence from Western Kenya shows that the number and size of financial transactions through M-PESA are highly concentrated on a weekly basis with a clear peak on market days in rural areas (Eijkman, Kendall and Mas, 2010).

Mobile solutions for providing micro-insurance have begun to emerge (box IV.3). As the practice is still at an early stage of development, not enough evidence is available for assessing its impact on poverty. However, the potential should be considerable (IFPRI, 2009). Micro-insurance can contribute in important ways to poverty reduction since farming activities are highly susceptible to weather, price variability and health risks. Poor farmer households faced with such uninsured risks can incur income losses both in the short term and in terms of future growth opportunities. When not insured against adverse weather conditions, farmers tend to use as little inputs as possible to minimize the risk of incurring losses. This inevitably results in less productive yields. In addition, it is difficult for uninsured farmers to obtain credit for buying fertilizers and seeds. Reducing transaction costs is an important factor for rendering micro-insurance more sustainable. To date, there is very little agricultural micro-insurance in existence (Roth and McCord, 2008). It is important to explore in greater detail the scope for mobile solutions to micro-insurance to transform farm activities in low-income countries.

Box IV.3. Mobile micro-insurance in Kenya

Launched in March 2010, the Kilimo Salama scheme (Swahili for "safe farming") grants weather-indexed insurance to small-scale farmers in the Kenyan Rift Valley. This product was developed from the partnership between several enterprises and one public institution: Syngenta (an agri-business TNC), Safaricom (a mobile phone operator in Kenya), UAP Insurance and the Kenyan Meteorological Department. Thanks to Kilimo Salama, every time a farmer buys seeds, fertilizer or other agro-chemicals – even in small quantities – he or she can also buy insurance against weather unfavourable to their crops.[a] In case of crop failure due to drought or excessive rain, insured farmers are entitled to compensatory payments made effective through M-PESA, the mobile-money transfer service run by Safaricom.

To acquire an insurance policy, farmers must be registered with one of the weather stations and pay an additional 5 per cent of the cost of inputs purchased. Mobile phones are used to send confirmations of the insurance contract, to collect contract coverage details and to send out compensatory payments when due.

Within one month from its launch, 9,500 farmers had subscribed to the weather index insurance scheme and another 40,000 are expected to join in the near future. The pilot project ran in 2009 and covered some 200 farmers during a period of prolonged rain. Some farmers received as much as 80 per cent compensation for their loss of crops.

Source: UNCTAD, based on SciDev.Net, 2010.

[a] *The weather is monitored through 30 solar-powered weather stations, each covering a radius of 15 to 20 km, with transmitted data being centralized in a regional weather index. Based on comparisons with crop-specific water requirements vis-à-vis historic rainfall patters, the system can determine the regions where crops failed due to excessive drought or rainfall.*

b. Use of the Internet and the web (mediated by PCs or mobile phones)

The Internet and the web are potentially powerful tools for delivering information to users and for marketing purposes. Particularly for growth-oriented enterprises, use of the Internet potentially allows access to new information. However, the vast majority of enterprises located in poor rural communities have limited or no direct access to the Internet, and they often lack the skills needed to make effective use of the technology (chapter II). To the extent that they will access resources on the Internet, they typically rely on some form of intermediated telecentre. While many governments have sought to provide useful web-based information to small enterprises, not least in rural areas, many such initiatives have had limited success due to the poor access to the Internet among beneficiaries as well as limited skills to make use of the information (see e.g. Wade, 2002; Madon, 2005; Ulrich, 2004).

In the mountain town of Pazos, Peru, for example, a local telecentre facilitated information access from distant sources which was used by farmers to find out about methods of cultivation, soil types and pests, etc. This helped them in sourcing the right inputs, to set up a greenhouse which duly produced a good crop, and it motivated other farmers to follow suit (Heeks and Kanashiro, 2009: 15). In other cases, though, farmers surveyed in the study failed to make effective use of the information they found. Some had found information about potato wholesalers to whom, in theory, they might sell their crops. But they lacked the necessary complementary inputs (particularly raw materials, skills and knowledge) to produce a crop of a quality high enough to meet wholesaler requirements. This highlights a common constraint for many "stand-alone" telecentre initiatives. While they may serve broader community needs, they are often insufficiently integrated into local enterprise support structures that can also provide non-ICT complementary inputs. Moreover, few telecentres in support of livelihoods provide targeted enterprise support (UNCTAD, 2008).[7]

In order for telecentres to be effective, they need to ensure that the services that are provided are responding to the actual needs of the intended beneficiaries. It is also desirable to find business models that are financially sustainable so that the services offered survive beyond a donor-supported pilot stage. The success of community information centres serving small farmers in rural Bangladesh has partly been explained by the careful assessment of client needs before deciding on the services to offer, partly by the partnership between different stakeholders (box IV.4).

The Internet is increasingly used for web-based marketing also in developing countries (Duncombe and Molla, 2006; UNCTAD, 2004a; Wresch, 2003). The web provides opportunities for enterprises that wish to

Box IV.4. Market-based information solutions for small farmers in Bangladesh

In rural Bangladesh, many small farmers are constrained by the limited coverage of Government extension services and often rely on sub-par agricultural techniques. The "Katalyst" programme – funded by UKAid, SDC, CIDA and the Embassy of Netherlands and implemented by Swisscontact and GTZ-International Services – teamed up with Grameen Phone and other partners to offer a telecentre-based market solution to address such needs, with tangible results.

Following an in-depth analysis in 2005 aimed at identifying the specific information needs of small farmers, and a one-year pilot project to confirm the viability of rural information centres to channel relevant information provided on specialized web pages, Katalyst reached an agreement with Grameen Phone to set up Community Information Centres (CICs) across Bangladesh. Under the scheme, small individual operators invest in the necessary infrastructure and enter a contract with Grameen Phone (the largest mobile phone operator in Bangladesh). The latter contributes in terms of connectivity, service offers, capacity building and promotion. Katalyst supported Grameen Phone to develop appropriate offers for farmers and modules for the operators. After a successful test run with a small number of CICs, Grameen Phone extended the network to several hundred centres.

Results to date are promising. While a few centres have had to close down for business reasons, those that are running typically turned profitable after 15 months. The investment per centre was about $1,500. As of 2009, surviving CICs served an average of about nine clients per day, 21 per cent of which sought agricultural information. The centres generated a daily income of $3–$4 per day for each centre operator in a country where over half of the population lives on less than $1.25 per day. This corresponds to about 1.5 million information transactions per year and the creation of an estimated aggregate income of $700,000. Moreover, an impact study found that the CICs had contributed to the creation of some 17,000 jobs in farms and small businesses and that the income of farmers has been safeguarded or increased as a result, thereby supporting livelihoods.

Several important lessons have been learned. First, for this kind of service to be successful and sustainable, the information provided must be carefully tailored to the specific needs of the users. At the same time, centres should offer a service mix that goes beyond agricultural information to make the centre financially sustainable by covering sufficient demand. Secondly, the combination of a business investor and a development partner such as Katalyst can help address the initial risk of the initiative; however for that to happen, it is essential that there is a layer of overlapping interest among the stakeholders involved. Third, it is important to understand local entrepreneurial needs and skills required to run the centres. Fourth, the location of the CIC is a key factor for its sustainability. Finally, mobile phone networks facilitate easier access to information and communication for rural people thanks to their wide coverage and availability. Combining the variety of access technologies (Internet, call centres, links to mass media) makes it possible to run high volume/low cost services, which benefit the providers as well as poor clients. A win-win situation in other words!

Source: UNCTAD, based on "Swisscontact and Katalyst, Bangladesh: Information system for small business", i4Donline.net, January–March 2010.

extend their market reach – possibly accessing global markets for their goods or services – and improving coordination of logistics. In many instances, however, smaller enterprises have found such markets difficult to break into (Mansell, 2004). Beyond ICT skills, success requires sufficient organizational capacity to ensure that orders can be made, quality controlled and payment delivered. In the case of agriculture, the relevance of such services is thus greater for growth-oriented enterprises. There are many examples of active web-based e-commerce platforms in use in developing countries. In China, for example, the web has been used for advertising farm products and for providing an electronic base for retail sales with significant results for some enterprises (box IV.5). At the same time, there is lack of reliable evidence to ascertain their degree of success and impact on poverty reduction.

Opportunities to benefit from e-commerce increase with the size and international orientation of the enterprise. Internet use is more important in global value chains for agricultural and tropical products, potentially benefiting also smaller enterprises in developing countries. Some successful cases have taken an approach to embed the Internet in the enterprise value chain. The "E-Choupal" initiative of the Indian Tobacco Company business division provides a dedicated platform that supplies high-quality farm inputs (information, products and services) to soya growers. Farmers have benefited from more accurate weighing, faster processing time, prompt payment, access to a wide range of input information, as well as accurate

knowledge about market prices and trends, which help them decide when, where, and at what price to sell. Farmers using the system got an average 2.5 per cent higher income (though it is unclear if this is due to a higher price or lower transaction costs) (Annamalai and Rao, 2003). Farmers benefited from lower prices for inputs and other goods. The Indian Tobacco Company also benefited, saving on commission and transport costs, and got a more direct link to farmers selling more inputs and goods to the farmers via the system. Those that lost out from the model were commission agents, labourers at the non-ICT-enabled Government markets, and shops near those markets. Moreover, few women had access to the system. This integrated value chain-driven application has continued to extend its scope and success, aiming to reach 100,000 Indian villages by 2010 (Qiang and Rossotto, 2009).[8]

While investment costs associated with e-commerce may outweigh benefits for small and micro-enterprises (Duncombe and Molla, 2006), benefits can be more easily achieved for larger firms and when applying the Internet to existing business-to-business (B2B) value chains, using it to exchange information, to coordinate outbound logistics and to improve communications (Humphrey et al., 2003). This has been demonstrated in the cut flower sector in Uganda which employs over 6,000 rural workers on 20 farms (InfoDev, 2008a: 44):

> *"Rosebud Ltd, a flower export company, has made ICT an intrinsic part of its growth strategy. The US$5 million farm project employs 700 and is owned by three Ugandan shareholders. Total exports per year are in the neighbourhood of 60 million stems, primarily destined for Europe. Rosebud has succeeded in eliminating the distance barrier in several ways. It uses email to communicate with customers and its website has an online form which allows customers to place orders. Users specify desired quantity and the form automatically updates prices, including taxes. Clients supply shipping and billing addresses, and staff from Rosebud follow up on the submitted order."*

In this case, the enterprise drew upon local ICT expertise to develop information management and IT systems which integrate all value chain processes, including ordering, logistics, marketing and financial control – making use of relatively cheap and easily adapted web-based tools and off-the-shelf accounting packages. This led to better coordination of outbound logistics, including the lowering of airfreight charges. ICTs were embedded into an existing value chain, an approach that offers greatest scope to improve supply chain management, facilitate access to market specific knowledge and reduce transaction and information search costs.[9]

c. Combined technologies

With more widespread access to mobile phones, there are today new opportunities to serve the needs of rural enterprises through combinations of different technologies. Such opportunities are being explored through various initiatives aimed at delivering information via intermediaries, particularly to subsistence-based enterprises. Combinations of

Box IV.5. Web-based marketing by rural farmers in China

In China, the Internet is used for advertising farm products and for providing an electronic base for retail sales. *Taobao.com*, China's main e-commerce platform, has registered more than 20,000 small businesses offering local food specialties. For example, in 2007, farmers in Luliang City, Shanxi Province, set up an online store in Taobao called "Shanliwang" (which literally means prosperity in the mountain) to sell red rice and other local specialties.[a] While selling online did not eliminate problems generated by bottlenecks in distribution channels, such as underdeveloped, time-consuming transportation, web presence helped bridge information gaps and made the farmers' products better known. Occasionally, it led to increased sales. For example, a farmer in the Fujian Province placed several advertisements on the Bulletin Board System for his Tieh-Kwan-Yin Tea. The advertisements drew much attention and boosted sales. In the second half of 2009, Tieh-Kwan-Yin Tea in Shanghai surpassed Longjing Tea to become the number one tea brand in China.[b] As a result, a growing number of Chinese farmers and other rural enterprises became aware of the potential of advertising online and began to subcontract network advertising enterprises for publicizing their products.

Source: Chinese Academy of Science and the Technology Management Department at Tongji University.

[a] *See "Wang Xiaobang's store on the Internet hit in China", 20 July 2009, available at http://www.tjxumu.cn/news/21579.html.*

[b] *See "Making mobile calls, 'calling' a road to rich", Shandong Business Daily, 13 May 2009, available at http://www.12582.com/main/News/Detail/8041047/1 .*

different ICTs can be more effective solutions as they have the potential to leverage the benefits of several technologies. One study identified 63 such initiatives currently underway on the African continent (Gakuru, Winters and Stepman, 2009). These revolved predominantly around use of mobile-cellular networks as a delivery platform,[10] and were largely donor-driven pilot or proof of concept projects. The study found, among other things, that (ibid.: 21):

> *"when the back end of the farmer information system contains a call centre, the farmer information system can implement farmer's feedback to be used for localisation and respond to specific farmers requirements such as language and specific products. The SMS platform can be used for alerts, targeted to provide farmers with specific information, thereby creating demand".*

A specific example of the potential for different technologies to support the information gathering for farmers is the Collecting and Exchange of Local Agricultural Content (CELAC) project, which serves seven districts of rural Uganda.[11] It seeks to share crop and animal farming good practice that has worked for farmers. The project makes use of mobile SMS as well as other multi-media communications, including online and hard copy newsletters written in both English and Luganda – the most widely spoken local language. The project has a database of phone numbers to whom agro-related information is sent every Monday, composed of farmers, community development workers and agricultural extension workers. The use of community radio call-in programs is also integrated into the service as is the use of drama on video and DVD to portray the farming practices and their challenges. Besides farmers, CELAC engages former agricultural extension workers as knowledge brokers to help in the collection and dissemination of traditional methods that work, including sharing information with other affiliates (e.g. Women of Uganda Network) that are able to translate into other local languages to help farming micro-enterprises based in other districts.

It has been suggested that greater marketing and (more importantly) transactional benefits would be attainable on a larger scale through participation of small producers in more comprehensive and scaled e-market places (Donner and Escobari, 2009), as in the case of the Chinese Taobao.com (box IV.5). Such platforms are able to coordinate information needs throughout the value chain – rather than just provide discrete pieces of information – such as only market prices (Boadi et al., 2007; David–Benz et al., 2006). Using various technologies, dedicated systems provide a full information service to specific sectors (covering quality requirements, inventory levels, market prices, etc.) across a range of produce categories. This may confer additional benefits as all supply chain actors (individual farmers, producer groups, traders, final buyers/processors and wholesalers/exporters) can access a common information management system.

For example, the Kenya Agricultural Commodity Exchange provides a comprehensive market information system plus an e-market place that individual farmers can access through information centres, SMS or voice recordings via a toll-free number. Results show significant use of the system to match supply and demand, as well as to learn about current market prices, providing leverage with brokers and traders (Parikh et al., 2007).[12] Another example is Warana Unwired in India which is a scaled initiative to address market access constraints for sugar cane farmers. When it relied primarily on a web-based solution, it failed to deliver the expected results. However, when it was re-launched, this time using a mobile phone application linked to a web-server, it showed positive results (box IV.6).

Local radio stations can also form part of an integrated telecentre approach, and if they are placed at the centre of the community, they hold the potential to be a useful tool for rural development, through which a large number of information services can be accessed. Radio can effectively overcome barriers of language, geographical isolation and lack of connectivity. Some stations provide indirect access to the Internet and broadcast to communities through so-called "radio browsing" programmes (box IV.7).

2. ICT use in fishing

Fishing is another natural resource based industry of direct relevance to the poor. In the South Indian province of Kerala, on which a number of relevant empirical studies have focused, more than 1 million people are directly employed in the fisheries sector (Government of Kerala, 2005). A number of typical information market failures can affect traditional fishermen in low-income countries (Jensen, 2007). While at sea, fishermen have limited knowledge of market prices and cannot identify in which market location they would get a better price. Due to the cost of transportation and perishability of their products, they can only visit one market per day, often ending

Box IV.6. ICT use in the sugar cane supply chain: Warana Unwired

Warana is a subdistrict of the Indian State of Maharashtra. The economy is centred on the production of sugar cane – some of which is processed and marketed through local processing plants in a cooperative located 2–25 km from the villages. The market for sugar is subject to fluctuating supply and demand, including a gradual deregulation and increased competition (Goel and Bhaskarkan, 2007). Within this changing market environment, greater coordination was needed between sugar cane farmers (up to 40,000 of whom operate in the Warana District) and the large cooperatively or privately-owned sugar mills that process the cane and sell the sugar and other by-products through distribution chains to the final consumers (Gaucher et al., 2003).

Information needs/costs

Along the value chain, information was required both by the farmers and the purchasers. Information collected in the village included the amount of fertilizer and water used by the farmers and the validity of sugar cane harvesting permits. Information sent to farmers included the quantity of sugar cane output to be collected after harvest as well as payment schedules.

Use of ICTs

Initially, the cooperative made use of a PC and an Internet-based system located in village kiosks for exchanging information. However, most of the initial project goals were not fulfilled (Veeraraghavan et al., 2009). For example, a portal developed ended up not being used by the farmers; a website concerning crops and pests fell into disuse; and other features providing price information and integrating local languages were demonstrated but not used.[a] Overall, the initial manifestation of Warana as a wired project was unsuccessful.

More recently, a lower-cost solution based around wireless technology and SMS has been developed to supplement the old system. Within a trial period of eight months, the new mobile-based system was found to be less vulnerable to power cuts and easier to maintain, more accessible by farmers in remote areas, and importantly, it allowed for immediate up-to-date provision of information and notification of prices. The "unwired" system has benefited farmers in terms of: (a) a significant reduction of the number of journeys needed to the centre, thus reducing transaction costs; (b) greater transparency and availability of data on sugar cane output for individual farmers, including fertilizer usage, harvesting permits and pay schedules; and (c) providing a competitive advantage for the cooperative, over those farmers that do not have the system.

Impact of ICT use

Sugar cane farmers benefited from a more efficient management of relationships with their customers. Project-based researchers found direct financial benefits comprising savings to individual farmers of up to INR800 per year in transportation costs, whilst the cooperative has been able to save approximately INR 1 million thus far (Veeraraghavan et al, 2009). There have also been other more 'intangible' strengthening of livelihood assets (de Silva, 2008). Human capital has been enhanced as farmers have become more proficient in the use of ICTs; and social capital has been strengthened through greater transparency in the availability of information, helping to build greater trust between farmers and purchasers.

Source: UNCTAD, based on Veeraraghavan et al., 2009.

[a] *The key reasons for early project failure were identified as (a) no information needs assessment was carried out; (b) there was lack of attention to quality and tailored software development; (c) there was no significant effort to market the services amongst farmers; and (d) overall the infrastructure was insufficient to provide a significant increase in the speed of communication (Veeraraghavan et al., 2009).*

up selling in their local market. They typically do not dispose of appropriate storage or inland transportation for their products. Therefore fishermen have little bargaining power in the market.

In the case of the fishing value chain, there is convincing evidence that increased use of mobile phones has helped fishermen address information asymmetries between fishermen, traders and consumers. Mobile phone use among small fishing enterprises in Kerala, India, had positive impacts on search costs related to selecting and purchasing inputs and also, more generally, on the organizational aspects of inbound logistics (Abraham, 2007). First, time spent at sea was reduced (thus saving fuel costs) as small fishing boats were alerted to large shoals of fish (with 94 per cent of fishermen benefiting from this practice). Secondly, the number of fishing boats put to sea at any one time was maximized. Mobiles were

Box IV.7. Benefits to farmers from community radio in Africa

The United Nations Economic Commission for Africa (UNECA) is managing a knowledge network of community radio stations and telecentres as part of the United Nations Regional Commissions Global Knowledge Network Initiative.[a] Telecentres and radio stations from Burundi, Ethiopia, Kenya, Rwanda, the United Republic of Tanzania, Uganda, Zambia and Zimbabwe are part of the network.

Community radio is already having an impact on people's livelihoods and advancing economic opportunities in parts of Africa. Moreover, it can access many of the existing sources of information and provide broad channels of communications to the poor and to remote areas. The liberalization of broadcasting and telecommunications offers a combined approach using both radio and the Internet, which can facilitate more innovative services for millions of people. Community radio stations are a good starting point for building information and knowledge societies, especially within rural, poor and disadvantaged communities.

Many community radio stations in Africa provide information helping enterprises access markets. One major advantage is that radio overcomes barriers of language, geographical isolation, lack of awareness of the Internet and related technologies, lack of access to free or affordable equipment and lack of connectivity. Some stations that have managed to get connected have pioneered a new phenomenon, known as radio browsing programmes, as a way of providing indirect access to the Internet and broadcast to communities. Radio browsing programmes raise awareness of what is available online and this allows people to identify their existing information needs and new opportunities, while also showing how these needs and opportunities can be met.

Fadeco Community Radio in the Kagera region in north-western United Republic of Tanzania is assisting small businesses in several ways by (a) disseminating information on available markets (prices, foreign exchange rates, prices of various commodities from different markets); (b) linking producers/businesses to markets and buyers to producers; (c) offering a platform for negotiation between producers and buyers; (d) influencing relevant policies; and (e) transferring technology through knowledge sharing and offer a platform for learning. Through programmes broadcast in Kiswahili, farmers/producers get to know prices of commodities and can advertise and sell their output. During Christmas 2009, several farmers were able obtain good prices for their cattle after having advertised and made bids over the radio.[b] Community radio has also helped improve the functioning of the market for bananas. While up to 76 per cent of all bananas were previously wasted, this situation has greatly improved. After a rigorous market campaign over the airwaves, the price of bananas went up to the benefit of farmers. Furthermore, local businessmen organized themselves and formed cooperatives for collective capital and buying power. An international banana market was established in September 2009 in the town of Mtukula (near the Ugandan border).

In Uganda, the Kagadi-Kibaale Community Radio (KKCR) based in the small town of Kagadi some 280 km west of Kampala has made significant improvements in people's livelihoods (Jallov and Lwanga-Ntale, 2007). Operated by the Uganda Rural Development and Training, KKCR started its broadcasts in August 2000 to empower and spur participatory development processes of communities in one of the western-most provinces of the country. It has helped farmers gain better access to price information and strengthened their bargaining position. The station has also helped empower women, by covering information about credit schemes available to help people start small businesses and create a livelihood for themselves and their families. Finally, some entrepreneurs have benefited from the possibility to market their products via the radio station.

Source: Information provided by UNECA.

[a] *The initiative aims to empower poor and disadvantaged communities through the transformation of selected ICT access points into knowledge hubs of global knowledge networks. It supports the role of community ICTs, such as telecentres and community radio stations, in promoting economic development in poor and rural communities. See www.knowledgenets.net/eca.*

[b] *The price of a cow rose from Tanzanian shillings 35,000 to 150,000 ($27–$116, respectively).*

used for communicating between geographically dispersed fishing boats in order to decide when to drop the nets. There was also reduced risk and uncertainty in the planning and coordination of fishing activities, such as through the communication of problems at sea (such as failed engines or changing weather conditions). Thus, there were significant positive impacts on livelihood security.

Mobiles came to good use also at the sales and marketing stage. Mobile communication enabled fishing communities with direct access to output market information (Jensen, 2007). With their phones, fishermen exchanged information about catch volumes and beach market prices at various locations, reducing search cost for the best available market for their products.

Interestingly, benefits extended beyond the individual fishermen who were using the phones. It was possible to observe a greatly improved functioning more broadly of the fish markets. Improved market coordination resulted in fishermen's profits increasing by an average of 8 per cent, including a revenue raise by an average Rs 205 (about $4.50) per day while mobile costs were about Rs 72 ($1.60) per day. Fishermen without mobile phones also saw their profits rise as a result of an overall improvement in market efficiency. Fish prices fell by 4 per cent, thus also benefiting poor consumers. In addition, wastage of fish within the market as a whole fell significantly (Jensen, 2007).

The Kerala studies point to efficiencies above the level of the enterprise for the sector and market as a whole. These are examples of "persistent rather than one-time gains since market functioning should be permanently enhanced through mobile phones" (Jensen, 2007: 919). Market efficiency (and sector productivity) was improved by producers and traders voluntarily taking up mobile phones because they saw the tangible benefits of so doing, rather than phones (or any other ICT) being introduced artificially as part of a funded project initiative. More sustainable benefits are likely to be attained though such "market-driven" processes of ICT adoption.

Mobile information systems are also used in fishing villages from other Southern Indian States, such as Puducherry and Tamil Nadu, where the M.S. Swaminathan Research Foundation (MSSRF) has been developing community ICT access since 1992. MSSRF designed "Fisher Friend", which is a mobile application in Tamil (local language), that provides timely weather and safety alerts, information about where shoals of fish have been detected and market prices. The proposed mobile handsets cost around Rs 2,500 (or $50) and operate on the Tata Teleservices network covering 10–12 km out from the shore. All information is gathered in a central server at MSSRF, Chennai. Upon sending a request from the mobile phone, fishermen get access to vital information via SMS. As of October 2009, about 200 fishermen were sharing 47 Fisher Friend mobile phones in Puducherry and Tamil Nadu. The application has the potential to further increase the safety of fishermen at sea (Nanda and Arunachalam, 2010; FAO, 2007).

Studies conducted in Ghana confirm that mobile phones are a critical piece of equipment for fishermen and fishmongers (Boadi and Shaik, 2006). Their use has generated benefits in terms of cost, convenience and communication, which in turn have fostered efficient business operations and trust (Boadi et al., 2007). In Ghana, radio broadcasts are also providing information to fishermen. Radio Ada in the south-east of the country has been broadcasting in the local language of Dangme since 1998, serving a population of 500,000 people. It offers market information and weather forecasts to help both fishermen and fishmongers plan their activities. Among other things, the station informs listeners about the availability of fish in particular areas. Moreover, fishmongers (mainly women) in the area are learning how different communities prefer to smoke their fish to allow them to adapt to different consumer preferences. Prior to the existence of Radio Ada, fishermen and fishmongers had to rely on informal networks that they could not always trust to find out how much fish was being sold for at the market.[13]

3. ICT use in small-scale manufacturing and services

Small-scale manufacturing and services encompass a wide range of micro and small businesses in both rural and urban areas. The types of activities performed may relate to retail sales, small manufacturers, artisans, taxi drivers and many other services. Consequently, the precise nature of the value chain differs considerably between the enterprises concerned. The degree of formality also varies as does the need for different ICTs. Enterprises range from those that are still unconnected to any form of telecommunications network to those that are already intensive 'networked' users of ICTs with frequent use of email and the web, and use of computers in applications such as for accounting and customer invoicing systems (Duncombe and Heeks, 2002a). Most enterprises that were previously non-users have taken their first step in ICT through use of mobile phones (Aker and Mbiti, 2010).

a. Mobile phone use

Similar to the cases noted for agriculture and fishing, ICT use among small and micro-enterprises in manufacturing or services in low-income countries has mainly been related to mobile phones. Depending on the nature of activities, such phones may be used in particular to stay in touch with existing suppliers and customers, or to find new ones. In a study of SMEs in 14 African countries, 76 per cent used mobile phones for contacting customers and clients (Esselar et al.,

2007). In the United Republic of Tanzania, one in four mobile subscribers used their phones for business purposes, which, among other things, helped reduce the need to travel (Vodafone, 2005). In the same study, a majority of micro-entrepreneurs in Egypt and South Africa indicated that mobile phones had contributed to increasing their profits, including by enhancing the flexibility of doing business (increased availability and possibility of placing/receiving remote orders).

A common feature of mobile phone use by micro-enterprises is a relatively low incidence of calls or SMSs for accessing business information, with use patterns dominated by social interaction.[14] This was found to be the case in a study from the Caribbean with regard to the use of ICTs by SMEs (ECTEL, 2009). Other studies have made similar observations (Souter et al., 2007). Particularly in the context of enterprises which are home-based, it is difficult to differentiate between, for example, social calls and those seeking to secure revenue. Nevertheless social uses of the mobile phone can reinforce the economic uses (Donner, 2009b; Burrell, 2008).

Qualitative studies confirm that mobile communications can provide tangible benefits for micro-enterprise's primary operations. Take the case of a small business set up to produce furniture in rural Uganda, for which the use of mobile phones helped reduce transaction costs (Burrell, 2008: 22):

> *"One of the primary ways [the owner] used his mobile phone was in managing timber supplies and trying to reduce his transaction costs. For example, he used his phone to call ahead to the timber supplier to determine if they had the right quality and quantity of wood. He also called to find out if the electricity was on in the town because he needed to have the wood he purchased prepared with an electric saw by the timber supplier. These preparatory calls saved him from making wasted trips into town… He also made use of air-time transfers on occasion to make payments to suppliers and this was another way to reduce transaction costs."*

Similarly, in a study of women's weaving micro-enterprises in Nigeria, the role of mobile phones in supporting the operational interactions helped to lower transaction costs and the level of risk (box IV.8). Producers saved time and money by substituting for journeys related to a wide range of value chain activities, such as checking identities of purchasers and suppliers, confirmation of orders, sourcing raw materials, confirming credit arrangements, checking changes to orders or deliveries and setting up and confirming presence for physical meetings (Jagun et al., 2008). However, issues of trust, design intensity, physical inspection and exchange required a continuing need for face-to-face meetings. The market structure remained fairly unchanged, with continued strong bargaining positions for intermediaries.

Ethnographic and qualitative studies of dispersed and little formalized value chains tend to be more cautious than quantitative analyses in linking use of mobiles with tangible benefits (Jagun et al., 2008; Molony, 2007). A study of the African blackwood carving sector in the United Republic of Tanzania, for example, found that information exchange along the value chain was intermediated through complex networks of traders, where the distinction between social and business networks was blurred – in this context, information exchange through face-to-face communication was deemed essential (Molony, 2007). It suggested that trading intermediaries, rather than being cut out of value chains, will likely reinforce their position and benefit through use of mobile phones.

The introduction of mobile phones has sometimes had certain disadvantages for the poor. In Zambia, for example, a "virtual mobile divide" emerged for poor women entrepreneurs that utilized mobile networking (Abraham, 2009). In the first instance, this was represented as a broader digital divide between those who were able to afford and access mobile networks and those who were not. But even among the mobile users, those with power and access to resources were more likely to be part of the active network, whilst women with low incomes became excluded (Abraham, 2009).

Many micro-enterprises are likely to gain from new mobile-money services. Significant benefits have been identified amongst (business) users with low incomes and with sufficient knowledge to use the systems effectively (Williams and Torma, 2007). While the potential is significant, early assessments of such services have also noted that the applications are often viewed by the poor with mistrust, similar to traditional banking channels (Ivatury and Pickins, 2006).

In April 2010, M-PESA in Kenya counted as many as 9.7 million customers which exchanged some $327 million monthly in person to person transfers.[15] As individual customers become acquainted with mobile-money they tend to remit smaller amounts

Box IV.8. Impact of mobiles on supply chain operations for women's micro-enterprise in Nigeria

The value chain in a nutshell

"Aso oke" involves the weaving of cloth on hand-looms in Nigeria. The cloth can be used in the production of fashion accessories such as shoes or bags, and in the production of home furnishings such as throws and cushion covers. Transactions begin when a buyer approaches either a weaver or – much more often – an intermediary to place an order. Orders for the fabric are usually bespoke and placing an order involves negotiating the buyer's design requirements: such things as the pattern and colours of the fabric, its consistency, and finishing. This negotiation will involve the weaver being called to meet the intermediary and/or buyer. Once the design has been agreed upon, a sample of the ordered fabric is produced and presented to the buyer for approval. Approval leads to the negotiation of the terms of the transaction including order quantity, delivery dates, and price. A deposit is then paid by the buyer which serves to both seal the trade agreement and provide initial capital for producing the order. Payment of the deposit marks the beginning of the production stage. Raw materials are purchased either by the intermediary or – infrequently – by the weaver and the fabric is woven to the buyer's specifications.

Information needs and constraints

- Operational processes tend to be slow requiring physical interaction, and may require journeys. Journeys are often slow because of poor quality and/or lack of transport infrastructure.
- There are high financial and time costs of gathering information necessary to prepare cloth and trade. Journeys are costly in terms of both direct and indirect costs: for most micro-entrepreneurs a day spent journeying is a day on which income generation is foregone.
- Micro-entrepreneurs are subject to trading risks because of information asymmetries. These include opportunism such as overcharging for goods or agreeing to a contract knowing it cannot properly be fulfilled, and adverse selection such as unwittingly selecting a trade partner or trade items of poor quality.

Intermediaries play an important role in this value chain. They hold information on buyers, sellers, products and prices. They can reduce the informational costs and increase the communication speed for buyers and sellers. Their broader spread of contacts allows trade to become less localized. They can make trade less risky, because of their informational resources and reputation. But intermediaries can also have a negative impact on micro-entrepreneurs. They are typically in a powerful bargaining position as they have more information than micro-producers and customers. As a result, they are often seen to force prices paid to producers down below market values, reducing the income for micro-entrepreneurs.

Use of mobile phones

Use of mobile phones by producers saved time and money in enterprise operations by substituting for journeys related to a wide range of value chain operations: checking identities of purchasers and suppliers, confirmation of orders, searching for and confirming presence of raw materials, confirming credit arrangements and pick-up of raw materials, checking changes to orders or deliveries, communication of minor amendments, checking and confirming presence of completed parts and setting up and confirming presence for physical meetings. Time saved per call was typically several hours. Money saved was typically understood by comparing call costs with transport costs.[a] There was some consideration of the opportunity costs of travel that could be recouped through phone use. For example, weavers could spend the time they would be travelling on producing cloth; intermediaries could instead seek orders or engage in other business. However, journeys and face-to-face interactions did not disappear entirely. They were still required for physical inspection. The need for inspection arose from a factor specific to design-intensive sectors like "aso oke" – the need to physically see particular items.

Impact on the poor

While there was no measurement of the impact on livelihood assets in this research, key findings included:

- Transaction processes were improved thanks to reductions in time, cost and risks. However, broader characteristics of commerce – issues of trust, design intensity, physical inspection and exchange, and interaction complexity – limit the impact as they compel a continuing need for face-to-face meetings.
- The market structure remained unchanged: commerce remained localized and intermediated. Indeed, mobiles have consolidated existing intermediaries (because of their access to capital and other resources) and also led to the creation of new forms of intermediaries. This could have an impact on the incomes of micro-enterprises.
- Some evidence suggests that those with mobiles got more trade while those without tended to become excluded from supply chains.

Source: Jagun et al., 2008.

[a] *For example, interviewees talked about a call rate of N50 ($0.40) per minute being cheaper than a taxi cost for an average journey of, say, N1,000 ($8), given that calls were normally completed in less than five minutes.*

with greater frequency (CGap, 2009). Beyond reducing the risk of robbery, mobile-money can improve the allocation of savings across households and businesses by facilitating the transfer of small amounts of money when needed and thus lead to more efficient investment decisions (Jack et al., 2009). Although in many cases the functionality of the services is directed mainly to monetary transfers for personal remittance, this is likely to change as mobile providers develop new value added services for the enterprise sector. For example, the M-Paisa system in Afghanistan has a specific focus on micro-credit (box IV.9).

Extending mobile-money services to the illiterate remains a challenge as transfers are transmitted and

Box IV.9. Mobile-money for enterprises in Afghanistan

Launched in 2008, M-Paisa is a mobile technology platform for transferring small amounts of money to the benefit of those with limited or no access to banking in Afghanistan. M-Paisa builds on technology developed for the M-PESA service in Kenya and is provided in Afghanistan by Roshan, the leading mobile telephony operator.

M-Paisa focuses on providing micro-finance to small enterprises. To facilitate loan disbursements and repayments, Roshan works with large micro-finance institutions (MFIs) in Afghanistan such as First MicroFinanceBank and Foundation for International Community Assistance. Other services to be covered by M-Paisa include a series of business applications such as salary payments and airtime distribution. MFIs and other business clients can rely on Roshan's wide network of retail outlets and use them as transaction points for transferring or collecting money even in very small amounts. For enterprises, the advantage is that their costs are reduced both with regards to front-office expenses and with regards to money transfer fees. For consumers, benefits include fewer journeys to and from large cities, reduced risk of traveling with a large amount of money and reduced transaction costs. Mobile-money transfers are more cost effective than existing alternatives such as local post or bus services.

In Afghanistan, the benefits of mobile-money transfers are particularly relevant since moving cash through the country is risky, expensive and time consuming. The road infrastructure and the number of bank retail outlets have been decimated by years of conflict and instability. For example in 2009, Afghanistan had 17 banks, 300 branches and 38 ATMs for a population of 28 million and a surface of 647.5 square km. In just more than one year from its launch, M-Paisa had acquired some 120,000 registered subscribers and 2,500 microfinance clients through the partnership with First MicroFinanceBank (Satchu, 2009).

Roshan and its majority shareholder, the Aga Khan Foundation for Economic Development, are aiming to further develop M-Paisa, while paying particular attention to the poor. There are currently only 50 M-Paisa trained dealers located in large Afghan cities such as Kabul, Mazar, Jalalabad and Herat. Thus, the service is not yet able to take advantage of Roshan's entire coverage area in 216 Afghan cities and towns and approximately 20,000 dealers and distributors. To address this matter, Roshan currently invests in training.

While mobile-money is not equivalent to a fully-fledged banking service, M-Paisa is one step ahead in complexity as compared to other m-transfer business models owing to its strong partnership with MFIs. Certain limitations remain. For example, money stored on M-Paisa accounts does not earn interest (as it would if stored in a bank account) and cannot be invested. Furthermore, when disputes arise over transfers or payments, current banking laws and regulations do not provide a resolution. The default of a civil litigation is most likely not an option for many Afghans, given the cost of litigation, the likely relatively small amount at dispute, and the overburdened state of the civil courts. Experience from other countries has shown that at peak times, the mobile-money system can generate errors such that either money is not transferred or money is transferred but no SMS confirmation is sent. In addition when the transfer pattern is persistently from rural to urban areas, recipient dealers face the risk of running short of cash thus effectively delaying payments (CGap, 2009).

The strengthening and tailoring of Afghan banking and telecommunications regulations are therefore crucial to the long-term success of an m-banking and m-commerce system. A successful system of mobile laws and regulations would adapt best practices from other countries supporting mobile-money to Afghanistan, and create novel mechanisms to address extant needs for the security of identities, networks and capacities against fraud; customer privacy and informed consent; data access and use; and anti-laundering and corruption, among other needs. Alternative dispute resolution mechanisms, built into transfer and collection systems of mobile-money platforms, are also key elements to resolving disputes quickly and efficiently, and to building trust. The best approach may be to integrate and adapt traditional justice mechanisms into an online setting using mobile phone technology.

Source: UNCTAD, based on Devanesan and Aresty, 2010.

confirmed through SMS. In Afghanistan, the mobile operator, Roshan, in 2010 started testing interactive voice recognition technology to guide users through transactions in English, Dari or Pashto. Another Afghan mobile phone operator, MTN, approached the gap in mobile phone use differently by focusing on expanding mobile use among women through setting up women-only retail stores. This solution responds to the needs of local customers where tradition prohibits women from interacting with men who are not relatives (GSMA Development Fund and Cherie Blair Foundation for Women, 2010). Women currently constitute 18 per cent of the Afghan mobile phone subscribers (ibid.).

b. Use of other ICTs

Few micro-enterprises in developing countries are direct users of computers and the Internet (chapter II). For women micro-entrepreneurs in Mumbai, India, for example, telephony is far more important than the Internet. In a survey of ICT use by 231 women-run informal sector micro-enterprises in Mumbai, the sample exhibited a profile that might be expected to be Internet users (Levy et al., 2010).[16] However, computer and Internet use was low: 15 per cent of the sample had a PC at home and 5 per cent a laptop. Only 9.5 per cent of the total sample of micro-enterprises was online. By contrast, about 75 per cent had business landlines, and nearly 90 per cent owned mobile phones. The small number of women entrepreneurs that made effective use of ICTs for their businesses were those that had overcome traditional gender roles and were more growth-oriented – graduating to small-scale. The majority, however, continued to rely on traditional (word-of-mouth) means for information access.[17]

Similarly, in a study of information provision to SMEs in Namibia, there was high Internet usage among business support organizations, but very low levels of access to the Internet and little e-mail communication by their client enterprises. The latter continued to rely on informal information sources despite the existence of a wide range of business information services locally (Chiware and Dick, 2007). Reasons included a lack of knowledge of formal provision (such as via the Internet), and a lack of skills to use the information, while the institutional providers of information were often badly attuned to enterprise needs. Studies in Botswana found little evidence of the Internet being used to overcome information access constraints by micro-enterprises (particularly those in rural areas), but greater usage by SMEs located in or near urban areas (Duncombe and Heeks, 2002a, 2007; Mutula and van Brakel, 2007).[18]

Opportunities created by e-commerce have not yet had a major impact on micro-enterprises in low-income countries, for several reasons. First, as noted in chapter II, few micro-enterprises in developing countries have their own website or information about their products posted online (figures II.11 and II.12). Secondly, various constraints have been identified for developing-country producers in using web-based transactions and marketing.

Both business-to-business (B2B) and business-to-consumer (B2C) e-commerce have largely failed to deliver the considerable potential benefits predicted in the earlier part of the decade (Mansell, 2004; Wresch, 2003). An assessment of benefits from e-commerce found little evidence of producers in developing countries selling significant amounts of goods directly to consumers online (Batchelor and Webb, 2002). The overall picture is one of slow progress for e-commerce directly benefiting poor producers. There is lack of more recent studies that might indicate more positive impacts that may have arisen in the latter half of the decade. However, numerous cases have been observed of successful web-based marketing of handicrafts and other items produced by poor artisans in developing countries. One example is “Botswana-craft”, which markets basketry and other traditional art on behalf of the San peoples of Botswana.[19] Another example is “CraftsinIndia”, which has a web portal that showcases a broad range of Indian artisans from its base in New Delhi.[20]

In the Red River Delta handicraft cluster in Viet Nam, village-based artisans specialize in the production of porcelain, silk textiles, embroidery and carved wood, predominantly serving local and regional markets. However, they are increasingly pursuing exports of higher value added furniture and porcelain goods to markets in the Far East and to the global diaspora (Konstadakopulos, 2006).[21] Despite strong belief in the potential of the Internet to expand markets, a severe lack of knowledge of how to link ICTs with business benefits has hampered success. Overall, no strong relationship between ICT use and more effective marketing by the cluster as a whole has been demonstrated. A key reason for this has been a lack of knowledge transfer from the enterprises that adopted ICTs and the cluster as a whole. Overall, smaller

enterprises lacked the complementary resources and skills required to make effective use of ICTs, and there was a poor match between the marketing needs of the enterprises and the web-based solutions offered.

As noted above, the scope for ICT use to contribute to increased productivity is larger for growth-oriented enterprises that are connected to value chains extending beyond the local market. There are other successful examples of ICT diffusion within small manufacturing enterprise clusters. ICTs are becoming an essential tool to improve the competitiveness in the Indian garments sector, ensuring its long-term survival. Tiruppur, for example, is the location of a well-established garment cluster in South India which manufactures for both export and domestic consumption (Nadvi, 1995). A group of medium-size firms sub-contracts to an array of small and micro-units providing backward and forward linkages to all aspects of the production process (from cotton ginning and yarn spinning, to specialist tailoring and screen printing). Rapid growth of the Tiruppur knitwear cluster has taken place under the aegis of the Tiruppur Exporters Association, with exports rising to Rs 11,000 crore ($244 million) in 2007 from Rs 290 crore ($6.4 million) in 1990.[22]

With the assistance of cluster-wide application of ICTs – suitable for the different actors involved – this cluster has been able to achieve significant economies of scale despite growing international competition.[23] Until recently, few ICT solutions were being used in the Tiruppur cluster owing to a lack of awareness and the right skills. Another key obstacle was the affordability of high-end systems required for effective value chain integration. In order to address these constraints, the National Manufacturing and Competitiveness Council, under the aegis of "Project Vikas", supported small and micro-enterprises that were looking to upgrade their use of computers for office automation, accounting and mobile communications.[24] Such support made it possible for the lead medium-scale firms to implement Enterprise Resource Planning or Customer Relationship Management throughout the cluster. A major benefit from ICT use was faster servicing of orders received. Further integration of a mobile-based order tracking system helped to bring down the order cycle time from 90 to 60 days.[25]

Comparing the functionalities of ICT use in sectoral value chains directly relevant to the poor can help to identify some technical commonalities. Technology deployed for one sector can also be used by another sector, even if the information content differs entirely. The value chain approach shows that there are both similarities and differences between technology designs and intended outcomes across sectors, especially when taking into account basic functions and needs of micro and small enterprises (Donner, 2009a). Section C highlights the main implications emerging from the analysis.

C. IMPLICATIONS OF ICT USE FOR POVERTY REDUCTION

Knowledge about the value of ICT applications to enterprise supply chains of relevance to the poor is still incomplete, and the evidence remains in most part anecdotal. The deployment of extensive ICT networks reaching the poor is too recent, and data availability is too limited, for extensive macro-level analysis of social and economic impacts to have emerged. There is thus a clear need for larger-scale empirical and representative analysis. Nevertheless, there is enough evidence to warrant greater attention to this area in discussions related to poverty reduction.

Judging from the evidence reviewed above, the main observed benefits of ICT use are twofold: (a) a reduction in information search and transactions costs for those involved in enterprise; and (b) improved communications within supply chains leading to benefits for individual enterprises and overall improvements in market efficiency. ICTs can also strengthen internal information systems for those (predominantly growth-oriented) enterprises that own a PC and are able to make effective use of computer-based applications. There is furthermore evidence that ICTs can provide other benefits around the strengthening of social and human capital (enhancement of skills, increased self-confidence, participation of women, empowerment, and security against income loss).

Meanwhile, some potential risks and disadvantages for the poor should also be noted. First, greater ICT use in enterprises which lead to productivity improvements and changes in the nature of competencies required may reduce the number of jobs available to poor people, at least in the short term. While it is in the long-term interest of countries to make their productive sectors more effective and competitive, policymakers need to be aware of the short-term implications for assistance to those primarily affected by the restructuring of economic activities, or that lack the required skills.

Another risk is that ICT use helps cement or even accentuate existing power relations and inequalities. In some cases, enterprises that are non-users of ICTs will be unable to attain the two key benefits of reduced transaction costs and improvements in communication and may find themselves at a competitive disadvantage. New ICTs can then easily become first and foremost a tool for the already well equipped to strengthen their power, thereby widening the gaps to others in society. Indeed, ICT use can reinforce the market position and power of existing trading intermediaries, whose actions may not impact positively on the livelihoods of the poor. Finally, the role of ICTs might be more limited in local value chain systems (particularly of subsistence-based enterprises) that rely heavily on pre-existing, informal and culturally rooted communication where the exchange of valued information is by means of personal contact.

A key challenge is to seize maximum benefits from the opportunities that have emerged from more widespread use of ICTs in low-income countries, while at the same time mitigate the risks of more rather than less inequality emerging as a result of ICT use. The remainder of this section summarizes the main implications of ICT use at different stages of the value chain (section C.1), implications from the perspective of subsistence-based (section C.2) and growth-oriented enterprises (section C.3), respectively, and for policymaking (section C.4).

1. Role of ICTs at different stages of the value chain

The sectoral reviews showed that the most critical areas of application for ICT by enterprises that are of direct relevance for the poor are related to the sourcing of inputs for production, and for outbound logistics and market access. Such applications may involve both the exchange of information and the conduct of transactions. ICTs are most valued by entrepreneurs when tangible benefits accrue from greater efficiencies – particularly those which relate to supporting two-way information flows with key customers or suppliers. Given that most enterprises in developing countries serve local and regional markets (or work through intermediaries or processors to reach global markets), such efficiencies are gained primarily through better use of basic business communications. It is unsurprising, therefore, that benefits of mobile phone networks are frequently cited.

The use of the Internet for accessing market information, among growth-oriented enterprises in developing countries, varies between sectors. For enterprises that trade across borders (importers, exporters and in the tourism sector) the Internet has become a critical tool for accessing and disseminating business information from and to external institutions and global business networks. However, most subsistence-based enterprises serve at best local markets, and will only derive benefit from net-based market information if and when sufficient web-based data (local content in local languages) is available through local networks, when they have the necessary capacity to make use of web access, and/or when consumer use of the Internet increases. Digitized content from local institutional (primarily government) and large private sector sources is growing in many developing countries. Internet-based information services might play a greater role in making available information support services through local sector-specific intermediaries, rather than directly, or to make information from national and local official sources more accessible. At the same time, there have been many failed attempts at reaching the poor through web-based solutions. As noted by some experts concerning the use of the Internet to provide information to enterprises in agriculture (de Silva and Ratnadiwakara, 2009: 13):

> *"There is no value in having all the crucial information in some website if the farmer has no access to the Internet."*

There is little evidence of ICTs having a direct impact on the core operations of micro-enterprises (such as in the manufacture of artefacts or the growing of produce). ICTs play a more important role further downstream in value chains, such as for the fish or sugar processor or for local SMEs manufacturing textile products. SMEs (and large enterprises) in developing countries are increasingly implementing higher-end systems (such as for Enterprise Resource Planning or Materials Requirements Processing) to control and coordinate the supply chains upon which smaller producers depend (infoDev, 2008b).[26] Therefore, the application of ICTs to the downstream processes of larger processors, manufacturers or buyers (including wholesalers and retailers) places new demands for information access and processing concerning the core activities of smaller enterprises in the value chain – including subsistence producers supplying raw materials.

The ability to benefit from high-end technologies that control the core operations of enterprises vary by country. In countries where large-scale manufacturers have already adopted such technologies, the conditions may be favourable to transfer technological know-how into the small-scale sector through collaborative, licensing and sub-contracting arrangements. In fact, in some countries, including India, such technological diffusion is already taking place. However, as indicated in the Tiruppur case, successful diffusion is only likely to occur when local factor endowments are conducive to such investment and through the encouragement of a wider institutional framework. For growth-oriented enterprises in most countries, formalization of information systems will take place through better internal data processing (business accounts, inventory, payroll, invoicing, etc.). Such ICT use can contribute positively to enterprise performance, notably through better controlling of finances and cash flow.[27]

ICTs are a key tool to build networks and linkages to other stakeholders: business, social and political ones. Risks can be reduced and market entry enhanced through extending networks of collaboration. When enterprises collaborate in order to access value chains, it provides for greater collective efficiency. Such networking of enterprises can involve exchange of commodities, information, services, subcontracting relationships, mutual reliance on technical specifications or standards, and access to a common labour force. Collaboration also enables scaled-up approaches to the upgrading of enterprise activities through integrated support and productivity enhancement packages employing sector strategies that encourage business incubators and demonstrators, such as witnessed in the Warana and Tiruppur examples. However, the degree to which enterprises are able to collaborate varies considerably such as witnessed in the Red River cluster in Viet Nam, where formal agglomeration (as opposed to informal, occasional collaborations) was at an incipient stage and local competition seemed to be a stronger force than local cooperation.

The combination of different technologies presents new solutions for reaching out to wider networks of poor users. They may be more effective as they can leverage the advantages of several different technologies. Such approaches may use computer databases and analytical power for centralizing knowledge before selecting and distributing the information requested through more widely diffused ICTs such as mobile phones or community radio. In many cases, such technology can be delivered by partnerships of organizations. A focus on opportunities from combinations may represent a move away from seeing mobile phones, PCs and the Internet as offering competing solutions for the supply of relevant information. Indeed, a review of progress with regard to "mobile-based livelihood services" highlighted the complexity of the systems deployed (Donner, 2009a: 13):

> *"…in almost every case, the service does not run on the handset on its own. Rather there is a PC, a server, or a whole organizational ecosystem behind whatever the user sees on his or her small mobile screen. More often than not the systems are deployed and maintained by large institutions in central, influential locations."*

2. Implications for subsistence-based enterprises

When considering the possibility for ICT use in subsistence-based enterprises to help reduce poverty, a number of barriers need to be kept in mind, some of which are more critical for certain technologies. First, there is typically a lack of literacy amongst enterprise operators (most of whom are women), and also a lack of English language skills (the dominant language for information on the Internet). Secondly, there is a predominance of traditional oral cultures and social barriers to accessing information via ICTs. Thirdly, lack of familiarity and skills with all ICTs, coupled with a lack of awareness, by enterprises can similarly act as a hindrance. Fourthly, poor infrastructure (electricity, roads) in rural areas and the distance may make it too cumbersome to access certain ICTs. As noted in chapter II, in some remote rural areas, large parts of the population still lack access to a mobile signal as well as electricity. Poor infrastructure can also reduce the value of accessing information – if a farmer is unable to transport his or her produce to the buyer. Finally, there is an important network aspect to consider. If there is no widespread use of ICTs throughout the enterprise value chain, i.e. among suppliers and customers, the value of ICT use will also be smaller.

In most countries, the majority of subsistence-based enterprises use ICTs at best as a communication tool – to aid person-to-person communications and networking. Mobile networks are already assisting in this respect, although for most such enterprises, mobile phone communication builds upon and extends pre-existing trading relationships that have been forged

through face-to-face contact. Some studies suggest, however, that mobile phones can disrupt pre-existing and traditional networks of communication. The contact lists of fish traders in Kerala and dairy farmers in Orong in Bhutan, broke away from localism and connected into geographically more dispersed networks, thus increasing the network effects associated with enhanced social capital.

Where other ICTs (e.g. the Internet mediated via telecentres) are used, they should provide a supplement, not a substitute, for pre-existing information systems. When possible, telecentres could be established as components of broader development projects that can court the community at large, clearly identifying ways in which one might benefit from telecentre facilities and services. This can be achieved most successfully when the Internet is integrated with other technologies that are more accessible by subsistence-based enterprises (such as mobile phones or community radio). Such integration also needs to be managed effectively, ideally by sector-based intermediaries (or "info-mediaries") that can also help leverage the resources necessary to bridge the financial, socio-cultural, and knowledge gaps experienced by (particularly the poorest) producers. If financially sustainable and well targeted to the needs of the local beneficiaries, telecentres still hold the potential to support rural enterprises.

ICT interventions for subsistence-based enterprises should not be judged solely on their monetary impact. Issues of governance, power relations, environmental sustainability and social benefits cannot be readily separated from enhancements to their communication and information systems for enterprise purposes. In this respect, the need for ICT access may be overshadowed by other constraints on subsistence-based enterprise, relating to markets, money, skills and motivation. Indeed, for any true benefit to be gained from applying ICTs among the poorest producers, basic skills and/or financial stability will need to be acted upon as part of broader development efforts that treat different policy domains in a holistic manner (chapter V).

3. Implications for growth-oriented enterprises

Growth-oriented enterprises are better placed to make use of ICTs, and they provide more capacity to generate wealth, employment, exports and innovations that will have a more sustainable impact on the long-term growth and productivity of individual subsectors. They may therefore represent greater prospects for ICT interventions to make a difference. In addition to direct impacts accruing to ICT-using enterprises, there may also be indirect benefits to producers located upstream. For example, in the cut flower cluster in Uganda, ICT investment in a downstream enterprise benefited the sector as a whole, creating expanded employment also for growers. Similarly, for the fishermen of Kerala, the use of mobile phones by the largest fishing boats created spillover gains even for non-users of mobile phones.

But one size does not fit all and targeted strategies are required because of the different roles ICTs play in different sector value chains. For growth-oriented enterprises, individual sectors require specific ICT support, as in the textile sector, where competitive pressures driven by rapid technological change mean enterprises must adapt quickly to the utilization of new technology. Growth-oriented enterprises may also need institutional support to upgrade their use of ICTs in order to achieve compatibility with customers or suppliers in regional and global value chains. In the Tiruppur case, assistance to smaller enterprises helped to enable the use of more sophisticated ICT solutions not only by the medium to large enterprises, but throughout the cluster. Support may be warranted in terms of fostering business linkages, coping with sector-wide re-designing of processes and developing new business and organizational cultures. ICTs should form part of, and enable, these broader sector-wide interventions, but they should not drive them. Effective implementation of such support necessitates close coordination between ICT and enterprise policies (chapter V).

4. Policy implications of a sectoral value chain approach

From a policy perspective, an emphasis on sectoral value chains allows for ICT-related interventions that are targeted to different enterprise activities. There are a number of justifications why such an approach may be desirable:

- *Relevance*. Information needs (and constraints) are often sector-specific. Up-to-date sector-specific information is more highly valued by enterprise owners than generic information. At the same time, it is important to ensure that such specialized information networks do not disadvantage poor enterprises by way of exclusion.

- *Targeting*. There is a need to be selective in how ICT interventions are targeted at poor communities. Using ICTs to improve the productivity of specific produce or product subsectors (such as for sugar cane or grain production) will bring longer-lasting sustainable benefits for the communities that depend upon those activities.
- *Needs assessment*. A subsector approach facilitates a more focused and manageable assessment of information and communication needs, than would be possible in cross-sectoral surveys.
- *Cost effectiveness*. It is more feasible to build subsector approaches within existing institutional arrangements, building upon available institutional resources (such as for sourcing finance). This is likely to be less expensive and more successful than creating new types of organization and new infrastructure.

Information is the key resource that ICTs can deliver. Sector-specific information (related to finance, skills, materials, technology, etc.) is generally more valued by enterprises, and up-to-date market-oriented information is also more valuable than generic information (Duncombe and Heeks, 2002a). This suggests that information delivered through business development services or agricultural support networks, should ideally be packaged in simple ready-to-use formats and available in the local language (written, speech or multimedia). In this respect, information providers should be encouraged to focus on market research, defining services in terms of benefits to customers, and focusing on areas of strength. These types of interventions often require a high level of sector knowledge on the part of the information providers. The more tailored the information is to the specific needs of an individual enterprise, the better. Two-way communication channels are preferable as they allow the intended beneficiaries to be directly involved and to spell out precisely what they are seeking in terms of information or knowledge.

The ability of ICTs to deliver such core information services on a large scale, in a timely manner and tailored to the individual needs of the poor, remains a question mark. New integrated information delivery services based around mobile phones using voice-service (helplines, etc.) or SMS appear to offer promising prospects. The efficacy of these systems for direct access to usable information has yet to be tested at scale, however, and the financial costs of information transfer to the recipient can be relatively high.[28] This makes it important to step up efforts to examine which, and under what circumstances, various kinds of ICT-based support services can have a tangible positive impact on the livelihoods of the poor.

Adoption strategies for ICT and enterprise support tend to fall into two categories:

- *Supply-side interventions*: e.g., providing information, training, and ICT equipment such as through community based telecentre initiatives.
- *Demand-side interventions*: e.g., where ICT is adopted through development of linkages to customers (e.g., sub-contracting to local large customers, export support to link to overseas customers) and other marketing support.

More successful application of ICTs to enterprise has followed the demand-driven route. For example, "eChoupal" in India was stimulated by the motivation of a large market player to provide goods and services to micro-enterprises, as well as the desire of micro-enterprises to sell their produce to a larger and more reliable customer (Annamalai and Rao, 2003). Similarly, the success of mobile phones in meeting the needs of dairy farmers in Bhutan or fishermen in Kerala was stimulated by demand for better communications, and the ability of the mobile sector to satisfy that demand. Most importantly, therefore, adoption strategies for ICTs need to emphasize the motivational drivers that make enterprises demand ICT. A value chain approach can serve to identify enterprise information needs. At present, there is too much focus on enablers that help enterprises overcome supply barriers to ICT use. Too much attention is also given to delivering supply-side information, for example, concerning access to finance or general business development services. More emphasis should be directed to accessing information via ICTs concerning market demand for goods and services and customers.

The initial focus for intervention should be on the basis of a subsector approach. This should involve the identification of subsectors that are most relevant for poverty reduction as they may vary between regions and countries. Of fundamental importance to the direct livelihoods of the poor in all developing countries are subsistence-based enterprises that cultivate and process natural resources (in livelihood terms – natural capital) – predominantly agriculture, horticulture, forestry, fishing, etc. Many micro-enterprises and SMEs located further down the value

chain also benefit from natural resources as inputs for further processing and fabrication. For example, for the production of local crafts, food and beverages or for direct resale to consumers through local kiosks, shops or markets. Focusing on subsectors will bring out the functions played by different types of enterprise within the value chain, differentiating subsistence-based enterprises (with little or no direct access to ICTs) from growth-oriented enterprises.

There is a potential tension here. For poverty reduction, subsistence-based enterprises have the greatest need for intervention, but ICT-related interventions targeting growth-oriented enterprises may have a greater economic effect (Duncombe and Heeks, 2002a). This suggests a need for a dual approach by governments and development partners that takes into account both the needs of the beneficiaries targeted and their ability to pay for the services offered. Where market-based solutions can be found, the chances increase that the interventions are sustainable. However, long-term public support is most likely to be required to address market failures in the delivery of information or services to subsistence-based enterprises with very low purchasing power.

NOTES

1 These intermediaries can be categorized into market actors such as (a) export and import agents; (b) brokers that act on behalf of larger purchasers; (c) processors that add value to agricultural and other produce; (d) certifying agencies and input providers (Parikh et al., 2007). Other intermediaries include extension agencies, NGOs and financial service providers, which may include micro-finance organizations and mobile phone enterprises.

2 See, for example, a study of informal cross border trade and trade facilitation reform in sub-Saharan Africa (Lesser and Moise-Leeman, 2009).

3 Defined as the gaps measured between the information that the enterprise needs in order to produce and trade, and the information they have or are able to acquire (e.g. Duncombe and Heeks, 2002a).

4 See also the discussion and resources organized by the Food and Agricultural Organization of the United Nations (FAO) related to e-Agriculture and the use of ICTs in rural enterprises, available at http://www.e-agriculture.org.

5 For growers and traders, the most important time is after harvesting (October-November), when onions from many locations have to be dried, packed and transported to meet tight delivery and demand schedules.

6 See Balancing Act News Update issue No 495 and SciDev.Net, 2010.

7 In the UNCTAD survey, most centres provided generic services such as access to information, personal communications and basic training in ICT.

8 Similar initiatives elsewhere in India include the Anand Milk Collection Centres in Gujarat and Warana for sugar cane farmers in Maharashtra (Harris and Rajora, 2006).

9 For more information see: http://www.rosebudlimited.com/.

10 Initiatives are categorized as four-fold comprising (a) voice information delivery services – telephony services that provide advice on farming methods and access to markets to farmers along the lines of a call-centre; (b) radio, including dial-up and regular radio broadcasts providing transmutable information; (c) extension services based on the mobile phone and database monitoring – using tracking and profiling methods to provide market information as well as some transaction and brokerage services; (d) e-learning for skills development and agricultural education using multi-media (predominantly video) content.

11 See http://www.celac.or.ug/.

12 See: http://www.kacekenya.com.

13 Information provided by UNECA.

14 See Donner, 2007a, for a review.

15 Information from Safaricom, June 2010. Exchange rate of $1 = 81.5 Kenya shillings.

16 Most respondents were young and educated, whilst two thirds could read and write English. The modal age of all the women interviewed was 35. Only 7 per cent had primary school education or less, 41 per cent had a bachelor's degree or more, while 70 per cent could read and 67.5 per cent could write English (Levy et al., 2010).

17 The preference for face-to-face interaction within local value chains was a significant constraint to accessing information online.

18 Duncombe (2007, 2002) found that levels of ICT use were very low in all the manufacturing sectors covered in the study of micro, small and medium enterprises – textiles and clothing, building materials, furniture and fabrication – irrespective of other variables such as enterprise size, the educational level of the entrepreneur, and the form of ownership. In contrast, the use of ICT was fast becoming a minimum requirement for survival in the market for manufacturing exporters, the tourist sector and domestic service subsectors. For example, in more advanced service-based sectors, a strong Internet presence was already becoming a powerful and relatively cheap marketing tool, both for raising the profile of the business and for rapid dissemination of information to potential and existing clients at home and abroad.

[19] See http://www.botswanacraft.bw/shop/indexnew.html.

[20] See http://www.craftsinindia.com/.

[21] Small-scale handcrafts production is recorded as contributing between 30 and 75 per cent of all non-State manufacturing employment in different provinces of Viet Nam – involving 60,000 households and employing up to 300,000 people.

[22] See"Tiruppur strikes back", *Business Today*, 17 December 2006 and http://www.tea-india.org/Default.aspx.

[23] An empirical study conducted in India demonstrated how ICT is becoming an essential tool to improve the competitiveness in the Indian garments sector, ensuring its long-term survival (Lal, 2005). Evidence from garment manufacturing firms in North India identified the presence of industry-specific ICT skills and a strong export-orientation as being the two key drivers for successful ICT adoption in clusters.

[24] Project Vikas is a five-year programme which aims to improve the adoption of ICT among SMEs in Indian manufacturing clusters. Approximately 400 modern SMEs and 2,000 rural and artisan-based clusters exist in India. Clusters contribute up to 60 per cent of India's manufactured exports. Some prominent manufacturing clusters in India include the Tiruppur textile, the Puna-Auto components, and the Chennai cluster for leather products (see http://www.projectvikas.com/default.asp).

[25] Under the aegis of Project Vikas, the Tiruppur Exporters' Association (TEA) in collaboration with G-Tech Info Solutions and Microsoft India has launched online solutions for the textile manufacturing SMEs in Tiruppur. The solutions include an Online Desktop by Airtel, Hosted Email by Global Outlook and Unified Communications by WIPRO: these comprehensive and affordable enterprise solutions aim at enhancing the productivity and efficiency of the cluster. See: http://www.projectvikas.com/default.asp.

[26] For example, in the textile sector, deadlines for the batch production of sub-contracted apparel items are becoming tighter due to more efficient production schedules (producers have to work faster) and producers need to supply increased levels of data concerning core production processes and quality requirements (increasing the scope of their work).

[27] "Off-the-shelf" packages such as "Quickbooks" or "Tally" are in widespread use in developing countries. However, they are sometimes inappropriate for individual sector or enterprise needs, and require customization.

[28] According to some observers, the text message is an expensive and limiting method of moving information, and when text messages can cost $0.10 or more, regular use (which presumably is required to create impact) may become unaffordable for the poor (Donner, 2009a).

5 THE POLICY CHALLENGE

Rapid changes in the ICT landscape are expanding the scope for the poor to benefit from better access to mobile phones and from new services and applications, sometimes based on combinations of different technologies. Previous chapters have highlighted opportunities for ICT production and use by enterprises to contribute to poverty reduction. The principal question addressed in this final chapter concerns what policymakers can do to seize these opportunities in ways that bring tangible benefits to the poor.

The chapter presents a preliminary assessment of this policy challenge. There is now more than sufficient evidence to warrant greater attention to the interface between ICTs and enterprises and to how it can make real contributions to economic growth and poverty reduction. At the same time, there is still a need for more hard data and research of the kind required to enable comparative analysis of different ICT interventions targeting the poor and to ensure that strategic interventions reflect the specific needs of potential beneficiaries. In this new context for ICT policymaking, national governments have a renewed incentive to work together with development partners and other stakeholders. Indeed, a more demand-driven approach to policy interventions adds importance to the development of effective partnerships between governments, donors, the private sector and civil society.

This chapter is divided into four main sections. Section A describes the ecosystem for effective policymaking concerned with ICTs, enterprise and poverty. It also discusses the changing policy environment for ICT and ICT4D intervention, highlighting the importance of moving towards a more demand-driven approach. Sections B and C are concerned, respectively, with implications for governments and their development partners. Section D presents policy conclusions and recommendations for priority action.

A. THE NEED FOR HOLISTIC AND MORE DEMAND-DRIVEN POLICYMAKING

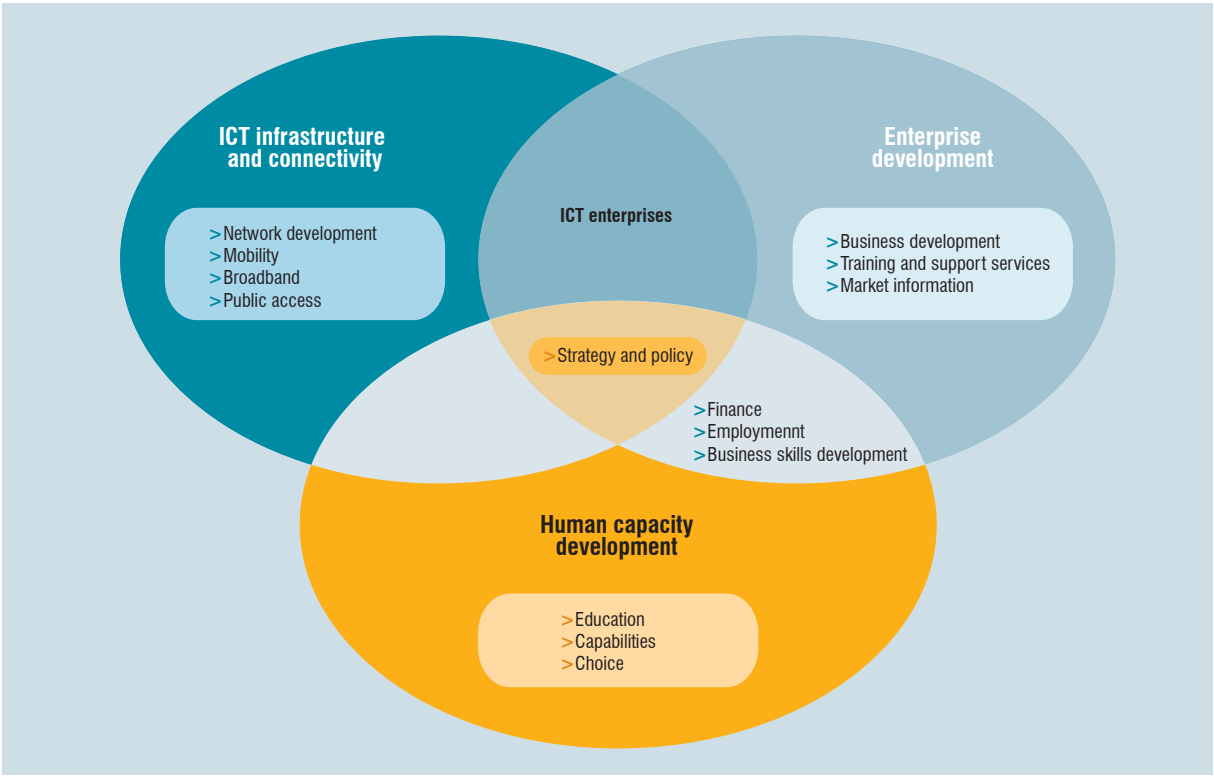
1. The ecosystem for ICTs, enterprise and poverty reduction

In reviewing possible policy interventions, it is useful to consider the three domains of ICTs, enterprise and human capacity development as linked components of a single ecosystem (figure V.1), the relationships between which influence the overall direction of policy and outcomes in all three policy domains. Governments and their development partners can most effectively facilitate desired developmental outcomes if they view the three domains holistically, integrating strategic approaches to each in ways that foster dynamic interactions between them and enable businesses and citizens at all levels to achieve social and economic gains.

Underpinning policy approaches to the relationships between these three domains is the broad commitment to social and economic development of governments and their development partners, both donors and international financial institutions (IFIs). A number of approaches to development and poverty reduction were discussed in chapter I, in particular those built around economic outcomes, the livelihoods of citizens (especially the poor), and the capabilities which people have or need to address the challenges they face and seize the opportunities that are available to them. Measures are needed to address the disadvantages which the poor face in every aspect of their lives and livelihoods – in social networks and access to land and capital, in reducing vulnerability and uncertainty as well as enabling opportunity. Such measures must have at their heart efforts to raise the capabilities and capacity of the poor, through formal and informal education and through information resources at the point of need. These give the poor opportunities to take the enhancement of their livelihoods into their own hands.

ICT infrastructure and connectivity – the first element of this ecosystem – have grown remarkably in developing countries during the past decade (chapter II). Broadcasting continues to play an important role, sometimes

Figure V.1. The ecosystem for reducing poverty via ICTs and enterprises



Source: UNCTAD, adapted from Emdon, 2010.

neglected in the literature, in the portfolio of information and communications resources available to most citizens (Chapman et al., 2003). Mobile telephony has, for the first time, made immediate interactive communications readily available to the poor in low-income countries. Access to the Internet has grown more slowly and has had a substantial impact mainly on governments and larger businesses. Its relevance to the poor is currently more limited but may grow as the Internet becomes more accessible through mobile phones. Much attention is now being paid to the deployment of broadband infrastructure, which will enhance the capacity of fixed and mobile networks alike and has the potential to make faster, cheaper Internet accessible to the poor. In spite of these advances, however, there remain areas in which telecommunications access is sparsely distributed, and continued efforts are therefore needed to connect the poor in remote rural areas to national and global networks.

Infrastructure and connectivity are only part of the picture where access to ICTs is concerned. Affordability is as important as connectivity in enabling the poor to gain from new technology (chapter II). In addition, to benefit fully from improved access, users need relevant content, the capabilities to make use of it, and the power and transport infrastructures that facilitate connectivity and stimulate wider economic activity. In short, ICT infrastructure and connectivity should not be seen as isolated developmental challenges, but should be integrated with human capacity development and the wider infrastructure landscape.[1]

The second element of the system illustrated in figure V.1 concerns *enterprises and enterprise development*. As described in earlier chapters, enterprises in developing countries vary enormously in scale, character and economic impact. They range from large-scale production and service businesses, tightly linked into global trading networks, to the micro-enterprises of the poor. Most are (to varying but increasing degrees) users of ICTs. Meanwhile, some enterprises – from equipment makers, telecommunications operators and call centres to computer maintenance business and mobile airtime vendors – are directly involved in the production of ICT goods and services (chapter III). Policy approaches need to consider all these categories. ICT sector enterprises, including micro-enterprises, are important catalysts and lubricants of the spread of ICTs throughout business and society, with ICT micro-enterprises playing a crucial role in enabling other micro-enterprises to make use of the opportunities created by new technology. An important distinction amongst enterprises for policymakers is that between those that are growth-oriented and those that are subsistence-based. Policymakers must be aware of the different needs and circumstances of these types of enterprise, of their different capabilities to make use of various ICTs and of the different impacts that ICT interventions may have upon them (chapter IV).

Another important aspect of the relationship between ICTs and enterprise concerns the value chain for the production and sale of goods and services. There is growing evidence from low-income countries that ICTs – particularly mobile phones – can enable small and micro-enterprises outside the ICT sector to increase productivity, diversify production, develop markets and generally enhance commercial viability (Donner, 2009a; Donner and Escobari, 2009). These gains are not outcomes of technology *per se* but of the application of technology to meet business requirements at various steps along the value chain – including access to information which may reduce transaction costs for inputs, extend marketing opportunities, improve market outcomes, and enhance the quality of customer relations (chapter IV). While this experience is evident across sectors, the ways in which individual enterprises relate to ICTs vary according to their needs, the industries and activities in which they are engaged as well as the skills and capabilities of their owners.

The enhancement of *human capacity* – the third policy domain – plays a central role in this development agenda, and has a complex but dynamic relationship with both ICTs and enterprise. On the one hand, ICTs offer new ways of building capabilities, through improved access to information, new and more interactive services and innovative approaches to formal and lifelong education. On the other hand, effective use of many (though not all) technologies requires capabilities such as literacy, as well as financial and other resources which are not universal or equally distributed. Policies that seek to take advantage of ICTs to support internationally-agreed poverty reduction targets therefore need to address deficits in these capabilities as well as in infrastructure and connectivity. Human resource development, including formal and informal education, is crucial to supporting a growing ICT sector, and *vice versa*.

The relationships between ICTs, enterprise and capacity development play out differently in different

economic sectors. In the context of this report, it is particularly important to consider ICT use in agriculture, which – through subsistence farming, production for sale or employment – underpins the livelihoods of the majority of the poor in low-income countries. The rural poor suffer from multiple disadvantages. Low educational standards limit access to knowledge that might improve productivity and household welfare. Lack of capital and of access to capital limit their ability to grow production year on year or to make use of resources that might enable increased earnings. Poor transport infrastructure restricts the markets into which surplus produce can be sold. Local power structures tend to disempower the poor and lead many into debt. Lack of communications infrastructure means that many still are unable to take full advantage of new information and communication opportunities. The livelihoods of the rural poor, in short, are constrained by a number of factors, whose combined impact makes it difficult for them to raise incomes and improve the quality of life.

The need for comprehensive policies to address the circumstances of those in chronic poverty is well recognized (World Bank, 2002), and highly relevant to the analysis in this chapter. ICTs offer routes to improved incomes for farmers, for example through better access to agricultural extension services, information about inputs and market prices, and opportunities to extend customer reach (Donner, 2009a). However, these opportunities are more likely to be exploited by those who have the skills/capabilities to make effective use of them. They are also more likely to add value if they are reinforced by government and business structures that offer support and encourage growth through enterprise. A matrix of policies that build human capacity amongst poor farmers, provide support and guidance for their farm businesses and make relevant content and services available through new ICTs is more likely to reduce poverty and raise incomes than any one of these in isolation.

This Report is primarily concerned with the potential that ICTs have to enhance livelihoods and opportunities for the poor, and thereby contribute to internationally agreed poverty reduction goals. The relationship between poverty and economic growth is complex. Sustained economic growth is necessary for achieving substantial progress in reducing poverty. However, it cannot overcome poverty on its own, and can even leave the poorest sections of society behind (Forestier et al., 2002). The challenge for policymakers is to identify and facilitate growth in ways that reduce poverty and inequality, and that empower those in poverty to achieve more sustainable incomes and enhance their livelihoods, as well as achieving macroeconomic gains. The analysis has two main implications for this discussion.

Firstly, strategies and interventions concerned with ICTs, enterprise and poverty should focus on the interrelationships and interactions between the three policy domains within the ecosystem, rather than seeing them as separate areas of activity. Policies that encourage investment in infrastructure deployment and enhancement are important in their own right (Friedrich et al., 2009; Kim et al., 2010). However, to address adequately challenges of economic growth and poverty reduction, they need to be seen as an integral part of the entire system illustrated in figure V.1. At the conjuncture between ICTs and human capacity development, for example, policymaking needs to ensure the capacity of regulators to promote dynamic competitive markets and an enabling environment for innovation in technology and service provision. At that between ICTs and enterprise, policymakers should consider the catalytic role of the ICT sector in enabling various kinds of enterprise in other sectors to make use of ICTs. At the heart of figure V.1 lie government and development partners' strategies and interventions for enterprise and development. It is here that an understanding of the ecosystem as a whole and of the synergies between its three components is most valuable.

Secondly, governments and development agencies cannot deliver on the promise of ICT for development on their own. The private sector is crucially important as the primary source of infrastructure investment and service innovation. Indeed, the development of an "information society" is at least as much the outcome of private sector investment and of advances in technology as it is of intervention by the State or international agencies. Citizens and enterprises have shown themselves to be adaptable and innovative in appropriating technologies and services to meet their needs. Governments and development actors need to learn from this experience and intervene in ways that help the private sector and civil society to seize opportunities created by technology developments. As illustrated in earlier chapters, successful projects aimed at enhancing the productive use of ICTs by enterprises have often involved multiple stakeholders acting in partnerships.

2. The changing context for policymaking

Information and communication technologies have substantially concerned development policymakers since the mid-1990s when international agencies, including UNCTAD, began to consider the implications of an "information society" for economic growth and individual empowerment.[2] It has not always proved easy, however, to translate broad policy aspirations for ICT4D into programme and project form. It takes time for new development opportunities to become embedded in programme planning and design. Pilot interventions, particularly in rural communities, have often struggled to fulfil their promise because of unreliable power supplies and shortages of ICT maintenance and other skills. Even successful pilots have proved costly to sustain and difficult to scale up. The translation of broad aims for ICT4D into practical interventions with target beneficiaries is, therefore, work in progress, with lessons to be learnt from the experience of both failure and success.

Two challenges in particular have made it difficult to achieve consensus concerning the impact of ICT4D and its potential at macro, meso or micro levels.

- *Changes in the ICT environment.* Changes in technology and markets are taking place far more rapidly than in other economic sectors. For example, mobile telephony has made connectivity in some rural areas of low-income countries – long regarded as unviable – into a reality. Expansion in the reach of communications networks has been accompanied by continual innovation in services and applications, influencing adoption patterns and user behaviour. These changes have been difficult to predict. They have opened up new opportunities for development interventions but have also undermined the sustainability of other projects.
- *The evidence base.* The evidence base for ICT4D remains weaker than in more established development sectors. The deployment of extensive ICT networks and implementation of ICT4D programmes in developing countries are too recent, and data availability is too limited, for extensive macro-level analysis of social and economic impacts to have emerged. In addition, the pace of change in technology and markets means that impacts, too, are changing fast and that findings may be of transitional relevance. The bulk of ICT4D analysis still derives primarily from micro-level studies. While these provide valuable insights into developments in particular contexts, care is needed when extrapolating findings beyond those contexts (Souter, 2008).

These challenges complicate the work of decision-makers. By the time a particular technology, intervention or business model has proved successful in one context, its relevance elsewhere may have been overtaken by events. The "village phone" businesses first developed in Bangladesh by Grameen Phone, and replicated in several other developing countries, provide a case in point (chapter III). To remain viable, village phone providers have had to move towards new business models, with varying success (Aminuzzaman et al., 2003; Shaffer, 2007). Similar experiences are likely to be common as technology and markets continue to change rapidly.

Likewise, improvements in information access which enable individuals or village communities to enhance their production and marketing of produce, and thereby incomes, may not be replicable on a larger scale where all communities within a district are so enabled. Other factors, such as elasticity of demand, have a bearing on whether the spread of ICTs leads to lasting economic gains for such communities or mainly to a redistribution of value amongst producers or between producers and consumers.

The evidence base concerning ICTs and enterprise is improving as experience accumulates and development actors gain greater understanding of the ways in which new technologies are interacting with established patterns of personal and business behaviour. However, policymakers need to build a stronger understanding of interactions between the relevant policy domains within specific national and sectoral contexts as well as observing the experience of other countries.

As with other goods and services, higher levels of ICT ownership – from transistor radios to high-end laptops – are likely to be associated with higher levels of income and other resources, and of capabilities required for their effective use such as literacy and education (Overå, 2006). There is always a risk, therefore, that ICT adoption increases disparities between more established and better resourced enterprises and those which are less well endowed. A poverty-focused approach to ICTs and enterprise needs to address this challenge. Policymakers need to find ways of supporting ICT adoption and use also at lower levels of economic activity and sophistication

if they wish to address the enterprise requirements of the poorest social groups. In order to do so, they also need to understand the potential of different ICTs to address the varying needs of the poor in different contexts.

3. The need for a more demand-driven policy approach

The analysis above underlines the diversity of ICTs, enterprises and the poor. Different ICTs vary in terms of their accessibility to the poor, their functionality and the requirements of users. The needs of different enterprises for information and other inputs vary according to their size, industry and market-orientation, and the extent to which they are likely to benefit from improved ICT access also varies as a result. The poor differ in the degree and nature of their poverty, whether they live in urban or rural areas, with regard to literacy and other capabilities, by gender and in terms of the natural and political environment surrounding them. All of these factors mean that policy interventions, if they are to be effective and reach intended beneficiaries, should be tailored to specific contexts.

However, many of the strategies and policy initiatives for ICTs and ICT4D which have been developed by governments and their development partners in the past 15 years have emphasized the delivery of services to communities rather than responding to communities' own needs. This has sometimes led to a centralized, top-down model of development which has been insufficiently responsive to the needs of small-scale enterprises and to the priorities of target beneficiaries (O'Farrell et al., 1999; Heeks, 2009c; Souter, 2010). In order to make future policy development for ICTs and enterprise more demand-driven, three steps are essential.

Firstly, policymaking must be built upon a stronger understanding of the real experience and requirements of target enterprises. Experience suggests that there is often a risk of interventions being driven by the potential of a certain technology rather than focusing on the needs of enterprises and understanding the limits of local capacity and capabilities (Heeks, 2005). Reaching beyond the requirements of larger enterprises – which may be more ICT-intensive – to micro-enterprises of the poor is not straightforward. Addressing this challenge requires careful prior assessment of the needs and experience of beneficiaries. This assessment should include improved understanding of the current level of enterprise performance and use of ICTs, observation of the changing communications environment and usage patterns, monitoring and evaluation of programmes, and assessment of the impact of ICTs on livelihoods as a whole.

Secondly, policymakers need to recognize and build upon the ways in which people (including the poor) and enterprises (including micro-enterprises) appropriate ICTs as they become available, making innovative use of the opportunities which they offer in ways that suit their business circumstances (Heeks, 2009c; Souter, 2010). The forms that appropriation has taken have often surprised policymakers – from the extensive adoption of SMS and the use of airtime as currency to the rapid take-up of mobile transaction services in some countries. Basing interventions around the actual behaviour of enterprises in this way makes it less likely that they will be overtaken by events.

Thirdly, to address these first two points, policymaking needs to secure the input and engagement of enterprises at all levels, especially those most relevant to the poor, in programme design and implementation. Direct involvement by target beneficiaries in programme design brings their experience – of the constraints they face in using new technology, and of the best ways in which they can make use of them – to the fore and helps to focus interventions on outcomes of higher value to end-users.[3] Participation reduces the risk that centralized, top-down initiatives offer enterprises the services that policymakers think they ought to have rather than those which are of most direct and immediate value.

Policy here must always be sensitive to and inclusive of women as well as men. More attention should be paid to women's role in policies concerning enterprise. ICT policies also need to be sensitive to gender, recognizing, for example, that women may experience additional barriers to information access (including educational and social barriers), and that ICTs may provide new opportunities for women (for example, through airtime resale or through local outsourcing) (chapter III). Policymakers should ensure that women are fully engaged in the design and delivery of ICT and enterprise initiatives, and that these aim to meet their needs as much as those of men (Hafkin, 2002).

More generally, interventions aimed at enhancing ICTs and enterprise need to be tailored to local, sectoral and cultural requirements. Successful experience in

one set of circumstances need not imply success elsewhere: one size does not fit all. Policy on ICT4D and enterprise should move away from top-down supply-led approaches to those that reflect the real requirements of enterprises which are of direct value to the poor, the barriers and drivers to the adoption of ICTs in poor communities, and the broader context of affordability, capability and content surrounding them. Rooting policy approaches in the real experiences of relevant enterprises will also foster the flexibility in programme design and implementation that is needed to respond both to various local circumstances and to continuous change in technology and markets. It places greater demands on national governments and development partners to be well informed before launching new policy interventions, and to work in partnership with stakeholders that can contribute valuable knowledge and experience in relevant areas.

B. IMPLICATIONS FOR NATIONAL POLICYMAKERS

This section discusses the implications of the changing policy environment, described above, for national governments and government agencies concerned with ICTs and enterprise development. Governments are responsible for creating and maintaining an enabling environment within which enterprises can succeed, but not necessarily for providing services directly to enterprises. The following discussion focuses on three key aspects of their role: enhancing affordable access to ICTs, facilitating greater use of ICTs by enterprises, and linking ICT and enterprise policies to poverty reduction.

1. Enhancing affordable access to ICTs

a. Infrastructure and connectivity

Since the 1980s, communications markets worldwide, including those in developing countries, have been liberalized, wholly or partly privatized, and brought within regulatory frameworks intended to achieve consumer value through competition. The results are generally considered strongly positive. Liberalized markets have seen higher levels of investment, including investment in rural areas, lower prices and higher adoption rates for telephony.

Policymakers have two prime responsibilities in this context. Their first is to provide an *enabling environment* for the private sector to invest in infrastructure and service innovation, and for business in general to take advantage of the new opportunities arising from ICTs. The promotion of competition in communications networks and services, and the absence of unnecessary constraints on business formation and innovation, are central to this purpose (chapter II).

Their second responsibility is to address areas of *market failure* where – for whatever reason – the private sector is not deploying infrastructure or making services available which would enhance opportunities for citizens and businesses in the way that these are being enhanced elsewhere. Market failures of this kind are most likely to occur where target populations are relatively sparse and income levels are low – such as in remote and rural areas. But market failure can also occur in cities and at specific points along the communications supply chain, such as international broadband gateways, if there is insufficient competition to deliver the services required at affordable cost. A variety of intervention strategies can be used to address market failures, including public investment and subsidy as well as regulatory mechanisms (Intven, 2000).

In a competitive environment, network operators have strong incentives to upgrade capacity in line with rising demand. In the past 15 years, private investment has brought telephony to rural areas of developing countries which had previously been regarded as unviable by both State and private companies. Despite great progress in terms of improved connectivity, there remain significant gaps. As noted in chapter II, about 50 per cent of rural residents in Africa may not yet be covered by a mobile signal. Although private investment in the reach of networks is growing rapidly,[4] there will continue to be areas of market failure where infrastructure and connectivity are concerned. Given that most of the world's poor live in rural areas, there is a strong case for expediting infrastructure roll-out into these. In the short term, this case applies especially to basic mobile telephony, but in the medium term also to broadband networks.

(i) Network access

Business models for the provision of access have changed considerably since second-generation mobile telephone networks began to be deployed. Demand for mobile services has greatly exceeded the expectations of governments and the private sector at the time of licensing, leading to much faster

deployment of networks and much higher levels of adoption than were originally anticipated. Competing enterprises continue to extend mobile networks into remote areas and to reach users at lower income levels, often relying on ICT micro-enterprises such as handset retailers and airtime resellers within the supply chain. Basic voice telephony and services enabled by it – including SMS information services and, in some countries, mobile transactions – are therefore increasingly available (chapter II).

Ongoing connectivity challenges for the poor arise in two main areas: the extension of basic communications networks to remote and rural areas where service levels can be expected to be insufficient to recoup capital investment costs; and the extension of sufficient capability, at broadband speeds, to the whole communications environment so as to enable intermediated access to Internet resources.[5] It is in these two areas, where the market is failing to deliver desired outcomes with the required speed, that policymakers may need to intervene in order to expedite network and service deployment. In July 2010, Finland became the first nation in the world to make access to broadband a universal service and legal right for every citizen of that country.[6] For low-income countries, a first step may be to ensure universal coverage of mobile services.

Many developing countries have established universal service or access funds (USFs) which are intended to subsidize the deployment of infrastructure in remote and rural areas. The financing required is usually obtained through levies on the turnover or profit of licensed communications operators. Until recently, most such policies and funds focused on expanding access to basic voice telephony, typically by subsidizing public telephone installations in rural locations.

While some programmes have succeeded in providing basic voice access in previously isolated villages, particularly in Latin America in the early years of USF experience, more recent experience has raised questions about the relevance of this approach (Stern and Townsend, 2006; Hudson, 2010). Fund implementation has not always been successful. Some USFs are not operational or have been unable to disburse the (sometimes very large) sums that they contain. The selection of locations for subsidized deployment has proved problematic. Operating companies have argued that funds now inhibit rather than facilitate investment.[7] As mobile companies have extended networks into more and more remote areas without subsidy, demands have also been made for the capital accumulated to finance higher levels of connectivity, including broadband.[8]

The emergence of mass markets for telephony (and potential mass markets for mobile Internet) has changed the balance between capital investment costs and likely operational returns, making basic services commercially viable in most areas and adding to revenue streams for new services that can be made available through broadband networks. These developments suggest that the current model of financing universal access may no longer be the best way to promote the extension of ICT connectivity and services where these are not being delivered by the market. Governments should re-examine the appropriateness and use of USFs in meeting the needs of delivering ICT capabilities and services. Reconsideration is particularly needed of the scope of infrastructure and services which should be covered by such regimes – for example, whether they should be extended to include broadband services or cover capacity-building efforts – and of the flexibility in implementation and management required to respond to rapid changes in technology and markets.

The reconfiguration of national communications environments also presents new opportunities for network development partnerships between different stakeholders. In some countries, for example in East Africa, governments have begun to invest in national backbone infrastructure, either alongside or in partnership with new infrastructure investments made by private sector operators.[9] These investments are intended to expedite nationwide broadband availability, and support has been available for them from IFIs (Kim et al., 2010).[10]

Regulatory frameworks have significant influence on commercial viability and can therefore be important factors that encourage or discourage new network investments. Regulators have begun to move away from technology-specific to technology-neutral licensing, giving operating companies greater freedom to choose the technologies that they consider most appropriate for particular environments (infoDev, 2009a).[11] Infrastructure sharing between operators, whether voluntary or mandated, can reduce the capital costs of network deployment and management, though it can be challenging to implement. As well as physical co-location of network elements (such as ducts and towers), infrastructure sharing includes

regulation for "open access" to infrastructure, the principle that infrastructure owners must make their networks available to their competitors on fair commercial terms.

Although large-scale network deployments are at the heart of most infrastructure development, they may not always be the best way to reach the most remote areas. In some locations, it has proved possible to incorporate communications infrastructure in programmes designed to address other infrastructure deficits (such as power and water), or enabling "micro-telcos" in remote communities to connect to national networks rather than waiting for existing infrastructure operators to connect them to their networks (Mahan and Melody, 2007; Gillwald, 2005).[12] The economics of infrastructure development will fluctuate as technology and markets change, requiring careful and continuous assessment of deployment options and regulatory implications.

(ii) Local access

Public access points such as telecentres – kiosks or offices in local communities, offering a variety of communications services including telephony and computer-based Internet access – have been a central element of many government strategies for ICT diffusion. In the past, they have widely been thought to be the most effective means of bringing information technology and thereby information resources to poor individuals and communities that could not otherwise afford them. Computers, which were then the only viable tool of enabling Internet access, held the central role in information transfer envisaged in telecentre programmes (Heeks, 1999; Latchem and Walker, 2001; Soriano, 2007).

As with USFs, the role of public access points needs reconsideration in light of changing communications markets. While telecentres have played a valuable role in many cases and may continue to do so, many deployment programmes have also struggled to achieve sustainability. As ownership of mobile telephones has increased, potential users have preferred the convenience and privacy of mobility to public facilities. Those at the lower end of the income scale, who do not have phones of their own, also seem to prefer to access information through the use of borrowed phones and through networks of peer informants rather than to make regular use of telecentres (Veeraghavan et al., 2009).

Public access points such as telecentres still have the potential to support micro-enterprises, where they are financially sustainable and well targeted towards the needs of local beneficiaries. The example of the telecentres established through the Katalyst programme (box IV.2), which provide market information to farmers in Bangladesh, illustrates this point. Equally important is the experience reported from Warana (box IV.6), which showed a preference for mobile phones rather than telecentres as a means of accessing information, leading to a change in the mode of service delivery (Veeraghavan et al., 2009). When telecentres are provided, they should be established as components of broader development projects that can court the community at large, clearly identifying ways in which users might benefit from their facilities and services. This may involve the integration of the Internet with other technologies that are more accessible by subsistence-based enterprises (such as mobile phones or community radio). Such interventions need to engage intermediaries who can help to bridge the financial, socio-cultural and knowledge gaps experienced by the poor.

The Katalyst experience in Bangladesh illustrates a further important point in the delivery of services – the potential for collaboration with different stakeholder groups. In that case, services are provided in partnership between a non-governmental organization, private sector telecommunications operators and international funding agencies. In Gujarat, the e-Gram programme delivers government services through a network of independent "village computer entrepreneurs". The flexibility offered by arrangements of this kind may significantly reduce costs and allow a wider variety of services to be made available to local communities through a single outlet.

b. Affordability

If access to communications and information resources is to have an impact on the enterprises of the poor, and livelihoods dependent on these, then they must be affordable as well as physically available (chapter II). There is considerable evidence both of the high levels of expenditure which some poor people are prepared to allocate to ICTs, especially telephony, and of elasticity of demand which suggests that price reductions would lead to higher usage and consequential value (Gillwald and Stork, 2008; Adam et al., 2009). Price levels for voice telephony,

SMS and, in the future, mobile Internet are therefore significant in determining the extent to which micro-enterprises take advantage of information resources (such as price and weather information) and of other ways in which ICTs can enhance productivity (such as reduced transaction costs and improved customer management).

From the perspective of the poor, it is affordable access to mobile telephony that is particularly important today. As noted in chapter II, there is large variation in total cost of ownership of mobile phones, even within the group of low-income countries (Gillwald and Stork 2008; Adam et al. 2009). Mobile voice and data services alike were noted to be the most affordable to low-income consumers in South Asian economies such as Bangladesh, India and Pakistan. There are a number of reasons why costs are relatively high in other places, making it difficult to generalize across countries where the balance of barriers and remedies will be different. The costs of mobile usage fall into two main categories: those concerned with handsets and those concerned with usage (chapter II).

Competition plays a crucial role in setting price levels for mobile *usage*. Prices are more likely to be low where there is a high level of competition between operators. Regulators should therefore encourage competition between service providers wherever possible. However, even where market entry is relatively open, other barriers may inhibit effective competition from arising. Here, too, regulatory intervention can be crucial. Some operators have dominant control over critical backbone infrastructure, with the result that new entrants may find it cheaper to build their own networks than to pay high wholesale prices for access to existing infrastructure. Regulators need to remain vigilant over interconnection charges to ensure they are aligned with costs. Open access regulation and other measures to promote infrastructure sharing can mitigate this problem and lower total costs. Spectrum constraints may also have the effect of limiting market entry. In such cases, governments may need to lift spectrum restrictions and consider setting spectrum aside at favourable terms for market entrants in order to encourage competition.

The price of handsets is also a significant factor in mobile phone adoption, particularly where competition has reduced the cost of usage. Micro-enterprise owners at the lower end of the income scale may have to save for a significant period of time in order to pay for a handset, which represents a significant capital purchase to them (Donner, 2009b). It has been estimated that in Ethiopia the availability of handsets costing $20 or less would lead to a threefold increase in the number of subscribers, and perhaps twice as much in rural areas (Adam et al., 2009). Low-cost handsets at around this price, with Internet capabilities, are now also becoming available, suggesting that handset prices may be less significant determining factors in Internet access in future.[13] Cheap handsets are also often available in secondary markets, where their use is supported by micro-enterprises that retool them for local conditions (chapter III).

Another issue that may be tackled by regulators concerns differences in charging for on-net and off-net calls (i.e. calls to subscribers of the same and of competing networks). These tend to raise the overall costs of phone usage because they can make it cheaper for users to hold multiple phones (or SIM cards) in order to take advantage of differential prices (Sutherland, 2007).[14] This also tends to favour dominant operators, who can exploit termination charges to provide low on-net calls.

Where markets are competitive, operating companies have sought to facilitate usage at low-income levels through a variety of mechanisms. Regulators can encourage operators to address low-income users in a variety of ways, including the following:

- *Long period for inactivity*. Prepaid validity should be for the longest possible period of time since many of the poor have fluctuating incomes and may not be able to make calls on a regular basis.
- *Per-second charging*. The standard method of pricing calls is on a per-minute basis. A number of operators have adopted per-second charging, which benefits poorer users since they can make shorter calls without paying a full minute's tariff.
- *Nationwide tariff.* Many countries have a single tariff for mobile calls that is applicable to all domestic locations. This eliminates domestic long distance and roaming surcharges, benefitting consumers.
- *Low denomination recharge.* Offering low denomination recharges ensures that the poorest do not have to tie up funds in unused prepaid credit.
- *Friends and family*. Offering the option of free or lower cost calls to a few selected numbers benefits poor users.

More comprehensive efforts toward low-income markets can be seen in South Asia, where operating companies have moved away from business models

based on securing high average revenue per user towards models that focus on the marginal value of additional increments of use. These new business models have led to reductions in prices to consumers, making mobile phone usage more affordable in South Asia (chapter II; Samarajiva, 2009b). In countries where this change in business practice has not occurred, higher prices for incremental use tend to disadvantage lower income users. Regulators and telecoms operators in other developing regions should explore the potential of this shift in business practice for network development and usage.

One final aspect of affordability which has received a good deal of attention is the taxation of communications equipment and, especially, mobile use. Customs duties on imported ICT products significantly increase the cost to users. Excise and value added tax on airtime similarly add to the cost of telephone usage for individuals and small businesses. Both telecommunications businesses and international agencies have argued that usage taxes may reduce the beneficial impact of phone use both for individual businesses and at a macroeconomic level (GSMA, 2008; UNECA, 2010).[15] On the other hand, such taxes are attractive to Ministries of Finance because they are simple to collect, difficult to evade and provide substantial and increasing revenue (Heeks, 2009d). Policymakers need to consider their potential negative impact on demand alongside the fiscal benefits that currently accrue.

2. Fostering greater use of ICTs in enterprises

a. Content and services development

Connectivity and affordability provide opportunities for enterprises to add value to a variety of business activities (chapter IV). Enterprises take advantage of these opportunities on their own initiative, without the stimulus of intervention by governments or development agencies. However, it is clear that their potential can be enhanced by services which are designed to meet the specific needs of enterprise users. Individual producers can ring around different markets to identify best prices, but will find it more convenient if relevant market prices are aggregated for them through an information service which they can access as and when they need (e.g. by SMS). Such information services are becoming available for different markets in different countries, initiated by commercial businesses, NGOs, government agencies or international organizations (Donner, 2009a).

There has been much discussion in the ICT4D literature – particularly in connection with the viability of telecentres – about the importance of "local" or "relevant" content, i.e. of information resources which are explicitly related to the needs and circumstances of target users (Subramaniam et al., 2005).[16] What content is relevant will vary significantly between enterprises. It may be static, providing information only, or interactive, enabling entrepreneurs to seek guidance on choices that they need to make or problems that they face (for example, veterinary advice services).[17] Content can be tiered, with opportunities for users to move from informational text to interactive contact if they require additional advice.

As stressed above, for policy interventions to be effective, they must respond to the specific needs of the businesses concerned for information, knowledge and services. Content and services also need to be delivered in a format that low-income users can readily access and absorb. Policymakers need to recognize the varying extent to which different ICT tools are available to enterprises that are of relevance to the poor, and the different capabilities that micro-enterprises have to make use of them. Government and other agencies have increasing experience of delivering diverse information through a variety of media, including broadcasting and telecommunications. However, adoption of new information sources cannot be taken for granted. People, including those who run micro-enterprises, have established and trusted information sources, many of them within their own communities. New sources need to gain the trust and confidence of users by demonstrating accuracy, reliability and the ability to add value to business performance (Souter et al., 2005; Molony, 2007).

Lack of literacy and language skills are, of course, barriers to information access that are faced by many micro-enterprises, especially in low-income regions. For content to reach the poor, it needs to be available in languages that intended users understand. This often means national rather than international languages, but can also mean languages or dialects which are specific to local or minority groups. In the case of market information provided to dairy farmers in Bhutan, for example, services were made available in four languages (Dzongkha, Sharchop, Lhotsham as well as English, see box IV.2). In practice, many people who run micro-enterprises in low-income economies

cannot read or write. Where they are concerned, programmes need to make innovative use of voice-based telecommunications interfaces and of proxies such as info-mediaries.[18] Mobile and radio solutions are particularly attractive in this context.

Content is most valuable to end-users when it is available at the point and time of need. Accessing content from the workplace is more convenient and saves time and cost, whether that workplace is a workshop, field or fishing boat. This gives content which can be delivered on mobile devices, already owned or available to entrepreneurs, more immediacy and thereby often higher value than that which can only be accessed from a community resource such as a telecentre. Access to interactive services from the point of need can be especially valuable, and help to overcome challenges of literacy. Even where literacy is not a problem, limited language and other capabilities suggest that simplicity of access is important. Content that can be accessed through SMS, for example, is at present more readily available than content which requires web access, because of the limited capabilities of many mobile phones. As handsets improve, however, and mobile Internet develops, content which can be obtained from websites will be more accessible, especially where those sites are configured for mobile rather than PC access.

Content which has value to enterprises is produced by many different agencies, including government departments, private businesses and NGOs. Partnerships between these different stakeholders are important in facilitating content reach and avoiding duplication. In practice, governments have often found it easier to provide services and information through centralized programmes with relatively little differentiation between delivery locations (Bhatnagar, 2004; Heeks, 2005). As a result, such programmes may take the limited availability of ICTs in some locations insufficiently into account – for example, using the Internet, which may only be available through telecentres, rather than media that are more widespread, such as mobile phones. Governments can learn significantly from NGO experience in delivering content at a local rather than a national level. NGOs that work directly at a local level are more likely to offer content which is tailored to local circumstances as they see them, often (though certainly not always) with direct involvement of local people in their design and implementation.[19]

Private sector content is often tailored to the marketing of products, though there are also significant examples of broader information programmes resourced by private companies, such as e-Choupal in India (chapter IV). The most prominent ICT-enabled improvement for small businesses in developing countries in recent years – led by the private sector – has been the growth of mobile-money services (chapters II and IV).[20] Mobile telephony now provides a platform which can be used for transactions and small-scale management of capital either alongside or in lieu of microcredit facilities. Mobile-money services can enable better cash flow and financial management as well as more efficient transfers of remittances – an important source of capital for micro-enterprises – at significantly lower commission rates than can be obtained by other means (McKay and Pickens, 2010). This potentially increases access to capital at lower cost (Porteous and Wishart, 2006; UNECA, 2010; Duncombe and Boateng, 2009).

The scope for mobile-money services depends significantly on the regulatory frameworks for both telecommunications and financial services. Governments need, for example, to ensure that telecom businesses are entitled to offer transaction management either alone or in partnership with conventional banks.[21] Financial services regulation is – rightly – based on strong precautionary principles, designed to protect against fraud and other criminal activity. If banking services are to reach the poor, arrangements are needed that enable services to be provided to small-scale customers who lack official identification documents and to micro-enterprises that lack official registration. Such regulatory changes are complex and challenging but – as experience in Kenya shows (box V.1) – can be overcome, with potentially substantial value in improved transaction flows (Makin, 2009).

Governments, including financial and communications regulators, need to work with the private sector to understand the complexities of these new financial interactions and develop regulatory mechanisms that facilitate transactions, ensure their security and minimize the risk of abuse. Laws and regulations in this area may need to address the issues of (a) the security of identities, networks and capacities against fraud; (b) customer privacy and informed consent; and (c) data access and use. Such laws and regulations should also inhibit money laundering and corruption,

Box V.1. M-PESA and regulatory developments in Kenya

Kenyan regulators have allowed M-PESA to develop mobile-money services in spite of the fact that the implementing mobile operator, Safaricom, does not have a banking licence.[a] The Central Bank of Kenya receives monthly statistical reports and requires M-PESA to seek its approval before launching new functionality or products. Whilst mobile-money and payment services delivered by M-PESA are relatively new, they are merely new means of payment. These are governed by prevailing laws (such as the law of contract), which continue to apply. However, to facilitate the development of such services, a draft National Payment Systems Bill has been prepared to integrate payments executed through electronic means and recent amendments in 2009 to the Kenya Information and Communications Act have brought legal recognition to electronic transactions hence legitimizing such transactions before courts of law.

M-PESA services are available in other countries of the region and as such, those services will benefit from the efforts of Partner States to harmonize cyber legislation. In this respect, a "Framework for Cyberlaws", prepared with UNCTAD assistance, was adopted in May 2010 and will facilitate the development of such services by regulating key legal issues such as electronic transactions, electronic signatures and authentication, data protection and privacy, consumer protection and computer crime.[b]

Source: UNCTAD, based on information from Safaricom and the Central Bank of Kenya.

[a] *See http://www.mobilemoneyexchange.org/News/vodafone-hails-kenya-as-mobile-money-regulatory-model_1.*

[b] *The creation of an enabling legal and regulatory environment was identified in the e-Government program initiated by the East African Community secretariat in 2005 as a critical enabling factor for effective implementation of e-Government and e-commerce strategies at national and regional levels. For more information on UNCTAD's support in this area, see http://www.unctad.org/ecommerce.*

among other things. Alternative dispute resolution mechanisms, built into transfer and collection systems of mobile-money platforms, are also important elements required for building trust in new transaction mechanisms.

The potential impact of mobile-money – and, in time, mobile micro-insurance services – is considerable (chapter IV). These applications illustrate how new technologies can interact with other business and government services to offer added value, not least to social groups and enterprises that have been hitherto effectively excluded. The scale to which mobile transactions can do this may be exceptional, but the potential for similar value gains in other areas of business management, such as customer and supplier interfaces, should be explored by governments in partnership with the private sector and civil society. The scope is likely to increase significantly if and when mobile Internet becomes available and affordable to small and micro-enterprises.

b. Support for the ICT sector and skills development

Policy interventions to support the ICT sector need to be related to the different aspirations that the governments of different countries have in this context. Governments that aspire to integrate their national economies into the global value chains of ICT manufacturing need to address several challenges. Policy choices can greatly influence the scope for a country to participate in the global ICT production system, as they did historically, for example, in the Republic of Korea (Kim, 2010). Critical policy areas include the development of a competitive infrastructure for handling large volume imports and exports of components and finished products. Labour productivity and labour costs also need to be competitive for success to be achieved. Given the prominent role played by transnational corporations in this value chain, governments also need effective policies to attract foreign direct investment.

Business regulation is an important factor in enabling value to be gained, especially for growth-oriented enterprises. To be competitive in international markets, businesses need to be able to respond quickly to the new opportunities that are unlocked by ICTs. This makes the flexibility of business regulation an important factor in ICT-enabled growth. National governments play the central role in establishing domestic regulatory environments and should ensure that they do not discourage innovation and new enterprise. This applies both in general and specifically to the ICT sector. While this may have most significance for larger businesses, it is also important to micro-enterprises that interact with larger businesses within their value chains (see chapter IV).

Two sets of measures are especially important in this context. Firstly, and of particular importance to medium and large enterprises, governments need to adjust regulatory environments to suit ICT-enabled ways of working. Significant changes needed include those enabling commerce conducted by electronic means, including legislation to permit transactions using electronic signatures, and appropriate arrangements for security against fraud and cybercrime. These enabling and protective measures affect not only large transactions but also micro-level transactions such as those of mobile-banking. Without adequate legislation, customers, enterprises and governments will be reluctant to make use of existing opportunities for efficiency savings (see e.g. UNCTAD, 2006: chapter 8; UNCTAD, 2005: chapter 6).

Secondly, governments should consider how best to facilitate the development of the ICT support sector, which is an important catalyst for the effective application of ICTs in enterprises, and which can also add value in terms of new employment and income generation (chapter III). Many small ICT support businesses provide a service to larger companies throughout the economy, or complement them by offering niche services in areas that larger businesses find hard to reach, such as urban slums and remote rural areas. At present, however, they are often in short supply, especially outside large cities.

Skill requirements in tasks such as hardware maintenance and web design are substantial. Some governments (and international agencies such as infoDev) have used incubators to provide intensive support to a small number of ICT start-up businesses (infoDev, 2009a). Such incubators require substantial investment for each start-up enterprise, and cannot support enough businesses to meet the ICT needs that are developing in government and business nationwide, but carefully targeted incubators can add value and help raise standards. They may be most effectively used in more innovative and specialist areas of the ICT sector.

In the longer term, the educational system plays a central part in developing ICT skills that are required by enterprises. Education is among the most important underlying factors enabling individual prosperity and contributing to overall social and economic development. Improved capability among the poor to use information to improve livelihoods and protect against poverty and vulnerability is critically important. Literacy, language and interpretive/analytical skills acquired in school equip children to make more of the opportunities which become available to them as adults. They are particularly valuable in accessing information which is in written form and in building the capacity to make judgements about the quality and value of that information. Schools can introduce students to basic ICT skills, if suitable equipment and trained teachers are available. However, they do not necessarily provide them with the skills that enterprises need (Gaster et al., 2009). Government programmes should focus on enabling students to learn how to interpret information resources more effectively rather than on specific modes of information access which may not have lasting relevance.

Management skills are generally weak in small and micro-enterprises. Some governments and agencies have encouraged small enterprises to adopt software-based management techniques, e.g. for inventory control and bookkeeping. However, such techniques may not be cost-effective for many micro-enterprises. Firstly, in low-income countries, few mirco-enterprises use computers. Secondly, they often lack the necessary scale, financial resources or required skills. Thus, while programmes to support business skills in general can be valuable even to very small enterprises, formal initiatives to promote ICTs are more likely to be adopted by growth-oriented SMEs (Esselaar et al., 2007).

Governments will need to consider innovative and less formal ways of reaching micro-enterprises, including through mobile-based business support services. In Africa, there are few examples of such services to date (Donner, 2009a), but the rapid growth of mobile access suggests that it would be sensible for governments to take a fresh look at how business support services of this kind can be delivered and at specific requirements for assistance.[22] In doing so, they should consult both subsistence-based and growth-oriented enterprises about their needs and their communications preferences, to ensure that services are tailored most effectively to meet demand. The experience of the collaboration between Katalyst and Banglalink in Bangladesh can serve as a source of inspiration in this regard (box V.2).

3. Linking ICT and enterprise policies with poverty reduction strategies

How can government measures related to affordable access to ICTs and increased use of ICTs by enter-

Box V.2. Jigyasha 7676: the mobile helpline for farmers in Bangladesh

In 2009, "Jigyasha 7676" of Banglalink – the second largest mobile operator in Bangladesh and a subsidiary of the Egyptian company, Orascom Telecom – won the GSM Association's Asia Mobile Award in the category for Best Mobile Enterprise Application Product or Service. Jigyasha 7676 is a Helpline which provides information and advisory services to small farmers in Bangladesh. The service is an outcome of a joint collaboration with Katalyst (see box IV.4). While Katalyst saw the need to improve the performance of farmers, Banglalink identified an opportunity to expand its market share and reach new customers. While Katalyst was responsible for developing a sustainable business model among the various actors of this initiative, Banglalink provided the network infrastructure and promotion to make it available to users.

Before the helpline was launched, several actions were taken, including a careful market assessment to determine the feasibility of the service. Extensive promotion was also carried out to raise awareness of its availability. Since its launch in December 2008, anybody having a Banglalink connection can call Jigyasha 7676 and seek responses to queries from a database which has content related to 67 agricultural subsectors. The database is regularly updated with validated content. This material is integrated in a content management system which is delivered through a call centre.

The response has been positive. At the end of 2009, some 100,000 calls were received on average every month, with a high rate of stated customer satisfaction. About half of total callers said that they would call again to obtain information to help with livelihood problems.

Source: Information provided by Katalyst.

prises be linked to the reduction of poverty? The contribution which small and micro-enterprises make to household livelihoods also depends on contextual factors which lie outside their control – such as supply and demand for the goods and services that they produce, environmental and meteorological conditions, etc. – as well as in the personal circumstances of enterprise owners, such as their health, education and levels of indebtedness. While ICTs and information resources can contribute to improving livelihoods of small and micro-enterprises, they cannot do so in isolation. Enterprise owners need to make use of ICTs within the context of other resources which are available to them and in light of other constraints that may limit their ability to succeed (chapter I).[23]

Policymakers need to understand the diversity of circumstances and adjust their interventions to enable the widest range of enterprises to take advantage of initiatives, paying particular attention to enterprises at the lowest economic levels which are likely to be most constrained by their environments. For example, a high proportion of micro-enterprises among the poor are unregistered in government programmes and databases. So, if policy initiatives are to reach them, they need to be delivered in ways that are accessible also to unregistered enterprises. Policymakers should also bear in mind that micro-enterprises often form only part of the livelihoods strategies of poor households, and that micro-enterprises are often not a household's or an entrepreneur's sole source of income.

The need to position policies concerned with ICTs within a wider developmental context is just as important at meso and macro levels. Although this Report is primarily concerned with small and micro-enterprises, these operate within complex value chains in which they interact with larger businesses, at local or national level. These larger businesses provide employment as well as services, and generally make more use of ICTs. In the case of the ICT sector itself, there are important interconnections between large and small businesses, which contribute to the availability of content and services at the micro level (chapter III). Policymakers should pay attention to the health of the whole value chain, as well as focusing on the specific interests of the poor (chapter IV).

At a macro level, most developing countries now have some form of national development planning process. In recent years, many of these have taken the form of poverty reduction strategies (PRSs), often developed with the support of multilateral agencies and intended to provide a framework for negotiation of multilateral and bilateral official development assistance (ODA) (World Bank, 2002). These national development plans are often accompanied by sector strategies in areas such as agriculture. Many developing countries also have some form of ICT sector policy or strategy, often developed with the support of multilateral agencies (see e.g. UNECA, 2008; Labelle, 2005).

Although these ICT sector strategies are generally committed in principle to poverty reduction and other

national development goals, they have often been poorly integrated with poverty reduction strategies and with agreed strategies for other sectors in which it is believed that ICTs might add value (Tambo, n.d.; Adamali et al., 2006). Governments need to achieve greater coherence between poverty reduction strategies, strategies designed to foster enterprise and those concerned to leverage value from ICTs.

Two principal policy challenges arise as a result. The first concerns the way in which ICTs and wider development strategies are designed. Mainstream development planners need to understand more about the potential of ICTs, concerning both the societal impact of their wider availability and their potential when mainstreamed in traditional development domains. ICT specialists need to understand more about the constraints posed by geography and infrastructure deficits, especially in rural areas, and faced by individuals and enterprises with limited social, financial and other assets. Governments can address this problem by approaching strategy design in a more inclusive and cohesive manner, for example, by integrating transport and communications infrastructure upgrades so that local enterprises are in a better position to take advantage of the greater market reach that improved access to information will afford. Greater inclusiveness in policymaking should also help to ensure that policies are more demand-driven and open to effective monitoring and impact assessment.

The second challenge – alluded to in section A – concerns the rapid pace of change in technology and markets. Many current ICT policies and strategies have been in place for several years, and were developed before mobile telephony became accessible in rural areas. Most of these strategies envisaged that computers rather than mobile devices – and communal rather than individual resources – would provide the main mechanism through which ICTs enhance information and communication resources for the poor. These assumptions have been overtaken by events. The difficulties in implementing strategies that have resulted illustrate that policy frameworks need to be continually re-evaluated and adjusted to ensure that they are appropriate for current and future communications realities. Today's expectations and assumptions about technology and markets are no more likely to be sustainable in the medium term than those of 5 or 10 years ago. Long-term commitment on the part of policymakers to exploiting ICTs for enterprise and other development is therefore crucial but insufficient. Policies also need to become adaptive and continually re-evaluated (Swanson and Bhadwal, 2009). Development partners can assist in this process (see section C).

Government plans for the use of ICTs in development programmes should furthermore take account of infrastructure deficits in sectors other than communications, especially in rural areas. Power, for example, is essential for the delivery of many communications services and for enabling use of many ICT devices. Solar power and local generators can meet some but not all needs in this context. Transport networks are crucial in enabling the delivery of inputs and facilitating the distribution of goods produced in rural markets. Better market price information is more valuable to local producers if their goods can be transported to markets where better prices can be obtained. Policymakers should therefore consider ICT networks as part of a holistic infrastructure environment, recognizing that their economic value in rural areas is enhanced by broader integration of geographic areas into national physical and economic infrastructures. Remote areas are likely to see greater benefits from coordinated programmes designed to address multiple infrastructure deficits than from programmes focused solely on ICTs.

C. IMPLICATIONS FOR DEVELOPMENT PARTNERS

The interest of development partners in ICTs and ICT4D has fluctuated over time. It was only in the mid-1990s, however, with the expansion of the Internet, that ICTs – beyond investments in telecommunications infrastructure – began to play a prominent part in donors' and other development partners' strategies and programmes. A renewed focus on the role of knowledge in enabling development, and of ICTs in enabling knowledge, led to the implementation of the two-stage World Summit on the Information Society (WSIS) in 2003 and 2005.

Although the engagement of many developing-country governments in ICT4D has continued to increase since WSIS, that of IFIs and of donors seems to have stagnated (see e.g. Greenberg, 2008). A number of bilateral donors that invested significantly in ICT4D before and during WSIS have dropped explicit ICT4D programmes from their portfolios,

even if they continue to support the mainstreaming of ICTs in other development sectors (Souter, 2010).[24] This shift may have important implications. Indeed, a more demand-driven approach to policymaking will require more rather than less technical expertise for development agencies to be effective partners.

The role of development partners in ICT4D is essentially supportive. They can support the ways in which various government responsibilities are fulfilled, in design, funding and implementation, but should not determine them. How, then, can development partners support the efforts of national and local governments – and indeed of private sector and civil society actors – to achieve positive gains from the use of ICTs by enterprises, especially micro-enterprises? Four significant areas of potential support can be identified:

- Support for the integration of ICTs/enterprise into national development planning and implementation processes, including strengthening of the legal and regulatory frameworks for ICTs and enterprise.
- Investment in relevant infrastructure deployment in geographical areas where commercial investments are insufficiently forthcoming, or in technological areas of high potential, such as broadband, in which private investment is poorly distributed nationwide.
- Support for government initiatives in the ICT sector, enterprise and human capacity development, of the kind described in section B (i.e. those concerned with the provision of information services, training and awareness of the potential of ICTs, and more efficient local markets).
- The development of a deeper understanding of the impact of ICTs on enterprise by building a more extensive and more critical evidence base and establishing frameworks for the analysis of national communications environments and needs.

1. Integration of ICTs into development planning and implementation

In recent years, governments and development partners have improved the quality of dialogue concerning allocation of multilateral and bilateral resources. There have also been improvements in the coordination of development assistance amongst development partners themselves.[25] More coherence between national development strategies, including PRSs, and development partner support, for example through United Nations Development Assistance Frameworks (UNDAFs), should improve the likelihood that resources will be focused on agreed priorities. The United Nations Economic and Social Council has made repeated calls for more reference to ICTs in such documents. In a recent resolution the Council:[26]

> *"…Notes with regret that more than three years after the second phase of the World Summit, held in Tunis from 16 to 18 November 2005, the revised guidelines for United Nations country teams on preparing common country assessments and United Nations Development Assistance Framework still do not reflect the recommendations of the outcome documents of the Summit and do not contain a component on information and communications technology for development, and urges that the necessary coordinated action be taken for implementation of the recommendations in paragraph 100 of the Tunis Agenda."*

Such coherence does not, however, guarantee that either ICTs or enterprise development will be among the main priorities for donors and IFIs. As discussed above, ICTs do not feature prominently in many of the PRSs which act as frameworks for bilateral and multilateral assistance. The potential of ICTs and enterprise has been insufficiently explored in national development programmes and in country programmes negotiated by governments with donors such as the European Union and international financial institutions such as the African Development Bank. As noted, there is no requirement at present to consider the information and communications sector or ICT4D in the UNDAF preparation process (United Nations, 1999). As a result, in a 2009 review by UNECA of 20 UNDAFs in Africa, it was found that only two included ICT-related projects.[27]

Development partners need to reconsider the role of ICTs within their overall development planning, reflecting ICTs' growing importance in national economies and their new and larger potential role in achieving developmental outcomes, including poverty reduction. More widespread access to mobile phones has opened opportunities that previously did not exist. Development partners can also work with governments – through the dialogues which surround PRSs, UNDAFs and other development agreements – to improve the integration of ICTs and enterprise in national strategies, and to link these components of these strategies with poverty reduction. Further improvements in the evidence base concerning ICTs and enterprise (see section C.4) will contribute significantly to this effort.

Panama offers a concrete example of a collaborative effort among a beneficiary government, a donor and the United Nations. The three-year MDG Joint Programme – entitled "Entrepreneurial Network Opportunities for Poor Families", funded by the Government of Spain and implemented by the Government of Panama and five United Nations agencies, including UNCTAD – seeks to reduce poverty by supporting micro-enterprises among the poor. UNCTAD's role is to deliver entrepreneurial behavioural training through its Empretec programme. This training is adapted to the specific economic context and capabilities of intended beneficiaries, mainly in rural areas. In addition, UNCTAD has incorporated an ICT dimension in the training, with a view to further empower the entrepreneurs. ICT-related exercises help to raise awareness among entrepreneurs of the potential of mobile phones to increase productivity by way of improved access to information and opportunities, persuasion and networking – core areas of Empretec's methodology. A first impact assessment is scheduled for the end of 2010.[28]

2. Infrastructure investment

In the past few years, there has been an increase in government financing of large-scale infrastructure projects which are designed to accelerate the spread of broadband networks. Such initiatives are evident, for example, in East Africa, following the arrival of submarine cable connectivity to that region. IFIs have been involved in co-financing some of these investments in partnership with private companies and governments. Such IFI engagement is welcome and can play an important part in expediting the deployment of new infrastructure. Where public investment is justified, IFI support can be decisive in enabling the upgrading of national networks, including their extension to more remote areas. This can take the form of participation in public–private partnerships, rather than necessarily re-establishing public sector ownership of communications assets. Open access regulation should be used to ensure that new State assets are available to all network and service providers.[29] The establishment of the Broadband Commission is a major initiative in this area aimed at accelerating access to broadband networks to help fast-track achievements of the MDGs (box V.3).

For reasons already discussed, rural communications networks have higher value if they are integrated with improvements in power and transport networks. It has not been common practice for development partners to integrate communications with other network infrastructure initiatives in developing countries. The case for such coordination in regions suffering from multiple infrastructure deficits is, however, strong, in terms both of cost reduction and of maximizing synergies between communications and other infrastructure. Development partners should therefore encourage public and private investors to look for such synergies where possible, for example by installing fibre optic cables alongside new power and transport routes and by integrating communications into comprehensive infrastructure support programmes for remoter regions. Multilateral agencies may serve an important role in helping to coordinate such complex projects, which typically require the involvement of multiple

Box V.3. The Broadband Commission for Digital Development

The Broadband Commission for Digital Development was launched in May 2010 during the WSIS Forum 2010 in Geneva, 5 years after the WSIS, and 10 years after the adoption of the MDGs. Stressing that high-speed, high-capacity broadband connections to the Internet are an essential element in modern society, with wide economic and social benefits, its mission is to promote the adoption of broadband-friendly practice and policies to allow the entire world to take advantage of the benefits from broadband.

The Broadband Commission will seek to demonstrate that expanding broadband access in every country is a key way to accelerate attainment of the MDGs by 2015. The Commission will define practical ways in which countries – at all stages of development – can achieve this, in cooperation with the private sector.

The Commission is led by two co-chairs, H.E. Mr. Paul Kagame, President of Rwanda and Mr. Carlos Slim Helú, Honorary Lifetime Chair of Grupo Carso. The heads of ITU and UNESCO serve as vice-chairs. Other commissioners are from government, private sector, international agencies (including the Secretary-General of UNCTAD) and civil society and academia. Its outcomes will be presented to United Nations Secretary-General Ban Ki-moon in September 2010 in conjunction with the United Nations MDG Summit in New York.

Source: The Broadband Commission (www.broadbandcommission.org).

government ministries as well as a variety of private contractors.

3. Support for government initiatives

As well as funding infrastructure, multilateral agencies have the opportunity to provide financial backing and technical expertise for initiatives concerned with ICTs and enterprise that are proposed by governments (section B). This can be done either through budgetary support directed at enterprise development ministries in government or through direct support for specific programmes of activity.[30] As in other sectors, funding proposals should be subject to thorough assessment of projected impact before adoption, programmes should be independently monitored and evaluated during and after implementation, and also assessed for impact outcomes in the longer term. Information derived from such experiences has an important part to play in improving the understanding of the potential for ICTs and enterprise in practice.

One area of particular importance here is capacity-building, in which development partners can contribute international expertise as well as funding.[31] Training and technical assistance related to policy and regulatory capacity are a priority area. Communications regulation requires constant revision to meet changes in technology and markets. Regulators in small countries in particular find it difficult to keep up to date with these developments and to match the expertise of regulated companies. UNCTAD, the World Bank and ITU among other international agencies are assisting governments in this area.[32]

As noted above, only a few donors (including Finland) have retained specialist units with expert personnel devoted to ICT4D. There is a risk, therefore, that the potential of ICTs – particularly as cross-cutting developmental inputs – will be undervalued within development agencies, and that knowledge and experience will be poorly collated and diffused. Against this background, development partners need to consider how they can ensure that they stay abreast of rapid developments taking place within ICT4D and that the potential of ICTs is given adequate attention within their programmes.

4. Deepening the understanding of impact

National strategies for enhancing the value of ICTs for enterprise, and local processes that implement them, need to be rooted in the specific contexts for which they are intended – national and local infrastructure and power relationships, the availability of resources and skills within communities, particular geographic and sectoral requirements, etc. Simply transferring experience from one context (country, region or sector) to another is unlikely to achieve comparable gains. Good practices and positive experiences need tailoring to local circumstances.

Development partners should assume a more active role in consolidating and developing the evidence base concerning ICTs and enterprise, particularly the impact of ICTs on micro-enterprises and on the livelihoods of those dependent on them. Such knowledge maps have been useful in facilitating the re-evaluation of policy objectives and programme targets, by governments and development partners, in other areas of ICT4D such as education (e.g. Trucano 2005). An initial review to consolidate evidence from existing programme activities and academic studies would help in illuminating where it is possible to draw robust conclusions about the needs of micro-enterprises, the value derived by them in practice from the use of ICTs and its implications for the supply chains in which they are involved. It would also help to establish the scope and scale of wider developmental gains that can be attributed to the spread of ICTs within society and to interventions designed to support ICT adoption by enterprise. Better indicators are needed of the impact of ICTs themselves and of different policy approaches (Souter, 2008; Heeks and Molla, 2009).

However, for policymakers to be able to maximize the contribution that ICTs make to enterprise development and poverty reduction, they need to know more about their own national communications contexts and how these differ from experience elsewhere. Development partners can commission targeted research to help address these knowledge gaps. They can also develop guidelines for use by governments and other actors in different countries. Critical issues in any programme of research and analysis along these lines include:

- Better measurement of the use and impact of ICTs in the enterprise sector, from macroeconomic outcomes to the micro-enterprises of the poor. There are major information gaps, for example, with regard to the use of ICTs by micro-enterprises in low-income countries. This should be related to the ongoing work of the Partnership on Measuring ICTs for Development (box II.1).

- The design and development of communications audit processes, to establish clear baseline data for the current deployment and use of ICTs and other information and communications resources, and for communication needs assessments focused on SMEs and micro-enterprises.
- The systematic assessment of ICT and enterprise experience in a number of countries, at macro, meso and micro levels, to strengthen the available evidence base and provide a more substantial basis for cross-country comparisons of experience and good practice.
- Deeper assessment of the changing modalities of use of different ICT devices, services and content by micro-enterprises, and the relative value which these have for growth-oriented and subsistence-based enterprises.
- Assessment of the needs of ICT micro-enterprises, and of the way in which these micro-enterprises are adapting to changing technology and markets.
- Assessment of the best ways of using ICTs in the provisions of government support services to relevant kinds of enterprise.

D. CONCLUSIONS AND RECOMMENDATIONS

The world is witnessing a new dawn with regard to the potential of ICTs to contribute in the fight against poverty. For the first time, there are realistic opportunities for inhabitants of remote locations in low-income countries to become connected via ICTs. Rapid changes in the ICT landscape are creating new opportunities for the poor to benefit from better access to mobile phones and from new services and applications, sometimes based on combinations of different technologies. Increased access – even in LDCs – to mobile phones and related services is changing the affordability and access equation also for small enterprises at the bottom of the economic pyramid. Farmers, fishermen as well as entrepreneurs in urban areas are rapidly adopting mobile phones as a key tool to advance their commercial activities, and some poor people are finding new livelihoods on the back of this trend.

Policymakers should seize these new opportunities to leverage ICTs and enterprise to bring tangible benefits to the poor, including those living on the margins of subsistence. Successful approaches in this context need to address the whole ecosystem surrounding ICTs, enterprise and human capacity development.

A few developing countries have been able to develop ICT manufacturing or business process outsourcing sectors. All, however, have seen new communications technologies play an increasing part in the management and trading activity of large businesses and in the work of government. This has had a significant impact on business practice and is believed to have a significant impact on productivity and so potentially on economic growth. In the form, mostly, of broadcasting and mobile phones, ICTs have also reached deeply into societies, opened new ways for people to conduct their personal and business lives. Mobile phones are popular among the poor. As technology develops, they also look to be the most likely route to Internet access for the poor in developing countries. However, connectivity remains a challenge in some rural areas, and affordability is a constraint in many countries, especially for the groups with the lowest income.

There is strong evidence that ICTs are used by micro-enterprises, particularly those oriented towards growth rather than subsistence, in a number of ways that enhance business performance. They can improve the quality of information available and reduce the information search and transaction costs incurred by small businesses in sourcing inputs, obtaining advice and selecting markets in which to sell their products. ICTs can also help small enterprises to diversify their product and customer bases, and, where mobile-money becomes available, improve access to capital or cash-flow. These benefits do not transform the nature of most businesses, but can add value, increase incomes and improve livelihoods – not just in financial terms, but also through the expansion of social networks and the improvement of business knowledge. In addition to the benefits that ICTs bring to existing enterprises, they can also improve the functioning of markets and lead to the establishment of new businesses, from computer maintenance and web design to those selling mobile airtime on the street.

Micro-enterprises throughout the developing world are taking advantage of these opportunities. Their ability to do so, however, depends on a number of factors, including their own capabilities. Literacy, language and research skills, for example, are important determinants of information value. Access to capital and other resources can also be positive or limiting

factors, which tend to be unevenly distributed. Also important is the quality of ICT support services, the ease with which businesses can innovate and diversify, the presence of power and transport infrastructures to enable ICT-led business growth, and the availability of expertise – whether government or private sector – to help secure the gains from ICTs.

The expansion of ICT networks and services provides opportunities for governments and development agencies to leverage developmental gains. To maximize these, governments and agencies need to recognize that ICTs, enterprise and capacity development together form a system, and that the synergies between these three policy domains are as important as each is alone. Governments and agencies should therefore act not just to improve ICT connectivity but to raise the capabilities of micro-enterprises to make use of ICTs and to foster a business environment which encourages and rewards them for doing so. ICTs and enterprise need to become better integrated in national development strategies and in agreements, such as UNDAFs, which governments enter into with donors and IFIs. Governments and their development partners can act in all three domains. They should build on the ways in which enterprises already make use of ICTs and provide facilities that enhance that use and enable it to contribute more to livelihood gains. There is potential here in the area of ICT production (the supply side) and ICT use (the demand side).

On the supply side, their first responsibility is to provide an enabling environment which encourages the competitive provision of communications services. A pro-competitive regulatory environment unlocks the dynamism of communications enterprise, and in most areas it is unnecessary for governments to go beyond this by investing directly in the sector. Where there is market failure, however – including in rural areas which are not attracting private sector investment – governments and IFIs can accelerate ICT deployment by investing in networks either alone or in partnership with private companies. Such investments should focus on areas that will bring significant gains in poverty reduction. Governments can likewise accelerate the deployment of broadband backbone infrastructure, which will increase ICT capacity throughout their territories, where there is a risk that investment from the private sector will be uncompetitive or will be delayed. The recent formation of the Broadband Commission is an important step towards addressing this challenge.

A vibrant community of ICT support services is also important to facilitate greater reach of ICTs within the wider micro-enterprise economy. Governments can and should seek to stimulate it through relevant business support mechanisms and training. Micro and small ICT enterprises provide a vital link between the mainstream ICT sector and micro-enterprises, tailoring conventional service offerings to the scope and requirements of the poor – for example, by retailing low denomination airtime, by reconfiguring second hand phones or by providing cyber cafe access to the Internet. The quality of skills available in this ICT support sector will be a significant contributor to micro-enterprise.

On the demand side, governments can and should do more to facilitate better provision of relevant information and services. There are already private sector and NGO resources available in some areas to collect and disseminate information on market prices or agricultural practice to low-income communities using radio, mobile phones and, sometimes, the Internet. Information provision of this kind can reduce information costs substantially and improve the bargaining position of producers. Governments can facilitate the establishment of such resources where they are not currently being provided, and can back them up with their own business advice and extension services, by providing access to business data such as land records and certificates of entitlement, and by reducing the transaction costs at the interface between government and micro-enterprise.

Governments can also support the development of the capabilities of entrepreneurs to make use of ICTs. For the next generation, this includes the integration of ICT requirements in educational curricula. For the current generation of entrepreneurs, as well as building awareness and user skills, it includes enabling micro-enterprises to gain access to new services that can help to build business stability and performance, such as mobile transactions and mobile micro-insurance. Within the administration itself, governments should emphasize the training and capacity-building of policy and regulatory personnel responsible for coordinating interventions and for overseeing various parts of the ICT sector.

From a poverty reduction perspective, it is important that government attention focuses on subsistence-based micro-enterprises in rural areas as much as on growth-oriented micro-enterprises in urban districts. Thanks to improvements in connectivity (using mobile

phones and approaches combining diverse media), there are real opportunities to reach the poor, even in remote areas.

Furthermore, to be effective, policymaking must: (a) be rooted in a good understanding of the real experience and requirements of target enterprises; (b) build on the ways in which poor people and micro-enterprises appropriate ICTs as they become available; and (c) secure the input and engagement of enterprises most relevant to the poor, in programme design and implementation. For example, governments need to take a fresh look at how relevant business support services can be delivered via mobile phones. Moreover, the content of new ICT applications should reflect the specific needs of the intended beneficiaries and be delivered in languages and formats that are compatible with the capabilities and situation of the users.

Tailored policy interventions are needed in the following areas: (a) enhancing access to ICT infrastructure, especially wireless technology; (b) making ICT access affordable; (c) promoting relevant content and services development; (d) strengthening the ICT sector; and (e) improving the links between ICT and enterprise policies and poverty reduction strategies. Enterprise-related ICT policies need to become better integrated in national development strategies and in the UNDAFs.

It is time for the development community to revisit the scope for ICTs in enterprises to bring benefits to the poor. Interventions need to be rooted in today's realities – including the needs and circumstances of micro-enterprises and the communications environment available to them – and in realistic assessment of future prospects. Unfortunately, however, we do not yet know enough about the changes that are taking place. Governments and development partners can make a major contribution by helping to improve the evidence base related to the ICTs, enterprise and development nexus.

Finally, policies and interventions need to recognize that technology and markets are in constant flux. The great diversity of ICTs and the rapid, continual change taking place in this area mean that policy interventions need to be well informed about the precise needs of enterprises in different sectors and about trends in ICT technology and markets. To be effective in reaching intended beneficiaries, interventions need to be context-specific, demand-driven and reflecting changing needs: there is no one-size-fits-all fix available. Understanding this will enable more responsive collaboration between different stakeholders in various partnership constellations. If implemented successfully, the support of governments and development partners can help ensure that ICTs in enterprises make a stronger positive contribution to livelihoods and poverty reduction.

NOTES

1 See, for example, UNCTAD, 2009c.

2 See e.g. UNCTAD, 2000; World Bank, 1998; Mansell and Wehn, 1998.

3 Although the importance of target beneficiary participation has been increasingly emphasized in the past decade or so, it is still insufficiently applied in government and major donor programmes (Chapman et al., 2003, United Nations, 2008).

4 Member companies of the GSM Association announced at the Connect Africa summit in 2007 that they would invest some $50 billion in mobile networks in Africa during the following five years, by the end of which time, they said, 90 per cent of Africans should live within mobile signal areas: http://www.gsmworld.com/newsroom/press-releases/2078.htm; GSM Association, 2007.

5 These challenges were emphasized in the 2004 report of the United Nations Task Force on Financial Mechanisms for ICT for Development (UNDP, 2004). More recently, they were discussed during the first Open Consultations on Meeting the Challenges of Financing ICT for Development organized in October 2009 in Geneva by the United Nations Group on the Information Society (UNGIS). A report from the meeting is available at www.ungis.org. The financing challenge was also addressed in the Inter-sessional Panel of the CSTD in November 2009 (see www.unctad.org/cstd).

6 See http://www.government.fi/ajankohtaista/tiedotteet/tiedote/en.jsp?oid=301979.

7 See e.g. "Improvements and innovations in existing financing mechanisms: information and communication technology for development", Report of the Secretary-General, E/CN.16/2010/3 (United Nations), and http://www.infoworld.com/d/security-central/universal-service-funds-not-being-spent-397.

8 See "At Your Service: Telecoms in the Developing World", *The Economist*, 31 March 2007.

9 In the case of Uganda, see http://www.balancingact-africa.com/news/en/issue-no-337/internet/uganda-to-build-national-backbone; the United Republic of Tanzania, see http://www.i-policy.org/2010/05/tanzania-launches-first-phase-of-national-fibre-backbone.html; and Rwanda, see http://www.computerworld.co.ke/articles/2008/10/06/korea-telecom-build-rwanda-national-backbone.

[10] See, e.g., "World Bank endorses Central Africa Backbone Program", at http://www.developingtelecoms.com/world-bank-endorses-central-africa-backbone-program.html; East African Community Statement "Matters Relating to the East African Regional Fibre Backbone", at http://news.eac.int/index.php?option=com_content&view=article&id=131:ea-fibre-backbone&catid=48:eac-latest&Itemid=69.

[11] See http://www.icttoolkit.infodev.org/en/index.html.

[12] In some cases, it has been suggested that USFs may deter the development of micro-telcos because dominant operators see their contribution to rural infrastructure access as being delivered through the USF mechanism: see e.g. http://www.brainstormmag.co.za/index.php?option=com_content&view=article&id=1724.

[13] For example, Vodafone launched two new low-cost handsets aimed at low-income markets in February 2010: http://www.vodafone.com/start/media_relations/news/group_press_releases/2010/vodafone_adds_two.html.

[14] Many phone users in developing countries have SIM cards from more than one operator in order to take advantage of lower on-net charges.

[15] See also, for comment on an individual country, http://www.apc.org/en/node/9093/.

[16] The word "local" here may sometimes be misleading. What matters to enterprises is content which adds to their ability to maximize returns on their investment, labour and production. Not all such information is local in character – for example, information about different seed varieties or pesticides. Content which is local can also be delivered by national government and NGOs rather than local agencies. The word "relevant" is therefore more appropriate.

[17] Enterprises also benefit from information which is not explicitly business-oriented, for example on personal health.

[18] That is, individuals or organizations that assist end-users to access and interpret the information that they require.

[19] See e.g. IICD, 2009.

[20] Mobile-based micro-insurance services are also beginning to appear (chapter IV).

[21] Many financial regulators are unfamiliar with non-bank institutions and have questioned whether others than banks should be allowed to run payment schemes (see e.g. Makin, 2009).

[22] See Hellström (2010) for examples of innovative use of mobile applications in East Africa.

[23] One way of addressing this broad contextual approach – the 12C's framework – was proposed in the *IER 2006* (UNCTAD, 2006: chapter 3).

[24] For example, the United Kingdom, Department for International Development used to have a strong unit supporting ICT4D but it has been eliminated (Greenberg, 2008). Similarly, the Swiss Agency for Development and Cooperation has been phasing out most of its support to international mainstreaming efforts of ICTs in development processes since 2008 (see www.sdc.admin.ch).

[25] See the Paris Declaration on Aid Effectiveness and associated documents at http://www.oecd.org/dataoecd/11/41/34428351.pdf.

[26] Economic and Social Council resolution 2009/7, para 13, available at http://www.un.org/en/ecosoc/docs/2009/resolution%202009-7.pdf.

[27] Information from UNECA.

[28] For more information on the Empretec programme, please see www.unctad.org/enterprise.

[29] Open access here refers to infrastructure owners making their facilities available to their competitors on terms which are competitive with their own downstream businesses.

[30] It can also be incorporated in agreements with donors and IFIs such as UNDAFs and the Country Strategy Papers which African governments agree with agencies including the European Union and the African Development Bank.

[31] The Report from the Open Consultations on Meeting the Challenges of Financing ICT for Development notes: "Areas in need of particular attention include the development of local content and applications, as well as raising sufficient resources to build the required capacity in developing countries" (UNGIS, 2009: 19).

[32] See, for example, Intven 2000; infoDev 2009b, and the training activities of ITU at http://academy.itu.int/. For more on UNCTAD's work on ICT and law reform, see http://r0.unctad.org/ecommerce/ecomlaw.htm. Model legislation is available to address these needs e.g. from the United Nations Commission on International Trade Law (UNCITRAL), available at http://www.uncitral.org/uncitral/en/uncitral_texts/electronic_commerce.html.

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STATISTICAL ANNEX

Annex tables

Annex table I.1. People living on less than $1.25 (PPP) per day, 1996 and 2005

Country	1996			2005		
	Number of poor (thousands)	Population (millions)	Poverty rate (%)	Number of poor (thousands)	Population (millions)	Poverty rate (%)
Africa	**329,310**	**678**	**48.5**	**359,306**	**845**	**42.5**
Algeria*	1,956	29	6.8	1,399	33	4.3
Angola	7,308	13	58	6,847	16	42.5
Benin	3,952	6	61.8	4,219	8	50
Botswana	511	2	31.9	424	2	23.1
Burkina Faso	7,078	11	67	7,667	14	55
Burundi	5,412	6	85.9	6,392	8	81.3
Cameroon	7,421	14	51.5	4,897	18	27.5
Cape Verde	128	0	31.2	94	1	18.4
Central African Republic	2,411	4	68.1	2,700	4	64.4
Chad	4,955	7	67.1	5,955	10	58.7
Comoros	264	1	52.8	277	1	46.1
Congo	2,258	3	77.9	1,953	4	54.1
Côte d'Ivoire	3,642	15	23.7	3,789	19	20.4
Democratic Republic of the Congo	30,546	47	65.7	34,786	59	59.2
Djibouti	29	1	4.8	148	1	18.6
Egypt	1,520	62	2.5	1,450	73	2
Ethiopia	33,079	58	56.7	29,346	75	39
Gabon	108	1	9.8	62	1	4.8
Gambia	821	1	68.4	507	2	31.3
Ghana	8,047	18	44	6,760	23	30
Guinea	3,292	8	43.9	6,285	9	69.8
Guinea-Bissau	557	1	46.4	679	2	42.5
Kenya	5,915	28	21.1	7,020	36	19.7
Lesotho	857	2	47.6	767	2	38.7
Liberia	2,008	2	87.3	2,961	3	86.1
Madagascar	10,788	14	74.9	12,644	19	67.8
Malawi	8,590	10	83.4	9,772	13	73.9
Mali	7,102	9	78.9	5,971	12	51.4
Mauritania	538	2	23.4	396	3	13.4
Morocco	1,237	27	4.6	892	30	3
Mozambique	13,340	16	81.3	14,008	21	68.2
Namibia	789	2	46.4	884	2	43.8
Niger	7,623	10	79.4	8,729	13	65.9
Nigeria	76,800	112	68.5	88,195	141	62.4
Rwanda	4,374	6	74.1	6,870	9	74.4
Senegal	4,915	9	52.9	3,943	12	33.5
Sierra Leone	2,336	4	55.6	2,791	6	49.9
South Africa	9,180	40	23	9,636	47	20.6
Swaziland	684	1	76	705	1	62.4
Togo	1,308	5	27.8	2,414	6	38.7
Tunisia	561	9	6.2	101	10	1
Uganda	14,101	22	64.4	14,918	29	51.5
United Republic of Tanzania	25,073	31	81.7	31,708	38	82.4
Zambia	5,897	10	62.1	7,380	11	64.3
Asia	**1,184,353**	**3,041**	**39**	**894,132**	**3,423**	**26.1**
Bangladesh	63,880	129	49.6	77,360	153	50.5
Bhutan	238	1	47.7	171	1	26.8
Cambodia	4,998	12	42.7	5,611	14	40.2
China-Rural	407,963	825	49.5	198,368	760	26.1
China-Urban	34,859	393	8.9	9,315	545	1.7
India-Rural	343,054	694	49.4	342,882	782	43.8
India-Urban	98,695	255	38.8	112,920	312	36.2
Indonesia-Rural	57,690	123	46.8	27,484	114	24
Indonesia-Urban	27,110	72	37.6	19,807	106	18.7
Iran, Islamic Republic of	1,018	60	1.7	1,002	69	1.5
Jordan	83	4	1.9	21	5	0.4
Lao People's Democratic Republic	2,141	5	44.5	2,019	6	35.7
Malaysia	277	21	1.3	139	26	0.5
Mongolia	432	2	18.8	571	3	22.4
Nepal	15,194	22	68.4	14,818	27	54.7
Pakistan	60,368	125	48.1	35,188	156	22.6
Philippines	15,411	70	22	19,130	85	22.6
Sri Lanka	2,513	15	16.3	2,032	20	10.3

Country	1996			2005		
	Number of poor (thousands)	Population (millions)	Poverty rate (%)	Number of poor (thousands)	Population (millions)	Poverty rate (%)
Thailand	1,099	58	1.9	252	63	0.4
Timor-Leste*	421	1	54.7	427	1	43.6
Turkey	962	63	1.5	1,960	72	2.7
Viet Nam	43,844	74	59	18,955	83	22.8
Yemen	2,103	16	13.1	3,699	21	17.5
Latin America and the Caribbean	**53,070**	**485**	**10.9**	**45,250**	**550**	**8.2**
Argentina-Urban	554	35	1.6	1,744	39	4.5
Bolivia, Plurinational State of	1,484	8	19.5	1,801	9	19.6
Brazil	18,753	164	11.4	14,498	187	7.8
Chile	63	15	0.4	116	16	0.7
Colombia	5,267	39	13.5	6,244	45	13.9
Costa Rica*	255	4	7.1	103	4	2.4
Dominican Republic*	481	8	5.9	472	9	5
Ecuador	1,791	12	15.4	1,277	13	9.8
El Salvador*	854	6	15	899	7	13.5
Guatemala*	2,109	10	20.7	1,666	13	13.1
Guyana*	51	1	7.3	54	1	7.3
Haiti*	4,841	8	60.5	5,389	9	58
Honduras*	889	6	15.6	1,516	7	22.2
Jamaica*	44	3	1.7	6	3	0.2
Mexico	6,463	93	7	1,773	103	1.7
Nicaragua*	1,196	5	24.9	863	5	15.8
Panama*	336	3	12.4	297	3	9.2
Paraguay	758	5	15.5	549	6	9.3
Peru	2,079	24	8.6	2,231	27	8.2
St. Lucia*	21	0	20.9	29	0	17.8
Suriname*	64	0	15.9	64	0	14.2
Trinidad and Tobago*	99	1	7.6	7	1	0.5
Uruguay-Urban	31	3	1	3	3	0.1
Venezuela, Bolivarian Republic of	3,310	23	14.7	2,653	27	10
Oceania	**1,734**	**5**	**35.8**	**1,803**	**6**	**29.7**
Papua New Guinea*	1,734	5	35.8	1,803	6	29.7
Transition economies	**19,374**	**296**	**6.5**	**14,803**	**291**	**5.1**
Albania	6	3	0.2	27	3	0.9
Armenia	557	3	17.5	143	3	4.7
Azerbaijan	1,401	8	18.1	3	8	0
Belarus	203	10	2	0	10	0
Bosnia and Herzegovina	0	3	0	6	4	0.2
Croatia	0	4	0	0	4	0
Georgia	222	5	4.5	601	4	13.4
Kazakhstan	777	16	5	174	15	1.2
Kyrgyzstan	1,463	5	31.1	1,121	5	21.8
Republic of Moldova	547	4	12.7	316	4	8.1
Russian Federation	5,140	148	3.5	229	143	0.2
Tajikistan	3,885	6	65.9	1,408	7	21.5
The former Yugoslav Republic of Macedonia	0	2	0	6	2	0.3
Turkmenistan*	1,793	4	41.7	566	5	11.7
Ukraine	986	51	1.9	47	47	0.1
Uzbekistan*	2,394	23	10.3	10,157	26	38.8
Developed Europe	**1,026**	**105**	**1**	**215**	**102**	**0.2**
Bulgaria	18	8	0.2	0	8	0
Czech Republic	0	10	0	0	10	0
Estonia	3	1	0.2	0	1	0
Hungary	0	10	0	0	10	0
Latvia	11	3	0.4	0	2	0
Lithuania	0	4	0	15	3	0.4
Poland	540	39	1.4	38	38	0.1
Romania	441	23	2	162	22	0.8
Slovakia	14	5	0.3	0	5	0
Slovenia	0	2	0	0	2	0
World	**1,657,734**	**4,812**	**34.5**	**1,373,611**	**5,453**	**25.2**

Source: UNCTAD, based on data from PovcalNet of the World Bank. See Chen and Ravallion (2008) for information on methodology.
*Note: * Regression-based PPP.*

Annex table II.1. Penetration of selected ICTs, 2009 or latest year (per 100 inhabitants)

Region/Economy	Fixed telephone lines	Mobile cellular subscriptions	Internet users	Fixed broadband subscriptions
Developed economies				
America				
Bermuda	88.96	131.05	83.25	61.67
Canada	54.36	68.75	78.11	29.70
United States	49.26	94.83	76.24	27.10
Asia				
Israel	45.33	125.84	51.61	25.80
Japan	34.89	90.37	76.80	24.94
Europe				
Andorra	44.30	75.49	78.53	26.83
Austria	38.89	140.76	73.45	22.45
Belgium	39.97	116.65	76.20	29.44
Bulgaria	28.69	140.73	45.00	12.98
Cyprus	47.59	112.23	49.81	20.21
Czech Republic	20.18	137.51	64.43	19.48
Denmark	37.69	135.39	86.84	37.86
Estonia	36.77	202.99	72.35	25.25
Faroe Islands	41.95	114.25	75.18	34.08
Finland	26.85	144.59	84.14	29.40
France	56.94	95.51	71.58	31.12
Germany	59.27	127.79	79.26	30.43
Gibraltar	77.31	92.12	65.07	29.95
Greece	53.13	119.12	44.54	17.17
Greenland	38.47	93.32	62.83	21.28
Hungary	30.71	118.01	61.81	18.81
Iceland	57.40	108.15	93.46	33.21
Ireland	46.05	107.88	67.38	21.62
Italy	35.58	151.35	48.83	19.71
Latvia	28.63	99.72	66.84	11.51
Liechtenstein	54.58	97.46	64.05	75.19
Lithuania	22.74	150.96	59.76	19.28
Luxembourg	56.27	147.89	87.31	32.91
Malta	61.83	103.27	58.86	24.41
Netherlands	44.12	127.66	89.63	35.57
Norway	39.48	110.89	92.08	37.30
Poland	25.10	117.02	58.97	13.57
Portugal	37.82	141.76	48.27	17.42
Romania	24.97	119.28	36.60	13.18
San Marino	68.56	76.54	54.21	31.89
Slovak Republic	18.90	101.70	75.17	14.39
Slovenia	51.19	103.98	64.28	23.06
Spain	44.67	113.56	62.62	21.55
Sweden	55.64	123.53	90.80	41.08
Switzerland	61.45	122.30	72.41	34.65
United Kingdom	54.60	130.55	83.56	29.81
Oceania				
Australia	42.36	113.75	74.00	25.36
New Zealand	43.83	110.16	84.38	22.99
Developing economies				
Africa				
Algeria	7.38	93.79	13.47	2.34
Angola	1.64	43.84	3.28	0.11
Benin	1.42	56.33	2.24	0.02
Botswana	7.40	96.12	6.15	0.77
Burkina Faso	1.06	20.94	1.13	0.04
Burundi	0.38	10.10	0.78	0.00
Cameroon	1.66	37.89	3.84	0.00
Cape Verde	14.28	77.53	29.67	1.38
Central African Republic [a]	0.27	3.80	0.51	0.00
Chad	0.12	23.97	1.68	0.00
Comoros [a]	3.76	14.79	3.59	0.00
Congo [a]	0.66	58.94	6.66	0.00
Côte d'Ivoire	1.34	63.33	4.59	0.05
Democratic Republic of the Congo	0.06	15.39	0.55	0.00

Region/Economy	Fixed telephone lines	Mobile cellular subscriptions	Internet users	Fixed broadband subscriptions
Egypt	12.42	66.69	20.04	1.30
Equatorial Guinea	1.48	65.80	2.13	0.03
Eritrea [a]	0.96	2.78	4.93	0.00
Ethiopia	1.10	4.89	0.54	0.00
Gabon	1.80	93.11	6.70	0.20
Gambia	2.87	84.04	7.63	0.02
Ghana	1.12	63.38	5.44	0.11
Guinea [a]	0.22	55.69	0.94	0.00
Guinea-Bissau [a]	0.30	34.79	2.30	0.00
Kenya	1.67	48.65	10.04	0.02
Lesotho	1.94	31.98	3.72	0.02
Liberia	0.05	21.29	0.51	..
Libyan Arab Jamahiriya	17.15	77.94	5.51	0.16
Madagascar	0.92	30.56	1.63	0.02
Malawi	1.15	15.72	4.69	0.02
Mali	0.62	28.76	1.92	0.07
Mauritania	2.26	66.32	2.28	0.27
Mauritius	29.43	84.36	22.51	7.18
Morocco	10.99	79.11	32.19	1.49
Mozambique	0.36	26.08	2.68	0.05
Namibia	6.54	56.05	5.87	0.02
Niger	0.43	17.00	0.76	0.01
Nigeria	0.92	47.24	28.43	0.05
Rwanda	0.33	24.30	4.50	0.08
Sao Tome and Principe	4.79	39.32	16.41	1.23
Senegal	2.22	55.06	7.36	0.47
Seychelles	26.20	109.56	40.36	4.53
Sierra Leone [a]	0.58	20.36	0.26	0.00
Somalia [a]	1.09	7.02	1.16	0.00
South Africa	8.62	92.67	8.82	0.96
Sudan [a]	0.88	36.29	9.94	0.11
Swaziland	3.71	55.36	7.60	0.13
United Republic of Tanzania [a]	0.40	39.94	1.55	0.02
Togo	2.70	33.05	5.38	0.04
Tunisia	12.45	94.96	34.07	3.63
Uganda	0.71	28.69	9.78	0.02
Zambia	0.70	34.07	6.31	0.06
Zimbabwe	3.08	23.88	11.36	0.14
Asia				
Afghanistan	0.46	42.63	3.55	0.00
Bahrain	30.12	199.38	82.04	20.85
Bangladesh	0.94	31.07	0.38	0.03
Bhutan	3.78	46.90	7.17	0.44
Brunei Darussalam	20.15	106.66	79.78	5.01
Cambodia	0.37	37.78	0.53	0.20
China	23.31	55.51	28.53	7.70
Democratic People's Republic of Korea	4.94	0.29	0.00	0.00
Djibouti	1.95	14.90	3.00	0.61
Hong Kong, China	59.65	173.84	61.24	29.34
India	3.09	43.83	5.12	0.65
Indonesia	14.77	69.25	8.70	0.74
Iran, Islamic Republic of	34.78	70.83	37.62	0.54
Iraq	3.60	64.14	1.06	0.00
Jordan	7.94	95.22	27.58	3.22
Republic of Korea	39.91	99.20	81.60	33.82
Kuwait [e]	18.54	99.59	36.85	1.51
Lao People's Democratic Republic	2.09	51.18	4.75	0.13
Lebanon	17.76	36.13	23.68	5.26
Macao, China	31.69	192.83	52.21	23.42
Malaysia	15.70	110.60	57.61	6.09
Maldives	15.84	147.94	28.39	5.78
Mongolia	7.07	84.20	13.10	0.91
Myanmar	1.62	0.90	0.22	0.03
Nepal	2.80	25.97	2.13	0.26
Oman	10.55	139.54	43.46	1.44
Pakistan	2.24	56.96	11.26	0.35
Palestinian Authority	8.14	28.62	8.32	5.45

Region/Economy	Fixed telephone lines	Mobile cellular subscriptions	Internet users	Fixed broadband subscriptions
Philippines	4.46	80.98	6.47	1.87
Qatar	20.24	175.40	28.31	9.22
Saudi Arabia	16.22	174.43	38.10	5.59
Singapore	39.11	140.43	77.23	23.71
Sri Lanka	16.98	69.65	8.78	0.84
Syrian Arab Republic	17.67	44.27	17.96	0.16
Taiwan, China	63.19	116.70	69.83	21.64
Thailand	10.37	122.57	25.80	1.47
Timor-Leste	0.21	10.23	0.19	0.01
Turkey	22.10	83.91	35.30	8.54
United Arab Emirates	33.95	232.07	82.15	15.01
Viet Nam	34.85	100.56	27.25	3.01
Yemen [a]	5.09	16.29	1.78	0.00
Latin America and the Caribbean				
Antigua and Barbuda	42.64	154.02	74.20	17.01
Argentina	24.24	128.84	30.40	8.80
Aruba	35.95	120.16	22.53	20.65
Bahamas	37.74	105.00	33.88	9.24
Barbados [b]	53.03	131.73	56.07	22.40
Belize	10.16	52.74	11.73	2.61
Bolivia, Plurinational State of	8.21	72.48	11.18	2.86
Brazil	21.42	89.79	39.20	7.51
Cayman Islands	67.69	..	42.75	0.00
Chile	21.07	96.94	33.98	9.81
Colombia	16.43	92.33	45.53	4.64
Costa Rica	32.60	42.59	34.48	6.01
Cuba	10.42	3.95	14.33	0.02
Dominica	26.26	159.08	42.02	24.01
Dominican Republic	9.57	85.53	26.77	3.93
Ecuador	14.71	100.07	15.06	1.77
El Salvador	17.83	122.77	14.42	2.42
French Guiana	21.34	96.50	25.70	..
Grenada	27.52	61.58	24.05	13.47
Guatemala	10.08	123.39	16.25	0.78
Guyana [d]	17.05	36.84	28.85	0.26
Haiti [a]	1.08	36.36	9.97	0.00
Honduras [a]	11.12	103.32	9.80	0.00
Jamaica	11.12	109.29	58.16	4.13
Mexico	17.72	76.20	25.95	9.05
Netherlands Antilles	44.90	..	..	..
Nicaragua	4.44	55.80	3.48	0.82
Panama	15.55	164.37	27.79	5.82
Paraguay	6.10	88.50	15.75	2.22
Peru	10.17	84.69	27.72	2.79
Puerto Rico [a]	21.85	68.21	25.12	10.75
Saint Kitts and Nevis	39.64	160.50	32.87	25.14
Saint Lucia [a]	23.81	102.21	82.99	9.10
St. Vincent and the Grenadines	21.08	110.90	69.59	10.54
Suriname	16.11	146.98	31.36	1.65
Trinidad and Tobago	23.52	147.17	36.23	7.84
Uruguay [a]	28.37	113.13	55.19	7.30
Venezuela, Bolivarian Republic of	24.02	98.39	30.95	6.51
Virgin Islands (U.S.) [d]	68.49	73.19	27.40	8.22
Oceania				
American Samoa	15.44	..	..	..
Fiji	16.11	75.36	13.45	2.47
French Polynesia	20.19	77.41	44.60	11.16
Guam	36.86	..	50.64	1.69
Kiribati [b]	4.08	1.02	2.04	0.00
Marshall Islands [a]	7.09	1.61	3.55	0.00
Micronesia, Federated States of [a]	7.86	34.32	15.35	0.10
Nauru	18.61	..	..	..
New Caledonia	26.35	83.18	33.99	12.80
Northern Mariana Islands	28.89	..	..	0.00
Palau	34.51	64.31	..	0.81
Papua New Guinea [a]	0.89	13.37	1.86	0.00
Samoa	17.84	84.43	5.03	0.11

Region/Economy	Fixed telephone lines	Mobile cellular subscriptions	Internet users	Fixed broadband subscriptions
Solomon Islands	1.57	5.73	1.91	0.38
Tonga	29.82	50.98	8.08	0.96
Tuvalu [a]	17.12	20.14	43.31	4.55
Vanuatu	3.01	52.73	7.09	0.21
Transition economies				
Albania	11.50	131.89	41.20	2.85
Armenia	20.43	84.98	6.75	0.19
Azerbaijan	15.82	87.83	41.77	1.13
Belarus	41.20	100.55	46.06	11.34
Bosnia and Herzegovina	26.51	86.48	37.74	7.76
Croatia	42.10	136.66	50.58	15.51
Georgia	14.55	66.59	30.51	3.52
Kazakhstan	24.06	95.90	33.89	8.75
Kyrgyzstan	9.09	81.85	40.03	0.10
Moldova	31.60	77.28	35.94	5.19
Montenegro	58.73	120.47	44.86	14.10
Russian Federation	31.80	163.62	42.38	9.16
Serbia	31.53	100.63	41.70	6.00
The former Yugoslav Republic of Macedonia	21.65	95.14	51.77	10.59
Tajikistan [a]	4.17	70.48	10.07	0.05
Turkmenistan [a]	9.35	29.35	1.57	0.05
Ukraine	28.50	121.06	33.47	4.17
Uzbekistan	6.75	59.73	17.06	0.32

Source: ITU World Telecommunication/ICT Indicators 2010.

Notes:
a. Data for fixed broadband subscriptions refer to 2008.
b. Data for fixed broadband subscriptions refer to 2007.
c. Data for Internet users refer to year 2005.
d. Data for Mobile cellular subscriptions refer to 2005.
e. Data for Mobile cellular subscriptions refer to 2008.

Annex table II.2. Use of computers by enterprise size (%) [a]
Corresponds to the core indicator 'Proportion of businesses using computers' (B1)

Economy/Group	Reference year	0-9 persons employed	10-49 persons employed	50-249 persons employed	250+ persons employed	Total (10+ persons employed)	Total (all enterprises)
Developed economies							
Australia [h]	2006	87	97	100	100	..	89
Austria	2008	..	98	100	100	98	..
Belgium [j]	2008	..	98	100	100	98	..
Bermuda [d, g, l]	2006	82	82	82	..	82	82
Bulgaria	2008	..	89	98	98	91	..
Cyprus	2008	..	94	100	100	95	..
Czech Republic [u]	2008	..	96	100	100	97	..
Denmark [i]	2008	..	98	100	100	99	..
Estonia [u]	2008	..	97	99	99	97	..
Finland [j]	2008	..	99	100	100	99	..
France [j]	2008	..	97	100	100	98	..
Germany [u]	2008	..	97	100	100	97	..
Greece [j]	2008	..	91	99	100	92	..
Hungary [u]	2008	..	89	97	97	90	..
Iceland	2008	..	100	100	100	100	..
Ireland [u]	2008	..	98	99	100	98	..
Italy	2008	..	96	99	100	96	..
Latvia	2008	..	94	99	100	95	..
Lithuania [u]	2008	..	95	100	100	96	..
Luxembourg	2008	..	98	99	100	98	..
Malta	2008	..	93	98	98	94	..
Netherlands	2008	..	100	100	100	100	..
New Zealand [b]	2008	93	97	99	99	98	96
Norway	2008	..	97	99	98	97	..
Poland	2008	..	94	99	100	95	..
Portugal	2008	..	95	100	100	96	..
Romania	2008	..	78	93	98	80	..
Slovakia [u]	2008	..	98	99	99	98	..
Slovenia	2008	..	98	98	100	98	..
Spain [u]	2008	..	98	100	100	98	..
Sweden [u]	2008	..	96	99	100	97	..
Switzerland [e]	2005	95	99	99	100	99	99
United Kingdom [u]	2008	..	94	99	100	95	..
Developing economies							
Argentina [m]	2006	100	100	100	100	100	100
Brazil [b]	2008	..	92	100	100	93	..
Chile	2005	..	..	..	..	..	60
Colombia [l]	2006	69	87	97	98	92	89
Cuba	2007	86	93	93	96	95	94
Egypt [d, e, f]	2008	6	40	80	97	51	40
Hong Kong, China [d]	2008	58	92	99	100	93	63
India [m]	2005	28	56	74	92	63	55
Jordan	2008	14	79	97	100	86	18
Lesotho [b]	2008	19	72	89	96	76	34
Macao, China [d]	2007	39	74	97	100	80	44
Mauritius [f, v]	2008	83	96	99	100	97	97
Mexico	2003	10	70	83	85	73	14
Mongolia [d]	2006	..	..	..	..	..	37
Occupied Palestinian Territory [w]	2007	18	83	..	..	83	21
Oman [x]	2008	20	70	86	92	79	29
Panama [c]	2006	65	87	98	97	90	79
Qatar	2008	60	98	100	100	98	67
Republic of Korea [d]	2006	42	97	100	100	98	46
Singapore	2008	71	93	99	100	94	76
Thailand [d, n]	2007	20	84	98	100	89	22
Turkey	2004	..	86	96	100	88	..
United Arab Emirates	2008	..	92	100	100	97	..
Uruguay [b, o]	2005	48	79	82	96	79	68
Transition economies							
Azerbaijan [g]	2007	10	37	50	77	43	23
Belarus [p]	2005	..	..	..	..	84	..

Economy/Group	Reference year	0-9 persons employed	10-49 persons employed	50-249 persons employed	250+ persons employed	Total (10+ persons employed)	Total (all enterprises)
Croatia [j]	2008	..	99	99	99	99	..
Kazakhstan [f]	2008	..	74	98	100	76	..
Kyrgyzstan [g]	2007	49	93	95	98	94	80
Russian Federation [g, r]	2007	..	84	98	100	92	..
Serbia	2007	..	90	98	100	92	..
The former Yugoslav Republic of Macedonia [b, q]	2008	78	92	97	100	94	79

Sources: UNCTAD Information Economy Database and Eurostat.

Notes:

a. Data collected through national surveys and censuses conducted between 2004 and 2009. Due to differences in methodology and timeliness of underlying data, comparisons across countries and over time should be made with caution. Different countries report data for different economic activities. Unless otherwise specified, data refer to enterprises which cover ISIC Rev.3.1 activities specified in annex tables II.5 and II.6.
b. Estimates.
c. Provisional data.
d. Data refer to establishments.
e. Data refer to the sample and have not been extrapolated to the target population.
f. Due to changes in the sampling frame/methodology, the data for the reference year should not be compared with the data for previous years.
g. Data include ISIC Rev.3.1.Section L (public administration and defence; compulsory social security).
h. Data refer to the year ended 30 June.
i. Category "50-249" refers to enterprises with 50 or more employees .
j. Data cover NACE Rev.1 sections D, F, G, H, I, K, O and do not include NACE J65-66 (financial and insurance sectors).
k. Category "10-49" refer to enterprises with "9-49" employees.
l. Category "0-9" refers to establishments with "1-10" employees.
m. Data cover only ISIC Rev.3.1 section D (manufacturing).
n. Categories "0-9", "10-49", "50-249", "250+" refer to establishments with "1-15", "16-50", "50-200" and "200+" employees respectively.
o. Category "0-9" refers to enterprises with "5-9" employees. Data cover ISIC Rev. 3.1 sections D, E, G, H, I, K71-74, M, N.
p. Data cover ISIC Rev. 3.1 sections A-K, M-O, excluding «small business» enterprises.
q. Category "0-9" refers to enterprises with "5-9" employees. Data cover NACE Rev.1 sections D, F, G, I, K, groups 55.1, 55.2, 92.1 and 92.2 .
r. Small private enterprises not surveyed. Category "10-49" refers to enterprises with "1-50" employees.
s. Categories "50-249" and "250+" refer to enterprises with "50-299" and "300 or more" employees respectively.
t. Data refer to enterprises with 100 or more employees. Categories "50-249" and "250+" refer to enterprises with "100-299" and "300+" employees respectively.
u. Data do not cover NACE Rev.1. section E (electricity, gas and water supply).
v. Data cover certain agricultural and non-agricultural establishments employing at least 10 persons and selected agricultural establishments with less than 10 persons employed.
w. Categories "0-9" and "10-49" refer to enterprises with "0-29" and "30+".
x. Categories "50-249", "250+" refer to enterprises with "50-100" and "100+" persons employed respectively.

Annex table II.3. Use of Internet by enterprise size (%) [a]
Corresponds to the core indicator 'Proportion of businesses using the Internet' (B3)

Economy/Group	Reference year	0-9 persons employed	10-49 persons employed	50-249 persons employed	250+ persons employed	Total (10+ persons employed)	Total (all enterprises)
Developed economies							
Australia [h]	2007	84	96	99	99	96	87
Austria	2008	..	97	100	100	97	..
Belgium [j]	2008	..	96	99	100	97	..
Bermuda [d, g, i]	2006	71	71	71	..	71	71
Bulgaria	2008	..	81	95	98	84	..
Canada [s]	2007	..	94	99	100	95	..
Cyprus	2008	..	87	100	100	89	..
Czech Republic [u]	2008	..	94	98	100	95	..
Denmark [j]	2008	..	98	100	100	98	..
Estonia [u]	2008	..	96	99	99	96	..
Finland [j]	2008	..	99	100	100	99	..
France [j]	2008	..	94	99	100	95	..
Germany [u]	2008	..	94	99	99	95	..
Greece [j]	2008	..	87	98	100	89	..
Hungary [u]	2008	..	85	96	97	87	..
Iceland	2008	..	100	100	100	100	..
Ireland [u]	2008	..	95	99	100	96	..
Italy	2008	..	94	99	100	94	..
Japan [t]	2008	..	..	98	100	99	..
Latvia	2008	..	86	98	100	88	..
Lithuania	2008	..	93	99	100	94	..
Luxembourg	2008	..	95	99	100	96	..
Malta	2008	..	90	98	98	92	..
Netherlands	2008	..	99	99	100	99	..
New Zealand [b]	2008	90	95	98	99	95	93
Norway	2008	..	95	94	99	95	..
Poland	2008	..	91	99	100	93	..
Portugal	2008	..	91	99	100	92	..
Romania	2008	..	64	83	97	67	..
Slovakia	2008	..	96	99	99	97	..
Slovenia	2008	..	96	98	100	97	..
Spain	2008	..	94	99	100	95	..
Sweden	2008	..	95	99	99	96	..
Switzerland [e]	2005	93	97	99	100	98	98
United Kingdom	2008	..	92	99	100	94	..
Developing economies							
Argentina [m]	2006	67	90	98	100	96	95
Brazil [b]	2008	..	88	99	98	90	..
Chile	2005	..	..	..	..	..	49
China	2005	..	..	..	..	..	47
Colombia [l]	2006	58	83	96	97	89	86
Cuba	2007	86	80	65	71	70	70
Egypt [d, e, f]	2008	2	20	53	83	31	24
Hong Kong, China [d]	2008	54	85	95	100	87	59
Jordan	2008	6	68	90	98	76	10
Lesotho [b]	2008	7	37	89	72	46	17
Macao, China [d]	2007	31	60	88	96	66	36
Mauritius [f, v]	2008	50	87	96	97	91	89
Mexico	2003	5	50	73	85	55	8
Occupied Palestinian Territory [w]	2007	12	68	..	..	68	14
Oman [x]	2008	10	37	78	89	59	17
Panama [c]	2006	52	75	95	97	80	68
Qatar	2008	40	93	100	99	95	50
Republic of Korea [d]	2006	40	96	100	100	97	44
Singapore	2008	67	89	99	100	92	72
Suriname	2006	12	55	77	74	59	16
Thailand [d, n]	2007	11	64	87	95	73	13
Turkey	2004	..	78	92	99	80	..
United Arab Emirates	2008	..	..	..	..	92	..
Uruguay [b, o]	2005	31	66	79	94	68	54
Transition economies							
Azerbaijan [g]	2007	4	17	25	58	22	11

Economy/Group	Reference year	0-9 persons employed	10-49 persons employed	50-249 persons employed	250+ persons employed	Total (10+ persons employed)	Total (all enterprises)
Belarus [p]	2005	..	..	..	..	38	..
Croatia [j]	2008	..	97	99	98	97	..
Kazakhstan [f]	2008	..	53	94	95	56	..
Kyrgyzstan [g]	2007	27	27	34	50	31	30
Russian Federation [g, r]	2007	..	54	82	95	71	..
Serbia	2007	..	86	86	94	87	..
The former Yugoslav Republic of Macedonia [b, q]	2008	59	81	90	98	83	61

Sources: UNCTAD Information Economy Database and Eurostat.

Notes: see notes for annex table II.2.

Annex table II.4. Use of websites by enterprise size (%) [a]
Corresponds to the core indicator 'Proportion of businesses with a website' (B5)

Economy/Group	Reference year	0-9 persons employed	10-49 persons employed	50-249 persons employed	250+ persons employed	Total (10+ persons employed)	Total (all enterprises)
Developed economies							
Australia [h]	2007	30	59	76	96	61	36
Austria	2008	..	77	92	97	80	..
Belgium [j]	2008	..	73	89	95	76	..
Bermuda [d, g, l]	2006	43	43	43	..	43	43
Bulgaria	2008	..	28	48	70	33	..
Canada [s]	2007	..	66	82	92	70	..
Cyprus	2008	..	43	78	96	49	..
Czech Republic [u]	2008	..	70	86	93	74	..
Denmark [j]	2008	..	85	94	96	87	..
Estonia [u]	2008	..	62	83	93	66	..
Finland [j]	2008	..	79	94	94	82	..
France [j]	2008	..	50	71	86	54	..
Germany [u]	2008	..	73	89	95	77	..
Greece [j]	2008	..	53	76	89	57	..
Hungary [u]	2008	..	44	66	77	48	..
Iceland	2008	..	74	..	100	64	..
Ireland [u]	2008	..	60	83	95	65	..
Italy	2008	..	55	81	91	58	..
Japan [t]	2008	..		81	96	89	..
Latvia	2008	..	37	61	87	42	..
Lithuania [u]	2008	..	50	73	91	55	..
Luxembourg	2008	..	61	78	95	65	..
Malta	2008	..	53	73	88	58	..
Netherlands	2008	..	83	94	96	85	..
New Zealand [b]	2008	47	61	81	93	64	57
Norway	2008	..	71	88	90	73	..
Poland	2008	..	50	77	88	57	..
Portugal	2008	..	42	69	92	47	..
Romania	2008	..	25	37	62	27	..
Slovakia [u]	2008	..	72	78	85	73	..
Slovenia	2008	..	67	84	97	71	..
Spain [u]	2008	..	51	72	89	55	..
Sweden [u]	2008	..	84	96	97	86	..
Switzerland [e]	2005	60	83	93	99	90	87
United Kingdom [u]	2008	..	72	92	98	76	..
Developing economies							
Argentina [m]	2006	27	54	76	87	72	71
Brazil [b]	2008	..	51	79	92	56	..
Chile	2005	..	..	..	..	..	19
China	2005	..	..	..	..	..	11
Colombia [l]	2006	12	29	58	78	44	41
Cuba	2007	47	41	26	25	26	27
Egypt [d, e, f]	2008	1	10	33	65	18	14
Hong Kong, China [d]	2008	15	45	72	87	50	19
Jordan	2008	1	38	70	83	50	4
Lesotho [b]	2008	3	17	44	39	22	8
Macao, China [d]	2007	1	10	22	54	14	3
Mauritius [f, v]	2008	17	38	52	66	44	43
Mexico	2003	1	7	9	12	7	1
Occupied Palestinian Territory [w]	2007	2	34	..	..	34	3
Oman [x]	2008	1	7	47	67	30	5
Qatar	2008	18	62	71	88	64	26
Republic of Korea [d]	2006	10	55	77	92	58	14
Singapore	2008	29	58	77	93	63	36
Suriname	2006	2	19	5	47	17	4
Thailand [d, n]	2007	3	27	48	70	36	4
Turkey	2004	..	43	71	91	48	..
United Arab Emirates	2008	..	..	..	..	85	..
Uruguay [b, o]	2005	6	24	46	72	27	19
Transition economies							
Azerbaijan [g]	2007	1	2	6	17	4	2
Belarus [p]	2005	..	..	..	..	10	..
Croatia [j]	2008	..	61	76	85	64	..

Economy/Group	Reference year	0-9 persons employed	10-49 persons employed	50-249 persons employed	250+ persons employed	Total (10+ persons employed)	Total (all enterprises)
Kazakhstan [f]	2008	..	5	35	41	7	..
Kyrgyzstan [g]	2007	7	6	11	22	9	9
Russian Federation [g, r]	2007	..	10	26	46	22	..
Serbia	2007	..	51	54	77	53	..
The former Yugoslav Republic of Macedonia [b, q]	2008	27	42	56	78	46	29

Sources: UNCTAD Information Economy Database and Eurostat.

Notes: see notes for annex table II.2.

Annex table II.5. Use of computers by economic activity (%) [a]
Corresponds to the core indicator 'Proportion of businesses using computers' (B1)

Economy/Group	Reference Year	Agriculture, hunting and forestry	Fishing	Mining and quarrying	Manufacturing	Electricity, gas and water supply	Construction	Wholesale and retail trade; repair of motor vehicles, motorcycles, etc.	Sale, maintenance and repair of motor vehicles and motorcycles, etc.	Wholesale trade and commission trade, except of motor vehicles and motorcycles	Retail trade, except of motor vehicles and motorcycles, etc.	Hotels and restaurants	Transport, storage and communications	Land transport, transport via pipelines	Water transport	Air transport	Supporting and auxiliary transport activities, activities of travel agencies	Post and telecommunications	Financial intermediation	Real estate, renting and business activities	Real estate activitiesa	Renting of machinery and equipment	Computer and related activities	Research and development	Other business activities	Education	Health and social work	Other community, social and personal service activities
		A	B	C	D	E	F	G	G50	G51	G52	H	I	I60	I61	I62	I63	I64	J	K	K70	K71	K72	K73	K74	M	N	O
Developed economies																												
Australia [f]	2006	..	..	89	89	96	88	..	..	97	83	76	..	79	..	..	..	83	94	94	..	..	..	..	..	..	97	..
Austria* [n]	2008	..	..	..	97	..	99	99	100	100	98	98	97	..	..	..	..	..	100	..	99	..	100	..	..	..	..	100
Belgium* [n]	2008	..	..	..	99	..	97	98	96	99	97	100	96	96	..	..	..	100	..	98	98	..	98	..	..	..	..	97
Bermuda [d, g]	2006	82	..	..	82	83	82	82	..	..	..	82	82	..	..	..	..	..	83	82	..	..	..	..	..	83	82	82
Bulgaria* [n]	2008	..	..	..	88	..	93	93	95	96	89	90	90	88	..	..	..	100	100	94	93	..	100	..	..	..	..	97
Cyprus* n	2008	..	..	..	94	..	88	97	94	99	96	96	88	86	..	..	..	100	100	100	100	..	100	..	..	..	..	100
Czech Republic* [n]	2008	..	..	..	98	..	97	96	97	97	95	98	96	96	..	..	..	99	99	96	95	..	100	..	..	..	..	98
Denmark* [n]	2008	..	..	..	..	..	98	99	99	99	98	..	..	93	..	..	..	..	..	100	99	..	100	..	..	..	..	..
Estonia* [n]	2008	..	..	..	97	..	96	99	100	100	98	100	98	98	..	..	..	100	100	96	96	..	100	..	..	..	..	97
Finland* [n]	2008	..	..	..	100	..	97	100	100	100	100	100	98	98	..	..	..	100	..	99	99	..	100	..	..	..	..	97
France* [n]	2008	..	..	..	97	..	99	98	100	99	95	99	97	97	..	..	..	95	100	99	98	..	100	..	..	..	..	99
Germany* [n]	2008	..	..	..	98	..	100	96	99	98	93	97	94	95	..	..	..	87	100	98	98	..	100	..	..	..	..	98
Greece* [n]	2008	..	..	..	97	..	95	95	98	98	88	74	95	94	..	..	..	100	100	91	90	..	100	..	..	..	..	100
Hungary* [n]	2008	..	..	..	90	..	88	92	95	95	87	77	89	90	..	..	..	88	99	90	89	..	98	..	..	..	..	98
Iceland* [n]	2008	..	..	..	100	..	100	100	100	100	100	100	100	100	..	..	..	100	100	100	100	..	100	..	..	..	..	100
Ireland* [n]	2008	..	..	..	98	..	99	98	99	100	97	96	98	98	..	..	..	100	100	98	98	..	100	..	..	..	..	100
Italy* [n]	2008	..	..	..	97	..	95	97	99	100	92	98	95	..	..	..	..	95	100	96	95	..	100	..	..	..	..	100
Latvia* [n]	2008	..	..	..	94	..	96	95	97	99	90	100	96	96	..	..	..	100	100	97	96	..	100	..	..	..	..	100
Lithuania* [n]	2008	..	..	..	96	..	98	96	94	98	95	100	92	92	..	..	..	100	100	98	98	..	100	..	..	..	..	100
Luxembourg* [n]	2008	..	..	..	98	..	99	97	100	98	95	97	95	95	..	..	..	97	100	99	99	..	100	..	..	..	..	100
Malta* [n]	2008	..	..	..	96	..	91	88	88	91	82	98	98	98	..	..	..	100	91	99	99	..	100	..	..	..	..	100
Netherlands* [n]	2008	..	..	..	100	..	100	100	100	100	100	100	100	100	..	..	..	100	100	100	100	..	100	..	..	..	..	100
New Zealand [b]	2008	84	92	94	98	100	98	97	99	99	94	91	99	98	100	100	100	98	99	96	77	99	99	95	98	100	100	96
Norway* [n]	2008	..	..	..	99	..	98	96	97	100	93	92	96	96	..	..	..	100	100	99	98	..	100	..	..	..	..	100
Poland* [n]	2008	..	..	..	94	..	95	95	96	98	91	97	96	95	..	..	..	98	100	97	97	..	98	..	..	..	..	100
Portugal* [n]	2008	..	..	..	98	..	88	98	95	98	100	100	100	100	..	..	..	96	100	99	99	..	98	..	..	..	..	100
Romania* [n]	2008	..	..	..	77	..	76	82	87	82	82	82	83	80	..	..	..	100	99	86	84	..	100	..	..	..	..	99
Slovakia* [n]	2008	..	..	..	98	..	97	98	100	99	97	96	99	99	..	..	..	100	100	99	99	..	100	..	..	..	..	100
Slovenia* [n]	2008	..	..	..	99	..	91	99	100	100	98	100	100	100	..	..	..	100	100	99	99	..	100	..	..	..	..	100
Spain* [n]	2008	..	..	..	98	..	96	99	100	100	97	100	97	97	..	..	..	100	100	99	99	..	100	..	..	..	..	100

Economy/Group	Reference Year	Agriculture, hunting and forestry	Fishing	Mining and quarrying	Manufacturing	Electricity, gas and water supply	Construction	Wholesale and retail trade; repair of motor vehicles, motorcycles, etc.	Sale, maintenance and repair of motor vehicles and motorcycles, etc.	Wholesale trade and commission trade, except of motor vehicles and motorcycles	Retail trade, except of motor vehicles and motorcycles, etc.	Hotels and restaurants	Transport, storage and communications	Land transport, transport via pipelines	Water transport	Air transport	Supporting and auxiliary transport activities, activities of travel agencies	Post and telecommunications	Financial intermediation	Real estate, renting and business activities	Real estate activitiesa	Renting of machinery and equipment	Computer and related activities	Research and development	Other business activities	Education	Health and social work	Other community, social and personal service activities
		A	B	C	D	E	F	G	G50	G51	G52	H	I	I60	I61	I62	I63	I64	J	K	K70	K71	K72	K73	K74	M	N	O
Sweden* [n]	2008	..	..	..	98	..	94	98	99	99	96	99	90	90	..	..	..	95	99	99	99	..	99	..	..	..	..	94
Switzerland [e]	2005	..	..	..	99	100	99	98	..	97	99	96	99	..	..	..	..	..	100	99	..	..	..	..	..	..	..	..
United Kingdom* [n]	2008	..	..	..	96	..	96	93	95	97	86	92	95	95	..	..	..	95	99	96	96	..	100	..	..	..	..	78
Developing economies																												
Argentina	2006	..	..	..	100	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Brazil* [b]	2008	..	..	..	94	..	99	95	..	..	..	72	98	..	..	..	..	..	..	95	..	..	..	..	..	..	..	90
Chile	2005	..	..	..	..	..	..	..	80	92	47	62									73	85	98	..	93	..	..	76
Colombia [i]	2006	..	..	..	83	..	..	97	96	98	95	..	..	..	..	..	..	..	..	98	..	..	..	..	..	..	..	..
Cuba	2007	89	96	100	98	100	99	100	96	99	81	94	90	96	100	100	100	100	100	99	100	100	100	100	99	99	98	65
Egypt [d,e,o]	2008	60	..	50	33	0	86	..	67	56	27	45	..	50	97	100	35	60	96	..	67	..	100	..	..	..	..	18
Hong Kong, China [d, j]	2008	..	..	..	53	..	56	..	66	..	..	..	..	33	..	..	..	..	84	..	..	..	..	..	..	62	..	..
India	2005	18	..	39	55	76	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Jordan	2008	..	..	55	12	100	47	12	5	29	12	14	72	16	100	100	83	100	99	67	47	16	99	100	71	..	40	12
Lesotho [b]	2008	..	..	..	69	..	..	25	..	..	..	56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Macao, China [d]	2007	..	..	..	63	..	64	36	32	46	27	27	70	42	69	100	76	73	..	75	73	..	..	..	81	..	..	100
Mauritius [k, o]	2008	91	..	60	97	100	98	97	100	98	95	97	98	92	100	100	100	100	100	99	100	100	100	100	99	99	100	100
Mexico	2003	4	..	24	13	37	79	10	..	43	8	5	22	22	..	..	..	..	61	100	26	..	71	69	65	56	32	7
Mongolia [d]	2006	14	0	50	39	53	53	23	27	26	18	34	51	42	50	91	51	64	32	50	31	32	71	75	54	74	42	43
Occupied Palestinian Territory	2007	..	..	..	20	..	59	15	..	..	..	86	31	..	..	..	..	..	59	..	..	..	..	..	..	..	..	..
Oman	2008	..	..	..	16	..	46	21	..	..	..	8	83	..	..	..	92	..	100	77	..	..	..	..	..	..	..	..
Panama [c]	2006	78	..	100	74	92	92	81	89	77	87	55	85	65	90	96	93	97	100	87	67	91	100	100	94	88	90	87
Qatar	2005	..	..	98	42	100	93	..	51	87	59	42		79	100	100	94	100	100		94	67	100	..	92	92	95	28
Republic of Korea [d, l]	2006	58	..	..	59	..	72	..	..	68	39	17	18	..	..	..	..	..	96	90	..	..	..	..	..	59	..	..
Singapore	2008	50	..	..	72	..	72	75	..	..	..	59	69	..	..	..	..	..	94	..	76	..	97	..	91	87	82	..
Thailand [d]	2007	..	..	..	20	..	57	..	23	47	19	12	..	19	..	..	75	..	..	..	35	41	91	86	75	..	..	..
Turkey* [n]	2004	..	..	..	85	..	80	91	..	..	..	98	93	..	..	..	..	..	..	95	..	..	..	..	..	..	..	96
Transition economies																												
Azerbaijan	2007	..	..	24	33	62	31	21	15	28	15	15	41	22	78	70	38	82	69	23	4	..	25	37	25	59	24	8
Croatia* [n]	2008	..	..	..	98	..	98	99	100	99	98	100	100	100	..	..	..	..	100	100	100	..	100	..	..	..	..	..
Kazakhstan*	2008	..	..	..	77	..	75	76	..	..	..	82	82	..	..	..	..	..	87	72	..	..	..	..	..	..	..	95
Kyrgyzstan	2007	76	0	60	70	88	64	56	72	52	63	89	73	76	100	56	56	83	92	65	52	75	69	94	65	93	95	78
Russian Federation* [m]	2007	96	86	96	95	89	96	91	95	94	89	89	95	93	96	99	94	99	95	89	83	76	99	98	91	99	98	80

Economy/Group	Reference Year	Agriculture, hunting and forestry A	Fishing B	Mining and quarrying C	Manufacturing D	Electricity, gas and water supply E	Construction F	Wholesale and retail trade; repair of motor vehicles, motorcycles, etc. G	Sale, maintenance and repair of motor vehicles and motorcycles, etc. G50	Wholesale trade and commission trade, except of motor vehicles and motorcycles G51	Retail trade, except of motor vehicles and motorcycles, etc. G52	Hotels and restaurants H	Transport, storage and communications I	Land transport, transport via pipelines I60	Water transport I61	Air transport I62	Supporting and auxiliary transport activities, activities of travel agencies I63	Post and telecommunications I64	Financial intermediation J	Real estate, renting and business activities K	Real estate activitiesa K70	Renting of machinery and equipment K71	Computer and related activities K72	Research and development K73	Other business activities K74	Education M	Health and social work N	Other community, social and personal service activities O
Serbia* [n]	2007	..	..	..	94	..	90	85	94	82	90	96	100	100	..	..	..	100	..	100	100	..	100	..	..	..	..	100
The former Yugoslav Republic of Macedonia [b, h]	2008	..	..	..	85	..	75	79	..	..	..	45	67	..	..	..	..	..	100	92	..	..	..	..	..	..	..	100

Sources: UNCTAD Information Economy Database and Eurostat.

Notes:

a. Data collected through national surveys and censuses conducted between 2004 and 2009. Due to differences in methodology and timeliness of underlying data, comparisons across countries and over time should be made with caution.
b. Estimates.
c. Provisional data.
d. Data refer to establishments.
e. Data refer to the sample and have not been extrapolated to the target population.
f. Data refer to the year ended 30 June. Data under I60 represent the overall proportion for divisions 60-63, K70 includes K71 and J includes K72.
g. Section A represents the overall proportion for sections A and B. Section K refers to divisions 70, 71, 74 and international businesses.
h. The survey covered enterprises with 5 or more persons employed. The sectors covered are NACE Rev.1 sections D, F, G, I, K, groups 55.1, 55.2, 92.1 and 92.2.
i. Section K represents the overall proportion for sections H, K, division 63, division 93 ('other service activities'), group 851 ('human health activities'), group 921 ('cinema, radio, television and other entertainment activities') and group 803 ('higher education services').
j. Industry breakdown is given according to the national classification HKSIC: section D includes manufacturing, electricity and gas; section G includes wholesale, retail, import/export trade, restaurants and hotels; section I includes transport, storage and communications; section J includes financing, insurance, real estate and business services; section O includes community, social and personal services.
k. Data cover certain agricultural and non-agricultural establishments employing at least 10 persons during the reference period.
l. Section A represents the overall proportion for sections A, B and C. Section M represents the overall proportion for sections E, L ('public administration and defence, compulsory social security'), M, N,
divisions 92 ('recreational, cultural and sporting activities') and 93 ('other service activities').
m. Section A refers to division 02 ('forestry, logging and related service activities'); section M refers to group 803 ('higher education'); section O refers to division 92 ('recreational, cultural and sporting activities').
n. Breakdown is given according to NACE Rev.1. Section H refers to groups 55.1 and 55.2 - 'hotels' and 'camping sites and other provision of short stay accommodation'; section O refers to groups 92.1 and 92.2 - 'motion picture and video activities' and 'radio and television activities'.
o. Due to changes in the sampling frame/methodology, the data for the reference year should not be compared with the data for previous years.
p. Data refer to enterprises with 100 or more persons employed. Categories A,B,C,L and P were not surveyed. Category K includes Category E, H, M, N, O, "maintenance and repair of motor vehicles and motorcycles" in G50, and "communications" in I. Internet access refers to CATV, FTTH, FWA and DSL.
** Data cover enterprises with 10 or more persons employed.*

Annex table II.6. Use of Internet by economic activity (%) [a]

Corresponds to the core indicator 'Proportion of businesses using the Internet' (B3)

Economy/Group	Reference Year	Agriculture, hunting and forestry	Fishing	Mining and quarrying	Manufacturing	Electricity, gas and water supply	Construction	Wholesale and retail trade; repair of motor vehicles, motorcycles, etc.	Sale, maintenance and repair of motor vehicles and motorcycles, etc.	Wholesale trade and commission trade, except of motor vehicles and motorcycles	Retail trade, except of motor vehicles and motorcycles, etc.	Hotels and restaurants	Transport, storage and communications	Land transport, transport via pipelines	Water transport	Air transport	Supporting and auxiliary transport activities, activities of travel agencies	Post and telecommunications	Financial intermediation	Real estate, renting and business activities	Real estate activitiesa	Renting of machinery and equipment	Computer and related activities	Research and development	Other business activities	Education	Health and social work	Other community, social and personal service activities
		A	B	C	D	E	F	G	G50	G51	G52	H	I	I60	I61	I62	I63	I64	J	K	K70	K71	K72	K73	K74	M	N	O
Developed economies																												
Australia [f]	2007	..	..	93	89	87	84	..	..	94	82	71	..	76	..	..	..	98	98	..	85	..	..	98	92	..	89	..
Austria* [n]	2008	..	..	..	96	..	97	98	100	99	95	98	95	..	..	..	..	..	100	..	98.5	..	100	..	..	..	..	100
Belgium* [n]	2008	..	..	..	97	..	96	97	96	99	94	95	96	95	..	..	..	100	..	98	98	..	98	..	..	..	..	97
Bermuda [d, g]	2006	71	..	..	71	72	71	71	..	..	..	71	71	..	..	..	..	..	71	71	..	..	..	..	..	71	71	71
Bulgaria* [n]	2008	..	..	..	81	..	88	82	88	88	73	87	84	81	..	..	..	100	100	91	89	..	100	..	..	..	..	97
Canada*	2007	..	..	..	99	..	95	..	..	99	94	82	92	..	..	..	..	..	100	93	..	..	..	..	..	..	..	..
Cyprus* [n]	2008	..	..	..	85	..	82	92	84	96	89	96	86	84	..	..	..	100	100	99	99	..	100	..	..	..	..	100
Czech Republic* [n]	2008	..	..	..	96	..	96	94	94	95	92	97	95	94	..	..	..	99	99	94	93	..	100	..	..	..	..	98
Denmark* [n]	2008	..	..	..	..	..	98	98	99	99	96	..	..	92	..	..	..	..	..	100	99	..	100	..	..	..	..	..
Estonia* [n]	2008	..	..	..	96	..	95	98	100	99	96	100	96	96	..	..	..	100	100	95	94	..	100	..	..	..	..	97
Finland* [n]	2008	..	..	..	100	..	97	100	100	100	100	100	98	98	..	..	..	100	..	99	99	..	100	..	..	..	..	97
France* [n]	2008	..	..	..	95	..	95	94	99	98	88	98	94	95	..	..	..	91	100	97	97	..	99	..	..	..	..	98
Germany* [n]	2008	..	..	..	95	..	96	92	98	97	87	97	92	93	..	..	..	82	99	97	97	..	100	..	..	..	..	97
Greece* [n]	2008	..	..	..	93	..	92	93	96	96	82	69	95	93	..	..	..	100	100	91	90	..	100	..	..	..	..	97
Hungary* [n]	2008	..	..	..	85	..	86	88	94	94	80	77	87	87	..	..	..	88	99	87	86	..	97	..	..	..	..	98
Iceland* [n]	2008	..	..	..	100	..	100	100	100	100	100	100	100	100	..	..	..	100	100	100	100	..	100	..	..	..	..	100
Ireland* [n]	2008	..	..	..	98	..	99	93	99	98	88	96	98	98	..	..	..	100	100	98	98	..	100	..	..	..	..	100
Italy* [n]	2008	..	..	..	95	..	93	95	98	99	88	97	90	90	..	..	..	91	100	94	93	..	99	..	..	..	..	99
Japan* [p]	2008	..	..	..	100	..	99	100	..	..	..	..	98	..	..	..	..	..	100	98	..	..	..	..	..	..	..	..
Latvia* [n]	2008	..	..	..	86	..	90	87	88	95	81	94	90	89	..	..	..	100	88	89	87	..	100	..	..	..	..	100
Lithuania* [n]	2008	..	..	..	93	..	94	94	92	97	91	100	91	90	..	..	..	100	100	98	98	..	100	..	..	..	..	100
Luxembourg* [n]	2008	..	..	..	95	..	96	93	97	97	87	95	94	94	..	..	..	97	100	99	99	..	100	..	..	..	..	100
Malta* [n]	2008	..	..	..	94	..	84	86	82	90	81	97	98	98	..	..	..	100	91	98	98	..	100	..	..	..	..	100
Netherlands* [n]	2008	..	..	..	99	..	99	99	100	99	97	98	99	99	..	..	..	100	99	99	99	..	99	..	..	..	..	100
New Zealand [b]	2008	83	92	89	96	100	97	95	98	97	91	86	96	92	100	100	100	98	98	95	74	92	100	100	98	98	100	90
Norway* [n]	2008	..	..	..	98	..	97	91	93	100	84	92	96	95	..	..	..	100	100	99	98	..	100	..	..	..	..	100
Poland* [n]	2008	..	..	..	91	..	93	92	93	96	86	97	94	93	..	..	..	98	100	97	97	..	98	..	..	..	..	100
Portugal* [n]	2008	..	..	..	93	..	83	93	94	93	94	98	93	93	..	..	..	96	100	98	98	..	98	..	..	..	..	100
Romania* [n]	2008	..	..	..	65	..	67	63	79	72	56	55	79	75	..	..	..	100	97	81	80	..	88	..	..	..	..	99
Slovakia* [n]	2008	..	..	..	96	..	97	96	100	98	94	96	97	97	..	..	..	96	99	98	98	..	100	..	..	..	..	100

Economy/Group	Reference Year	Agriculture, hunting and forestry	Fishing	Mining and quarrying	Manufacturing	Electricity, gas and water supply	Construction	Wholesale and retail trade; repair of motor vehicles, motorcycles, etc.	Sale, maintenance and repair of motor vehicles and motorcycles, etc.	Wholesale trade and commission trade, except of motor vehicles and motorcycles	Retail trade, except of motor vehicles and motorcycles, etc.	Hotels and restaurants	Transport, storage and communications	Land transport, transport via pipelines	Water transport	Air transport	Supporting and auxiliary transport activities, activities of travel agencies	Post and telecommunications	Financial intermediation	Real estate, renting and business activities	Real estate activitiesa	Renting of machinery and equipment	Computer and related activities	Research and development	Other business activities	Education	Health and social work	Other community, social and personal service activities
		A	B	C	D	E	F	G	G50	G51	G52	H	I	I60	I61	I62	I63	I64	J	K	K70	K71	K72	K73	K74	M	N	O
Slovenia* [n]	2008	..	..	..	99	..	88	99	100	100	96	100	97	96	..	..	..	100	100	99	99	..	100	..	..	..	..	100
Spain* [n]	2008	..	..	..	95	..	92	97	100	99	91	99	95	94	..	..	..	100	100	98	98	..	100	..	..	..	..	100
Sweden* [n]	2008	..	..	..	97	..	91	96	99	98	94	98	90	90	..	..	..	93	99	98	97	..	99	..	..	..	..	94
Switzerland [e]	2005	..	..	..	98	100	98	97	..	97	97	90	96	..	..	..	..	..	100	98	..	..	..	..	..	..	..	
United Kingdom* [n]	2008	..	..	..	95	..	94	91	94	95	83	90	92	92	..	..	..	95	99	96	95	..	100	..	..	..	..	78
Developing economies																												
Argentina	2006	..	..	..	95	..	..	..	..								..	..	..	..	..	..	..	..	..	..	..	..
Brazil* [b]	2008	..	..	..	91	..	99	91	..	..	..	64	96	..	..	..	..	..	..	93	..	..	..	..	..	..	..	87
Chile	2005	..	..	..	..	..	..	..	70	84	34	47	..	..	..	..	..	..	..	70	70	97	..	88	..	..	..	63
China	2005	..	..	13	43	32	66	54	..	..	..	35	40	..	..	..	..	..	54	67	..	..	..	..	..	..	..	..
Colombia [i]	2006	..	..	..	78	..	..	93	92	96	89	..	..	..	..	..	..	..	..	97	..	..	..	..	..	..	..	..
Cuba	2007	45	82	86	80	97	80	90	76	81	21	38	68	56	100	100	88	100	96	92	88	100	100	100	93	62	83	29
Egypt [d,e,o]	2008	20		50	17	0	67	..	67	34	12	25	..	28	97	100	18	16	74	..	67	..	83	..	..	..	..	12
Hong Kong, China [d,j]	2008	..	..	..	52	..	47	..	62	..	..	..	..	32	..	..	..	..	80	..	..	..	..	..	..	52	..	..
Jordan	2008	..	..	45	9	100	41	5	5	22	3	12	66	11	100	100	76	96	83	39	37	9	89	100	35	..	17	7
Lesotho	2008	..	..	..	45	..	..	9	..	..	..	41	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Macao, China	2007	..	..	..	56	..	56	29	29	37	21	16	63	28	56	100	71	64	..	55	47	..	..	..	76	..	..	90
Mauritius [k,o]	2008	81	0	60	88	100	89	92	90	95	89	87	94	79	100	100	97	100	96	97	100	100	97	100	97	87	84	91
Mexico	2003	2	..	18	9	15	60	6	..	32	4	3	21	21	..	..	..	..	41	100	15	..	61	42	44	24	11	3
Occupied Palestinian Territory	2007	..	..	..	14	..	40	10	..	..	..	72	21	..	..	..	..	..	49	..	..	..	..	..	..	..	..	..
Oman	2008	..	..	..	13	..	14	9	..	..	..	6	52	..	..	..	92	..	100	68	..	..	..	..	..	..	..	..
Panama [c]	2006	56	..	87	62	92	76	71	83	62	85	39	78	52	75	92	90	94	..	81	53	91	100	100	91	72	67	76
Qatar	2005		..	97	31	100	65	..	41	71	47	34	..	40	100	100	87	100	87		41	51	100	..	70	65	59	16
Republic of Korea [d,l]	2006	56	..	..	57	..	72	..	..	66	37	15	18	..	..	..	..	..	95	87	..	..	..	..	..	57	..	..
Singapore	2008	50	..	..	65	..	67	71	..	..	..	51	65	..	..	..	..	..	89	..	72	..	97	..	87	84	78	49
Suriname	2006	20	47	4	12	25	31	12	15	57	9	5	23	..	..	..	..	..	52	58	..	..	..	..	68	36	34	21
Thailand [d]	2007	..	..	..	13	..	44	..	14	33	11	5		14			72	..	..	..	12	17	78	86	42	..	..	..
Turkey*	2004	..	..	..	78	..	70	83	..	..	..	84	87	..	..	..	..	..	..	91	..	..	..	..	..	..	..	96
Transition economies																												
Azerbaijan	2007	..	..	15	18	25	8	13	8	19	8	10	25	7	67	57	30	53	47	16	2	..	18	24	17	22	8	4
Croatia*	2008	..	..	..	97	..	96	97	100	98	95	100	97	97	..	..	..	..	100	100	100	..	100	..	..	..	..	..
Kazakhstan*	2008	..	..	..	64		54	53	..	..	..	60	64	..	..	..	..	..	69	52	..	..	..	..	..	..	..	78

Economy/Group	Reference Year	Agriculture, hunting and forestry	Fishing	Mining and quarrying	Manufacturing	Electricity, gas and water supply	Construction	Wholesale and retail trade; repair of motor vehicles, motorcycles, etc.	Sale, maintenance and repair of motor vehicles and motorcycles, etc.	Wholesale trade and commission trade, except of motor vehicles and motorcycles	Retail trade, except of motor vehicles and motorcycles, etc.	Hotels and restaurants	Transport, storage and communications	Land transport, transport via pipelines	Water transport	Air transport	Supporting and auxiliary transport activities, activities of travel agencies	Post and telecommunications	Financial intermediation	Real estate, renting and business activities	Real estate activitiesa	Renting of machinery and equipment	Computer and related activities	Research and development	Other business activities	Education	Health and social work	Other community, social and personal service activities
		A	B	C	D	E	F	G	G50	G51	G52	H	I	I60	I61	I62	I63	I64	J	K	K70	K71	K72	K73	K74	M	N	O
Kyrgyzstan	2007	5	0	33	41	40	23	47	63	47	45	39	46	19	50	50	43	60	50	36	20	25	67	44	36	25	16	33
Russian Federation* [m]	2007	76	59	87	83	63	80	71	83	82	63	56	73	60	86	96	75	95	87	67	52	48	90	91	72	94	76	45
Serbia*	2007	..	..	..	89	..	79	82	87	81	83	80	93	92	..	..	..	100	..	94	93	..	100	..	..	..	..	100
The former Yugoslav Republic of Macedonia [b, h]	2008	..	..	..	70	..	68	56	..	..	..	39	57	..	..	..	..	..	100	84	..	..	..	..	..	..	..	99

Sources: UNCTAD Information Economy Database and Eurostat.

Notes: see notes for annex table II.5.

Annex table II.7. Internet applications by enterprises (%). Enterprises with 10 or more persons employed. [a] Corresponds to the core indicators B5, B7, B8, B12

Economy/Group	Reference year	Proportion of enterprises			Proportion of enterprises using the Internet for							
		With a website	Receiving orders over the Internet	Placing orders over the Internet	Sending and receiving e-mail	Getting information about goods or services	Getting information from public authorities	Information searches or research	Internet banking or financial services	Interacting with general government organizations	Providing customer services	Delivering products online
		B5	B7	B8	B12.a	B12.b.i	B12.b.ii	B12.b.iii	B12.c	B12.d	B12.e	B12.f
Developed economies												
Australia [h]	2007	61	31	56	..	..	..	..	..	81	..	..
Austria [j, z]	2008	80	14	34	..	..	71	..	..	81	5	..
Belgium [j, z]	2008	76	16	7	..	..	..	..	..	..	3	..
Bermuda [d, g]	2006	43	6	24	..	..	..	..	..	..	..	..
Bulgaria [j, z]	2008	33	2	4	..	..	53	..	..	58	6	..
Canada	2007	70	13	65	..	..	..	..	..	..	..	..
Cyprus [j, z]	2008	49	7	14	..	..	63	..	..	66	2	..
Czech Republic [j, z]	2008	74	15	27	..	..	70	..	..	73	6	..
Denmark [j, z]	2008	87	20	38	..	..	86	..	..	90	8	..
Estonia [j, z]	2008	66	12	18	..	..	75	..	..	77	5	..
Finland [j, z]	2008	82	..	25	..	..	90	..	..	95	7	..
France [j, z]	2008	54	13	18	..	..	67	..	..	74	3	..
Germany [j, z]	2008	77	..	..	..	..	47	..	..	56	5	..
Greece [j, z]	2008	57	6	10	..	..	64	..	..	78	7	..
Hungary [j, z]	2008	48	4	7	..	..	56	..	..	61	2	..
Iceland [j]	2008	64	21	35	..	..	89	..	..	91	1	..
Ireland [j, z]	2008	65	26	54	..	..	84	..	..	91	3	..
Italy [j, z]	2008	58	3	12	..	..	74	..	..	82	12	..
Japan [t]	2008	89	22	36	..	..	..	..	..	..	..	..
Latvia [j, z]	2008	42	6	9	..	..	51	..	..	55	5	..
Lithuania [j, z]	2008	55	22	26	..	..	83	..	..	86	15	..
Luxembourg [j, z]	2008	65	10	23	..	..	82	..	..	90	10	..
Malta [j, z]	2008	58	13	13	..	..	72	..	..	74	4	..
Netherlands [j, z]	2008	85	27	40	..	..	77	..	..	85	4	..
New Zealand [b]	2008	64	42	66	..	..	69	..	..	80	65	..
Norway [j, z]	2008	73	30	44	..	..	70	..	..	76	6	..
Poland [j, z]	2008	57	8	11	..	..	56	..	..	68	5	..
Portugal [j, z]	2008	47	19	20	..	..	68	..	..	75	13	..
Romania [j, z]	2008	27	4	4	..	..	37	..	..	39	3	..
Slovakia [j, z]	2008	73	5	9	..	..	82	..	..	88	9	..
Slovenia j, z	2008	71	9	15	..	..	85	..	..	89	11	..
Spain j, z	2008	55	10	19	..	..	59	..	..	64	5	..
Sweden [j, z]	2008	86	19	50	..	..	76	..	..	78	7	..
Switzerland [e, m]	2005	90	23	57	..	96	..	58	83	56	21	22
United Kingdom [j, z]	2008	76	32	47	..	..	60	..	..	64	2	..
Developing economies												
Argentina [x]	2006	72	43	46	93	85	72	..	..	55	41	7
Brazil [b, n]	2008	56	41	52	89	85	60	..	..	80	46	10
Chile [zi]	2005	19	2	3	48	..	..	..	..	..	..	..
China [zi]	2005	11	6	5	38	31	22	18		18	17	5
Colombia [o]	2006	44	39	37	86	61	49	54	74	51	45	10
Cuba [p]	2007	26	2	3	70	70	70	70	10	..	39	2
Egypt [d, e, f]	2008	18	4	4	24	20	12	9	8	4	11	8
Hong Kong, China [d, q]	2008	50	3	21	86	86	73	..	..	..	21	49
Jordan	2008	50	5	7	68	72	25	..	..	..	26	5
Lesotho [b]	2008	22	..	..	44	44	..	..	..	..	..	..
Macao, China [d]	2007	..	19	24	..	56	..	..	..	..	19	..
Mauritius [f]	2008	44	35	34	..	..	..	..	..	..	..	..
Mexico	2003	7	..	..	38	..	..	..	..	..	..	..
Occupied Palestinian Territory	2007	34	16	7	40	8	..	..	..	4	2	1
Oman	2008	30	30	32	7	19	23	18	43	33	25	43
Panama [c]	2006	..	31	35	78	65	54	49	56	29	31	..
Qatar	2008	64	62	48	84	76	76	..	..	57	49	..
Republic of Korea [d]	2006	58	7	34	88	55	46	72	64	38	35	10
Singapore [z]	2008	63	39	40	88	85	85	..	..	86	..	37

Economy/Group	Reference year	Proportion of enterprises			Proportion of enterprises using the Internet for							
		With a website	Receiving orders over the Internet	Placing orders over the Internet	Sending and receiving e-mail	Getting information about goods or services	Getting information from public authorities	Information searches or research	Internet banking or financial services	Interacting with general government organizations	Providing customer services	Delivering products online
		B5	B7	B8	B12.a	B12.b.i	B12.b.ii	B12.b.iii	B12.c	B12.d	B12.e	B12.f
Suriname	2006	17	..	..	..	..	..	..	..	..	..	..
Thailand [k, r]	2007	36	8	11	51	41	..	68	8	..	18	13
Turkey [s]	2004	48	..	..	..	55	45	..	61	46	41	3
United Arab Emirates	2008	85	26	29	87	84	72	..	..	62	49	26
Uruguay [b, u]	2005	27	25	25	66	52	45	25	35	23	35	3
Transition economies												
Azerbaijan [g]	2007	4	..	2	..	..	9	..	7	6	..	..
Belarus [y]	2005	10	..	..	..	..	..	..	..	..	..	..
Croatia [j, z]	2008	64	16	22	..	..	52	..	..	57	12	..
Kazakhstan [f]	2008	7	14	15	49	27	24	..	..	20	39	2
Kyrgyzstan [g]	2007	9	..	..	27	..	3	..	..	..	..	2
Russian Federation [g, w]	2007	22	14	20	68	45	33	..	..	14	..	4
Serbia [k]	2007	53	15	17	..	..	44	47	56	52	..	..
The former Yugoslav Republic of Macedonia [b, v, z]	2008	46	6	10	..	..	53	..	..	55	..	..

Sources: UNCTAD Information Economy Database and Eurostat.

Notes:

a. Data collected through national surveys and censuses conducted between 2004 and 2009. Due to differences in methodology and timeliness of underlying data, comparisons across countries and over time should be made with caution. Different countries report data for different economic activities. Unless otherwise specified, data refer to enterprises which cover ISIC Rev.3.1 activities specified in annex table II.6.
b. Estimates.
c. Provisional data.
d. Data refer to establishments.
e. Data refer to the sample and have not been extrapolated to the target population.
f. Due to changes in the sampling frame/methodology, the data for the reference year should not be compared with the data for previous years.
g. Data include ISIC Rev.3.1.Section L (public administration and defence; compulsory social security).
h. Data refer to the year ended 30 June. B12.b.i refers to enterprises gathering information or researching for assessing or development of businesses' range of products, services, processes or methods; monitoring competitors and identifying future market trends. B12.d refers to enterprises making electronic lodgements with government organizations.
i. B12.c excludes enterprises of ISIC-Rev.3.1.section J 'Financial intermediation'.
j. Data cover NACE Rev.1 sections D, F, G, H, I, K, O and do not include NACE J65-66 (financial and insurance sectors). B12.e refers to enterprises sharing electonically information with customers (info on demand forecasts, inventories, production plans, progress of deliveries, etc.)
k. B12.b.i. refers to enterprises using the Internet for market monitoring (e.g. prices).
l. B12.e refers to enterprises providing customer services (B12.e) and delivering products online (B12.f).
m. B12.e refers to enterprises providing after-sales services. B12.f refers to enterprises delivering and/or offering products/services on firm homepage.
n. Data refer to national projection for enterprises with more than 9 employees.
o. Data refer to enterprises with 11 or more employees.
p. Estimates for indicators B12.a-f.
q. B12.b.i includes also other information searches and research (B12.b.iii). B12.b.ii includes transactions with government organizations/public authorities (B12.d).
r. Data refer to establishments with 16 or more employees. B12.e refers to establishments using the Internet for advertising own goods and services.
s. B12.d includes enterprises using the Internet for e-procurement to government organizations.
t. Data refer to enterprises with 100 or more employees.
u. Data cover ISIC Rev. 3.1 sections D, E, G, H, I, K71-74, M, N.
v. Data cover NACE Rev.1 sections D, F, G, I, K, groups 55.1, 55.2, 92.1 and 92.2 .
w. B12.d Data refer to enterprises sharing information electonically with government institutions.
x. Data cover only ISIC Rev.3.1 section D (manufacturing).
y. Data cover ISIC Rev. 3.1 sections A-K, M-O.
z. B12.d includes getting information from the government B12.b.ii.
zi. Data cover all enterprises.

Annex table III.1. ICT sector share of total business sector workforce and gross value added (%)

Economy	Year	ICT sector share of total business sector workfoce (ICT1) (%)	ICT sector share of gross value added (ICT2) (%)	ICT2/ICT1
Australia	2006	4.98	7.10	1.43
Austria	2006	5.37	6.80	1.27
Azerbaijan	2006	1.70	2.40	1.41
Belgium [a]	2006	4.91	7.60	1.55
Bermuda	2006	2.80	4.30	1.54
Brazil [b]	2006	3.00	12.30	4.10
Canada	2006	5.42	7.60	1.40
Chile	2004	1.00	3.00	3.00
Croatia	2007	1.90	3.00	1.58
Cuba	2007	2.70	4.10	1.52
Cyprus	2005	3.20	7.90	2.47
Czech Republic [a, b, c]	2006	4.68	7.54	1.61
Denmark	2006	7.05	7.93	1.13
Egypt	2006	5.60	..	..
Estonia	2004	4.20	9.80	2.33
Finland	2006	9.80	14.78	1.51
France [e]	2005	6.54	7.92	1.21
Germany [a]	2006	5.59	6.92	1.24
Greece [a, c, b, g]	2005	2.98	5.94	2.00
Hong Kong, China [f]	2007	3.60	4.60	1.28
Hungary [a]	2006	6.33	10.95	1.73
Iceland	2005	6.20	7.30	1.18
Ireland	2006	8.33	12.14	1.46
Israel [b, c, h]	2007	8.60	16.30	1.90
Italy	2006	6.32	7.48	1.18
Japan [b, c]	2005	6.14	8.90	1.45
Jordan	2008	3.60	..	..
Kazakhstan [e]	2008	1.90	6.30	3.32
Latvia	2005	3.00	9.00	3.00
Lithuania	2004	4.40	9.40	2.14
Luxembourg	2003	3.50	9.20	2.63
Malaysia	2005	7.30	13.10	1.79
Malta	2002	5.00	8.70	1.74
Mauritius	2008	5.60	6.90	1.23
Mexico	2007	2.40	4.40	1.83
Mongolia [e]	2006	2.40	0.90	0.38
Netherlands	2006	6.31	9.20	1.46
New Zealand [e i]	2008	3.30	5.10	1.55
Norway	2006	5.89	8.34	1.42
Panama [d]	2006	2.70	..	..
Poland	2004	2.40	3.00	1.25
Portugal	2005	2.59	7.07	2.72
Republic of Korea	2006	6.18	13.69	2.21
Romania	2005	3.00	9.80	3.27
Russian Federation [d]	2007	4.60	5.10	1.11
Singapore [j]	2008	4.50	..	..
Slovakia	2004	6.50	10.00	1.54
Slovenia	2004	3.40	4.60	1.35
Spain	2006	3.90	6.75	1.73
Sweden	2005	8.73	10.78	1.23
Switzerland [k]	2007	5.00	..	..
Thailand	2007	3.20	..	..
United Kingdom [e]	2006	4.85	10.67	2.20
United States	2008	4.00	4.90	1.23
Uruguay [d]	2005	4.90	..	..

Source: UNCTAD Information Economy Database and OECD.

Notes:

a. "Rental of ICT goods" (7123) is not available.
b. "Wholesale of computers, computer peripheral equipment and software" (5151) is not available.
c. "Wholesale of electronic and telecommunications parts and equipment" (5152) is not available.
d. Preliminary data, estimates.
e. Data for ICT2 refer to 2005 for the United Kingdom, 2006 for France and Kazakhstan and 2007 for Mongolia and New Zealand.
f. Business sector does not cover "maintenance and repair of motor vehicles and motorcycles".
g. "Telecommunication services" (6420) include postal services.
h. 72 includes R& D industry (73, excluding biotechnology).
i. All counts provided were randomly rounded to base 3 to protect confidentiality.
j. This figure contains manpower employed in sections C, F, G, H, J, K, L, M, N, O of the Singapore Standard Industrial Classification (SSIC) 2005.
k. Jobs in full-time equivalent.

Annex table III.2. Imports and exports of ICT goods, absolute value and in percentage of total imports and exports ($ million)

Economy/Group	ICT goods imports ($ million)	ICT goods imports as a share of total imports (ICT3) (%)	ICT goods exports ($ million)	ICT goods exports as a share of total exports (ICT4) (%)
WORLD	**2,024,621**	**12.89**	**1,908,388**	**12.67**
Developed economies	**1,036,320**	**10.4**	**788,785**	**8.8**
America	**328,109**	**12.7**	**193,437**	**11.0**
Bermuda	0	0.0	..	..
Canada	40,640	9.9	18,573	4.1
United States	287,469	13.3	174,865	13.5
Asia	**90,331**	**10.9**	**123,410**	**14.6**
Israel	6,125	9.4	8,171	13.3
Japan	84,206	11.0	115,239	14.7
Europe	**593,626**	**9.3**	**468,484**	**7.6**
Austria	12,954	7.4	11,016	6.4
Belgium	20,436	4.3	14,975	3.1
Bulgaria	2,061	6.1	609	2.7
Cyprus	575	5.3	123	7.2
Czech Republic	22,108	15.6	22,457	15.4
Denmark	9,631	8.8	6,067	5.2
Estonia	1,208	7.0	846	6.2
Faeroe Islands	57	5.8	0	0.0
Finland	11,392	12.4	15,877	16.4
France	54,801	7.9	34,830	5.9
Germany	113,190	9.4	111,704	7.6
Greece	5,443	6.1	862	3.4
Hungary	20,112	18.5	26,917	24.9
Iceland	314	5.1	23	0.4
Ireland	15,106	17.8	22,253	17.5
Italy	33,894	6.1	14,506	2.7
Latvia	1,093	6.9	475	5.1
Lithuania	1,659	5.3	1,094	4.6
Luxembourg	1,378	5.4	880	5.0
Malta	1,060	20.6	1,335	44.8
Netherlands	70,996	14.3	73,858	13.5
Norway	8,047	9.0	3,341	2.0
Poland	20,802	9.9	12,884	7.5
Portugal	7,526	8.4	4,026	7.2
Romania	6,243	7.5	2,482	5.0
Slovakia	11,659	16.1	12,190	17.4
Slovenia	1,773	5.2	952	3.3
Spain	36,862	8.8	8,307	3.0
Sweden	18,377	10.9	18,630	10.1
Switzerland	13,413	7.3	7,161	3.6
United Kingdom	69,457	11.0	37,806	8.3
Oceania	**24,254**	**10.7**	**3,454**	**1.6**
Australia	21,066	11.0	2,909	1.6
New Zealand	3,188	9.3	545	1.8
Developing economies	**988,301**	**17.2**	**1,119,603**	**18.4**
Africa	**24,844**	**6.4**	**3,392**	**0.9**
Algeria	2,242	5.7	4	0.0
Botswana	219	4.3	10	0.2
Burundi	26	8.3	1	0.8
Cape Verde	28	3.4	..	..
Côte d'Ivoire	308	3.9	29	0.3
Egypt	2,325	4.4	130	0.5
Ethiopia	645	7.4	8	0.5
Gambia	12	3.8	0	2.9
Ghana	664	7.3	2	0.1
Kenya	700	6.3	57	1.1
Madagascar	166	4.3	6	0.3
Malawi	76	3.4	2	0.2
Mali	115	3.5	3	0.2
Mauritania	25	1.6	0	0.0
Mauritius	284	6.1	97	4.0
Mayotte	17	2.9	0	0.9
Morocco	2,235	5.3	756	3.7
Mozambique	158	3.9	5	0.2

Economy/Group	ICT goods imports ($ million)	ICT goods imports as a share of total imports (ICT3) (%)	ICT goods exports ($ million)	ICT goods exports as a share of total exports (ICT4) (%)
Namibia	217	4.6	31	0.6
Niger	45	3.6	4	0.7
Nigeria	2,872	10.2	2	0.0
Rwanda	137	11.9	2	0.5
Sao Tome and Principe	5	4.8	0	0.0
Senegal	219	3.4	13	0.6
Seychelles	15	1.5	2	0.8
South Africa	8,329	9.5	1,180	1.6
Sudan	336	2.0	1	0.0
Tunisia	1,300	5.3	865	4.5
Uganda	427	9.4	79	4.6
United Republic of Tanzania	450	5.6	13	0.4
Zambia	167	3.3	6	0.1
Zimbabwe	78	2.8	82	4.8
Latin America and the Caribbean	**111,036**	**13.6**	**68,579**	**7.9**
Anguilla	4	1.7	0	2.7
Argentina	5,586	9.7	335	0.5
Aruba	0	0.0	0	0.0
Bahamas	84	2.6	3	0.4
Barbados	109	6.3	16	3.5
Belize	41	4.9	0	0.0
Bolivia, Plurinational State of	223	4.4	0	0.0
Brazil	20,525	11.9	3,601	1.8
Chile	3,842	6.6	111	0.2
Colombia	4,580	11.5	95	0.3
Costa Rica	2,924	19.1	2,253	23.1
Dominica	10	4.4	0	0.7
Dominican Republic	848	5.2	328	5.8
Ecuador	1,555	8.3	40	0.2
El Salvador	541	5.5	17	0.4
Guatemala	978	6.7	37	0.5
Guyana	48	3.6	1	0.1
Jamaica	331	3.9	8	0.3
Mexico	59,637	19.3	61,606	21.2
Montserrat	2	5.2	0	7.1
Netherlands Antilles	125	8.7	5	3.3
Panama	669	7.4	0	0.0
Paraguay	2,175	24.2	17	0.4
Peru	..	..	22	0.1
Saint Lucia	28	4.2	9	5.7
Saint Vincent and the Grenadines	15	4.1	1	1.5
Suriname	24	1.9	4	0.2
Trinidad and Tobago	327	3.4	18	0.1
Turks and Caicos Islands	0	0.0	0	0.0
Uruguay	573	6.3	11	0.2
Venezuela, Bolivarian Republic of	5,231	11.6	40	0.0
Asia	**816,050**	**20.5**	**1,043,440**	**25.4**
Afghanistan	16	0.5	0	0.0
Bhutan	28	5.2	0	0.0
Cambodia	181	4.1	4	0.1
China	306,156	27.0	430,728	30.1
Hong Kong, China	164,686	41.9	158,672	42.9
Macao, China	621	10.6	121	6.1
India	15,901	5.0	2,375	1.3
Indonesia	12,656	9.8	6,347	4.6
Jordan	1,155	6.8	310	4.0
Lebanon	488	3.0	44	1.3
Malaysia	39,479	25.3	52,060	26.2
Maldives	95	6.9	0	0.0
Occupied Palestinian Territory	130	3.6	4	0.7
Oman	734	3.2	603	1.6
Taiwan, Province of China	46,490	19.3	82,087	32.2
Pakistan	2,476	5.8	95	0.5
Philippines	20,971	34.7	26,538	54.1
Qatar	2,285	8.2	21	0.0
Republic of Korea	58,614	13.5	115,625	27.4

Economy/Group	ICT goods imports ($ million)	ICT goods imports as a share of total imports (ICT3) (%)	ICT goods exports ($ million)	ICT goods exports as a share of total exports (ICT4) (%)
Singapore	90,279	28.2	122,991	36.4
Sri Lanka	644	4.7	104	1.3
Thailand	27,298	15.3	34,352	19.5
Turkey	9,979	4.9	2,623	2.0
United Arab Emirates	8,744	5.0	4,271	2.0
Viet Nam	5,751	7.1	3,439	5.5
Yemen	191	1.8	24	0.3
Oceania	**281**	**4.8**	**8**	**0.4**
Cook Islands	0		0	0.0
French Polynesia	133	6.0	2	1.1
New Caledonia	138	4.2	5	0.3
Samoa	9	3.0	1	0.8
Tuvalu	0	1.7	0	0.0
Transition economies	**36,090**	**6.8**	**4,185**	**0.6**
Albania	210	4.0	10	0.8
Armenia	247	6.0	14	1.3
Azerbaijan	367	5.1	8	0.0
Belarus	1,152	2.9	214	0.7
Bosnia Herzegovina	546	4.5	25	0.5
Croatia	1,882	6.1	514	3.6
Georgia	472	7.8	6	0.4
Kazakhstan	1,232	3.3	37	0.1
Republic of Moldova	168	3.4	109	6.8
Russian Federation	25,907	9.7	2,134	0.5
Serbia	1,296	5.7	260	2.4
The former Yugoslav Republic of Macedonia	353	5.2	..	
Ukraine	2,258	2.6	853	1.3
LDCs	**3,515**	**0.7**	**172**	**0.0**

Source: UNCTAD on the basis of United Nations Comtrade Data.

Note: Information on trade in ICT goods used in this report is based on COMTRADE data extracted in April 2010. The OECD's 2003 definition for ICT goods was chosen over the more recent one (2008). The ICT goods listed in this report therefore include those that "…must be intended to fulfil the function of information processing and communication including transmission and display, or must use electronic processing to detect, measure and/or record physical phenomena or to control a physical process".
This allows for comparability with previous editions of the IER, which also used this "extended definition" of ICT goods. Moreover, this report applies a parallel definition for the ICT sector, which has been used to collect data from National Statistical Offices worldwide. Depending on countries, data are reported in COMTRADE under the 2007, 2002, 1996, or 1992 versions of the Harmonised System (HS). While official definitions of ICT goods exist under the HS1996 and HS2002 classifications, and UNCTAD designed a conversion methodology for the 1992 version, this is not the case for the HS 2007 one. In this latter case, the report has made use of a correspondence table between the HS 2002 and HS 2007 which has tentatively been proposed by the OECD,s Working Party on Indicators for the Information Society (WPIIS). The correspondence table should be considered provisional until the final version, to be released by the OECD in 2010. The main issue here is the lack of full convertibility between the HS 2002 list and the HS 2007.
In 2008, Anguilla, Suriname and Tuvalu are reported in COMTRADE under the HS 1992 classification. Botswana, Gambia, Indonesia, Mauritania, Saint Lucia, Saint Vincent and the Grenadines, Samoa and Sao Tome and Principe are reported under the HS 1996 classification. The following economies are reported under the HS 2002 classification: Afghanistan, Albania, Aruba, Bahamas, Barbados, Belize, Bermuda, Burundi, Dominica, French Polynesia, Georgia, Ghana, India, Kazakhstan, Malaysia, Montserrat, Morocco, Mozambique, the Netherlands Antilles, Nigeria, Oman, Taiwan Province of China, the Philippines, Qatar, the Republic of Moldova, Turks and Caicos, Ukraine, the Bolivarian Republic of Venezuela and Yemen. All other economies available reported their trade using the HS 2007 classification.

SELECTED UNCTAD PUBLICATIONS IN THE AREA OF SCIENCE, TECHNOLOGY AND ICT FOR DEVELOPMENT

A. Flagship reports

Information Economy Report 2010: ICTs, Enterprises and Poverty Alleviation. United Nations publication. New York and Geneva.

Technology and Information Report 2010: Enhancing food security in Africa through science, technology and innovation. New York and Geneva.

Information Economy Report 2009: Trends and Outlook in Turbulent Times (*October 2009*). United Nations publication. Sales No. E.09.II.D.18. New York and Geneva.

Information Economy Report 2007–2008: Science and Technology for Development – the New Paradigm of ICT. United Nations publication. Sales No. E.07.II.D.13. New York and Geneva.

Information Economy Report 2006: the Development Perspective. United Nations publication. Sales No. E.06.II.D.8. New York and Geneva.

Information Economy Report 2005: E-commerce and Development. United Nations publication. Sales No. E.05.II.D.19. New York and Geneva.

E-Commerce and Development Report 2004. United Nations publication. New York and Geneva.

E-Commerce and Development Report 2003. United Nations publication. Sales No. E.03.II.D.30. New York and Geneva.

E-Commerce and Development Report 2002. United Nations publication. New York and Geneva.

E-Commerce and Development Report 2001. United Nations publication. Sales No. E.01.II.D.30. New York and Geneva.

B. Science, Technology and Innovation Policy Reviews

Science, Technology and Innovation Policy Review of Angola. United Nations publication. UNCTAD/SDTE/STICT/2008/1. New York and Geneva.

Science, Technology and Innovation Policy Review: the Islamic Republic of Iran. United Nations publication. UNCTAD/ITE/IPC/2005/7. New York and Geneva.

Investment and Innovation Policy Review of Ethiopia. United Nations publication. UNCTAD/ITE/IPC/Misc.4. New York and Geneva.

Science, Technology and Innovation Policy Review: Colombia. United Nations publication. Sales No. E.99.II.D.13. New York and Geneva.

Science, Technology and Innovation Policy Review: Jamaica. United Nations publication. Sales No. E.98.II.D.7. New York and Geneva.

C. Other publications

Estudio sobre las perspectivas de la armonización de la ciberlegislación en Centroamérica y el Caribe. UNCTAD/DTL/STICT/2009/3. New York and Geneva. (Spanish only).

Study on Prospects for Harmonizing Cyberlegislation in Latin America. UNCTAD publication. UNCTAD/DTL/STICT/2009/1. New York and Geneva. (In English and Spanish.)

Financing Mechanisms for Information and Communication Technologies for Development. UNCTAD Current Studies on Science, Technology and Innovation. UNCTAD/DTL/STICT/2009/5. Geneva.

Renewable Energy Technologies for Rural Development. UNCTAD Current Studies on Science, Technology and Innovation. UNCTAD/DTL/STICT/2009/4. Geneva.

Manual for the Production of Statistics on the Information Economy 2009 Revised Edition. United Nations publication. UNCTAD/SDTE/ECB/2007/2/REV.1. New York and Geneva.

WSIS Follow-up Report 2008. United Nations publication. UNCTAD/DTL/STICT/2008/1. New York and Geneva.
Measuring the Impact of ICT Use in Business: the Case of Manufacturing in Thailand. United Nations publication. Sales No. E.08.II.D.13. New York and Geneva.
World Information Society Report 2007: Beyond WSIS. Joint United Nations and ITU publication. Geneva.
World Information Society Report 2006. Joint United Nations and ITU publication. Geneva.
The Digital Divide: ICT Diffusion Index 2005. United Nations publication. New York and Geneva.
The Digital Divide: ICT Development Indices 2004. United Nations publication. New York and Geneva.
Africa's Technology Gap: Case Studies on Kenya, Ghana, Tanzania and Uganda. United Nations publication. UNCTAD/ITE/IPC/Misc.13. New York and Geneva.
The Biotechnology Promise: Capacity-Building for Participation of Developing Countries in the Bioeconomy. United Nations publication. UNCTAD/ITE/IPC/2004/2. New York and Geneva.
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Investment and Technology Policies for Competitiveness: Review of Successful Country Experiences. United Nations publication. UNCTAD/ITE/IPC/2003/2. New York and Geneva.
Electronic Commerce and Music Business Development in Jamaica: a Portal to the New Economy? United Nations publication. Sales No. E.02.II.D.17. New York and Geneva.
Changing Dynamics of Global Computer Software and Services Industry: Implications for Developing Countries. United Nations publication. Sales No. E.02.II.D.3. New York and Geneva.
Partnerships and Networking in Science and Technology for Development. United Nations publication. Sales No. E.02.II.D.5. New York and Geneva.
Transfer of Technology for Successful Integration into the Global Economy: a Case Study of Embraer in Brazil. United Nations publication. UNCTAD/ITE/IPC/Misc.20. New York and Geneva.
Transfer of Technology for Successful Integration into the Global Economy: a Case Study of the South African Automotive Industry. United Nations publication. UNCTAD/ITE/IPC/Misc.21. New York and Geneva.
Transfer of Technology for the Successful Integration into the Global Economy: a Case Study of the Pharmaceutical Industry in India. United Nations publication. UNCTAD/ITE/IPC/Misc.22. New York and Geneva.
Coalition of Resources for Information and Communication Technologies. United Nations publication. UNCTAD/ITE/TEB/13. New York and Geneva.
Key Issues in Biotechnology. United Nations publication. UNCTAD/ITE/TEB/10. New York and Geneva.
An Assault on Poverty: Basic Human Needs, Science and Technology. Joint publication with IDRC. ISBN 0-88936-800-7.
Compendium of International Arrangements on Transfer of Technology: Selected Instruments. United Nations publication. Sales No. E.01.II.D.28. New York and Geneva.

D. Publications by the Partnership on Measuring ICT for Development

Core ICT Indicators 2010. ITU. Geneva.
The Global Information Society: a Statistical View 2008. United Nations publication. Santiago.
Measuring ICT: the Global Status of ICT Indicators Partnership on Measuring ICT for Development. United Nations ICT Task Force. New York.

E. Issues in Brief

Measuring the Information Economy: How ICT Contributes to Development. Issues in Brief No. 7. UNCTAD/IAOS/MISC/2005/13.
E-Tourism in Developing Countries: More Links, Fewer Leaks. Issues in Brief No. 6. UNCTAD/IAOS/MISC/2005/11.
ICT and E-Commerce: an Opportunity for Developing Countries. Issues in brief No. 1. UNCTAD/ISS/MISC/2003/6.

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