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WORLD TELECOMMUNICATION/ICT DEVELOPMENT REPORT 2006

MEASURING ICT FOR SOCIAL AND ECONOMIC DEVELOPMENT

EXECUTIVE SUMMARY

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WORLD TELECOMMUNICATION/ICT DEVELOPMENT REPORT 2006

Measuring ICT for Social and Economic Development

Executive Summary

You want to know the difference information and communication technologies make? Try to live without them…

This document is the *Executive Summary* of the ITU *World Telecommunication/ICT Development Report 2006 – Measuring ICT for Social and Economic Development*. The report was prepared by a team of authors led by the Market, Economics, and Finance Unit (MEF) of the ITU's Telecommunication Development Bureau (BDT). The main authors of the report are Vanessa Gray, Esperanza Magpantay, Herbert Thompson, John de Ridder, and Russell Southwood. Christopher Garbacz, Stephen Esselaar, and Tracy Cohen also contributed. The full report and the ITU World Telecommunication Indicators Database are available for purchase from the ITU website, at www.itu.int/ITU D/ict/. The authors would like to thank all those ITU Member States and Sector Members, public telecommunication operators, regulators and others that have provided data and other inputs to the report. Special thanks to Chan Keu (keuchan@voila.fr) for drawing the picture of the cover.

The views expressed are those of the authors and may not necessarily reflect the opinions of ITU or its members.

INTRODUCTION

The 2006 ITU *World Telecommunication/ICT Development Report: Measuring ICT for Social and Economic Development* has been specially prepared for the World Telecommunication Development Conference (WTDC) (Doha, Qatar 7-15 March 2006). This year's report examines the specific issue of evaluating and measuring the impact of information and communication technologies (ICTs). ITU has long been involved in measuring the availability of telecommunication/ICT infrastructure and has more recently begun to measure the use of ICTs. The ITU's contribution in terms of statistical information and analysis has been critical in understanding the digital divide.

The importance of ICTs, and the way they are transforming the world, were confirmed with the UN's decision to hold the World Summit on the Information Society (WSIS). The resounding success of both phases of the Summit (December 2003 in Geneva and November 2005 in Tunis) further highlighted the magnitude of the topic. The final WSIS outcome documents – the *Tunis Commitment* and the *Tunis Agenda for the Information Society* – highlight the potential of ICTs in *"improving the socio-economic development of all human beings"*. They also point to the *"growing importance of the role of ICTs, not only as a medium of communication, but also as a development enabler, and as a tool for the achievement of the internationally-agreed development goals and objectives, including the Millennium Development Goals (MDGs)"*. Through this report, the ITU is reaffirming its leading role in measuring the Information Society by addressing an area where little international data and even fewer indicators are available: the impact of ICTs on economic and social development. Besides responding to an obvious need to go beyond access to, and use of, ICTs this report is also a direct response to the WSIS request to *"track global progress in the use of ICTs to achieve internationally-agreed development goals and objectives, including the Millennium Development Goals"*.

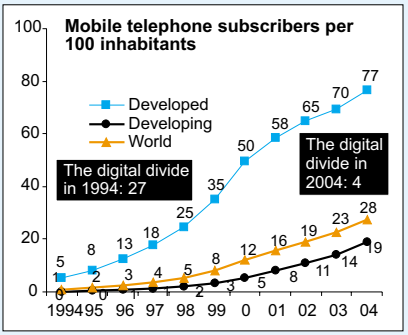
This new edition of the *World Telecommunication/ICT Development Report* will show that most work carried out in the area of impact measurement and indicators is still at a nascent stage, and often restricted to developed countries. Although there is a growing body of evidence that ICTs have an important macroeconomic impact – an area where a number of countries have carried out studies – it is not clear to what extent and how exactly ICTs have helped to directly reduce major development concerns, particularly those linked to the MDGs, such as poverty, hunger or sickness. The main objective of this report is to help measure the difference that ICTs are making. The report has six chapters. The *first* provides an overview of global telecommunication/ICT developments, with major trends in each region. The *second* chapter highlights the statistical divide, current efforts to overcome this divide, and the need to go beyond indicators on access to, and use of, ICTs. Chapter *three* looks at measuring the impact of the ICT sector on the economy, including a number of studies that have been carried out in this area. Chapter *four* examines the broader economic impact of ICTs, for example on productivity and employment, including in the public and private sector. Chapter *five* proposes a scheme to identify possible indicators for measuring the impact of ICTs on the achievement of the MDGs, based on concrete examples and case studies. Chapter *six* summarizes the report's main findings.

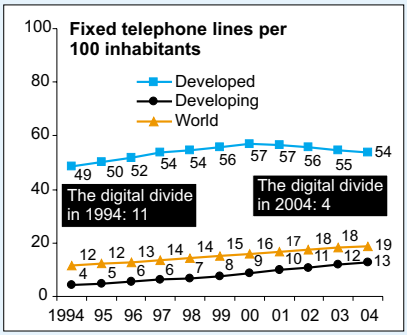
1. Status of Telecommunication/ICT development

By the end of 2004, the telecommunication industry had experienced continuous growth, as well as rapid progress in policy and technology development, resulting in an increasingly competitive and networked world. It is true and encouraging that overall, the digital divide has been reduced and continues to shrink. ITU statistics show that over the last 10 years, the digital divide between the developing and the developed countries has been narrowing in terms of fixed telephone lines, mobile subscribers and Internet users. In contrast to the slow fixed line growth, phenomenal growth rates in the mobile sector particularly, have been able to reduce the gap that separates the developed from the developing countries from 27 in 1994, to 4 in 2004. The fixed line gap has been reduced from 11 to 4 during the same period (Figure 1.1).

While on average almost one out of three of the world's citizens is a mobile subscriber, there are major regional differences. Indeed, despite the rapid growth in all of the world's regions, and particularly in the developing countries, major differences in penetration levels persist. In 2004, Europe's mobile penetration rate stood at 71 percent, almost

Figure: 1.1: Overall, the digital divide is shrinking...
Mobile telephone subscribers per 100 inhabitants, 1994-2004 (left) and fixed telephone lines per 100 inhabitants, 1994-2004 (right)





Source: ITU World Telecommunication Indicators Database.
Note: In these charts, the digital divide is calculated by dividing the penetration rates in the developed world by the penetration rate in the developing world. Penetration rates are rounded, whereas the digital divide is calculated based on actual numbers. For this reason, the digital divide results do not always correspond to the figures indicated in the graph.

twice the penetration rate of the Americas (43 percent), and nearly four times the penetration rate of Asia (19 percent). Europe had almost eight times the penetration rate of Africa, where less than one out of ten people subscribe to a mobile service (Figure 1.2, top left). These figures certainly highlight that access to, and use of, mobile services remain unevenly distributed between regions and countries. At the same time, they highlight potential market opportunities and new customers for operators whose revenues already – and despite high competition and falling tariffs – are on the rise.

3G technologies, which promise a wide range of innovative applications for users and a new source of revenues for operators, are unlikely to make a dramatic change for the world's poorest in the next couple of years. The majority of low-income countries has not yet deployed Third Generation services and the distribution of 3G subscribers worldwide highlights a stark 3G divide. Given the nascent state and low revenues of 3G services in most developed countries, operators are unsure about the potential and opportunities of 3G in developing markets and have been reluctant to invest in this sector.

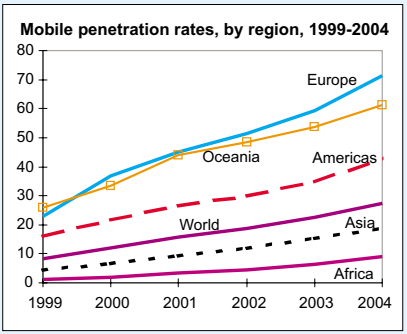
In contrast to its leading position in (second generation) mobile network availability and subscriber rates, Europe is not a leader in the area of 3G. Ninety-three percent of 3G subscribers are in Asia-Pacific and the Americas. Only a fraction of subscribers are located in Oceania and Africa. More than a regional divide, the 3G market still really separates a few advanced countries from the rest of the world. At the end of 2004, the United States (49.5 million), the Republic of Korea (27.5 million) and Japan (25.7 million) alone had over 100 million 3G subscribers, three quarters of the worldwide total at that time (Figure 1.2, top right).

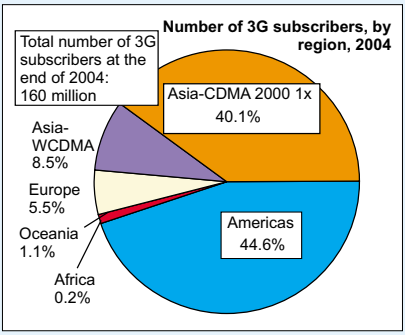
By end 2004, there were an estimated 840 million Internet users in the world, representing just over 13 percent of the total population. The highest penetration rates were found in Europe and the Americas, where almost one third of the population was online (Figure 1.2, bottom left). The growth of the Internet and new applications is driving demand for access at higher speeds and more and more countries are moving from dial-up Internet access to broadband. The introduction of high-speed Internet access is particularly important for the transformation of Information Societies since it opens up new possibilities and visions on how the Internet can provide a platform for enhancing countries' social and economic development. Besides opening up new markets and revenue streams to businesses, broadband has proven an important driver for the delivery of e-government, e-learning, and other services. The uptake of e-commerce is also closely linked to growing broadband penetration rates.

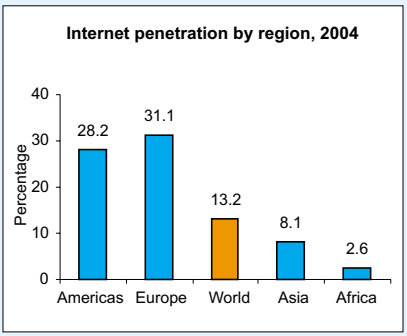
Both inter-modal and platform-based competitions and/or inter-operator competition have helped to substantially bring down broadband prices and increase the number of users in many developed countries. A number of advanced wireless technologies and

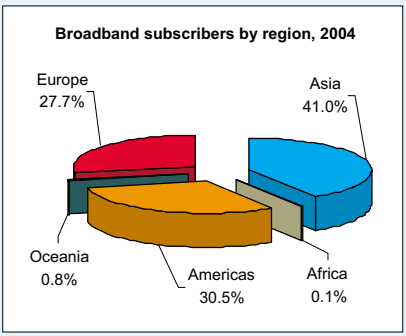
Figure 1.2: …but major disparities remain

Mobile cellular penetration, by region, 1994-2004 (top left) and distribution of the 160 million 3G subscribers at the end of 2004, by region (top right); Internet penetration by region, 2004 (bottom left) and distribution of broadband subscribers by region, 2004 (bottom right)









Source: ITU World Telecommunication Indicators Database (top left and bottom charts) and ITU adapted from 3GToday.com (top right).

techniques that provide a platform for high-speed data access using Internet Protocol (IP) are also used to expand broadband access. Viable last mile broadband technologies, such as Wi-fi have been used to offer public broadband access (hotspots) at airports, hotels, restaurants and other public places. A number of cities, and even countries, have announced plans to go entirely wireless and provide high-speed access to every one of its citizens. Wireless technologies, and particularly WiMAX, which promises to provide high-speed connectivity over a range of up to 50 km, are hoped to help fill infrastructure

gaps in rural and underserved areas. The continued evolution and enhancement of 3G technologies, such as High Speed Downlink Packet Access (HSDPA), which was recently adopted by the GSM community, equally holds great promises.

Nevertheless, by the end of 2004, the vast majority of broadband users were in the developed world and globally, Asia, Europe and the Americas represented no less than 99 percent of all broadband subscribers. Africa is home to a fraction of all broadband subscribers, and many African countries have not yet launched high-speed Internet services (Figure 1.2, bottom right).

This overview suggests that the world continues to be separated by major differences and disparities in terms of ICT levels. High growth rates in some areas, such as the mobile sector, are not sufficient to bring digital opportunities to all and increasing efforts must be undertaken to take advantage of the great potential offered by newer technologies, specifically 3G and broadband.

2. Measuring the Information Society

In November 2005, the second phase of the World Summit on the Information Society (WSIS) took place in Tunis, Tunisia. The fact that the UN decided to hold this Summit illustrates the increasing importance attached to information and communication technologies (ICTs). It demonstrates the pervasiveness of these technologies, as well as the recognition that ICTs are having a profound impact on people's lives. Besides putting the spotlight on the Information Society, the WSIS also highlighted the need to measure it.

The lack of comprehensive, timely and comparable data remains a major barrier to analyzing the status and progress of Information Societies, identifying reliable targets and adapting policies. To analyze the real use and potential of ICTs, it is imperative that countries carry out representative household and individual ICT surveys. Few developing countries currently do so, though. This adds to the already existing statistical divide on access to, and use of, ICTs.

To tackle these problems, a number of key stakeholders, including ITU and several other UN agencies and regional organisations, launched the *Partnership on Measuring ICT for Development*. This multi-stakeholder initiative currently represents the most comprehensive effort to develop, collect and disseminate globally relevant indicators to measure the Information Society. One of the major achievements of the Partnership has been the identification of a core list of ICT indicators. This list includes infrastructure, access and use indicators for individuals, households and businesses, as well as some ICT sector and trade indicators (Annex Table 1).

But, measuring access to, and use of, ICTs is not enough, particularly since it has been widely recognized that ICTs are not an end in themselves. One of the main reasons ICTs have received so much attention is the promise they hold for social and economic development. The final documents outlining the international community's commitment and steps on how to establish and organize the Information Society adopted during the WSIS process make this very clear, through their reference to "*ICTs as a tool for social and economic development*" (Box 2.1).

Despite the potential of ICTs to be an engine for economic growth and deliver innovative applications in government, commerce, education, and many other areas, there is limited quantifiable proof. Evidence remains largely anecdotal. Although there is a growing body of studies that show that ICTs have a significant macroeconomic impact, it is not clear to what extent ICTs have helped to directly reduce major development concerns and particularly those of the MDGs, such as poverty, hunger or sickness. To be able to understand, track and compare the impact that ICTs are having it is necessary to identify possible ways to measure impact. Besides responding to the need to examine impact indicators, this report is also a direct response to the international petition to "*track*

global progress in the use of ICTs to achieve internationally-agreed development goals and objectives, including the Millennium Development Goals" (*Tunis Agenda for the Information Society, paragraph 113).*

Box 2.1: The World Summit on the Information Society (WSIS) shows: Our expectations are high! The promises the Information Society holds…

The documents adopted during the World Summit on the Information Society (WSIS) clearly highlight the promises of information and communication technologies (ICTs) and accept the link between ICTs and social and economic development. The Geneva Declaration of Principles (DoP) and Plan of Action (PoA), and the Tunis Commitment (TC) and Tunis Agenda (TA) include over two dozen references that highlight how ICTs can help achieve the Millennium Development Goals (MDGs), contribute to economic growth, productivity, and sustainable development and create jobs, and contribute to and improve the quality of life. For example, the WSIS DoP states that the international community is *"aware that ICTs should be regarded as tools and not as an end in themselves. Under favourable conditions, these technologies can be a powerful instrument, increasing productivity, generating economic growth, job creation and employability and improving the quality of life of all".* The TA confirms that *"it will be possible to succeed in our challenge of harnessing the potential of ICTs as a tool, at the service of development, …to address the national and local development priorities, thereby further improving the socio-economic development of all human beings".*

3. The direct impact of the ICT sector on the economy

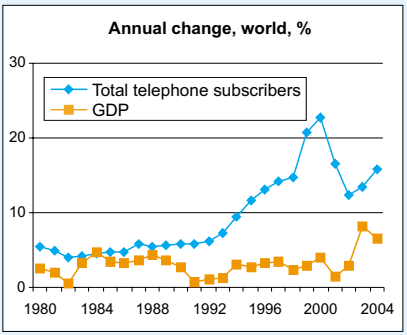
The phenomenal growth in information and communications technologies (ICTs) has important implications for economic growth, in both developed and developing countries. The ICT-producing sectors (both services and manufacturing) create direct and indirect benefits in the countries where they are located. Growth of these industries results directly in new jobs and revenue. The size of these direct benefits depends on how large the ICT goods and services producing sectors are relative to the economy, and how fast they have grown.

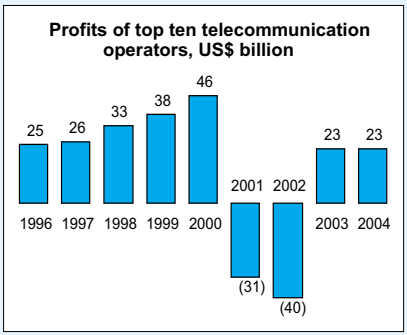
The telecommunication sector

The telecommunication sector deserves special recognition for its impact on the economy worldwide. The telecommunication services sector, which in most countries is larger than the ICT manufacturing sector, is growing rapidly in literally every part of the world. As highlighted in Figure 3.1 (left), access to telecommunication services (in terms of telephone subscribers) has been growing at high speed, exceeding global economic growth over the last two decades. Even during the "dot.com crash" the number of total telephone subscribers kept growing at a minimum annual rate of 12 percent. Besides telecommunication users, the now largely privatized and competitive telecommunication services sector is reaping the benefits of growth. After several difficult years following the "dot.com crash" just after the turn of the century, operators have again started to make profits. In 2003 and 2004, the top ten operators achieved profits of around US$ 23 billion (Figure 3.1, right).

Figure 3.1: GDP and selected ICT growth

Annual percentage change in world GDP and in total telephone subscribers (fixed plus mobile) and profits (net income) of top ten telecom operators (by revenue), 1996-2004

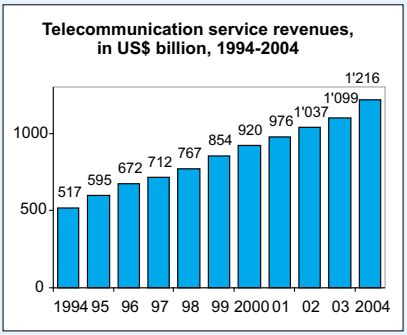


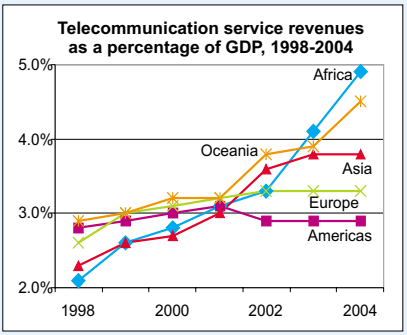


Source: ITU World Telecommunication Indicators Database (left) and ITU adapted from company reports (right).

Figure 3.2: Telecommunication service revenues on the rise

Telecommunication service revenues, in US$ billion, 1994-2004, global (left) and telecommunication service revenues as a percentage of GDP, 1998-2004, world regions (right)





Source: ITU World Telecommunication Indicators Database.

While the "doc.com crash" had important repercussions on operators' profits, revenues continued to grow all along. Worldwide, the ITU estimates that telecommunication service revenues have more than doubled, from US$ 517 to US$ 1'216 billion over the last ten years (Figure 3.2, left). As a result, total telecommunication revenues have substantially increased as a percentage of GDP in Africa, Oceania and Asia and have remained stable in Europe and the Americas. Africa is the region where telecommunication service revenues as a percentage of GDP have grown fastest. Today, they represent almost five percent of GDP in Africa, compared to 4.5 percent in Oceania, 3.8 percent in Asia, 3.3 percent in Europe and 2.9 percent in the Americas. This highlights the importance of the telecommunication sector for the African economy (Figure 3.2, right).

The ICT manufacturing sector

The ICT manufacturing sector is relatively small in most countries, although it has expanded rapidly in some, including the Republic of Korea, Japan, and the US since the last half of the 1990s. Data on employment, revenues and investment in the ICT manufacturing sector are collected mainly by developed and only some developing countries.

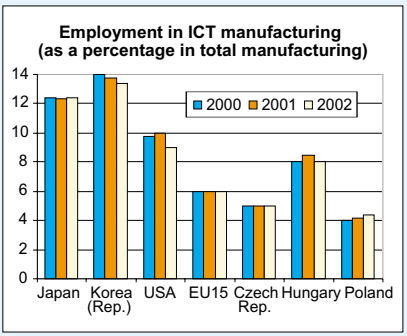
A comparison of different regions and countries highlights that employment in the ICT manufacturing sector (as a percentage of total manufacturing employment) varies, from 4.5 percent in the Czech Republic, to 14 percent in the Republic of Korea (Figure 3.3, left).

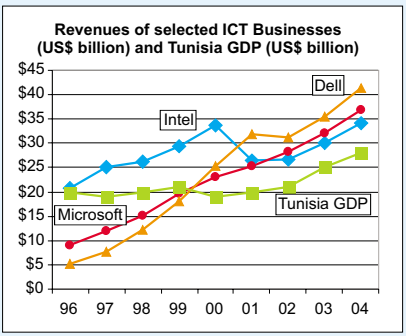
A different approach to understanding the economic impact of the ICT manufacturing sector is through information on growth of revenues and employment in the specific international ICT businesses. Employment and revenues of the manufacturing sector are on the rise again, exceeding global economic growth, and revenue and employment data of some of the larger ICT manufacturers show impressive results.

Figure 3.3 (right) illustrates the revenue growth of several key ICT companies, including major hardware and software companies, such as Intel (a leading chip maker and manufacturer of personal computers, networking, and communications products), Dell (today's largest computer vendor in the world) and Microsoft (the leading world

Figure 3.3: Telecommunication employment and revenue

Employment in ICT manufacturing (as a percentage in total manufacturing), 2000-2002, selected regions and countries (left) and revenues of selected ICT businesses compared to Tunisia's GDP, US$ billion, 1996-2004 (right)





Source: ITU adapted from EU (left) and OECD (right).

provider of personal computer operating systems and component software). Revenues produced by these telecommunication companies have exceeded the Gross Domestic Product of some countries, such as Tunisia.

Trade in ICT goods and services

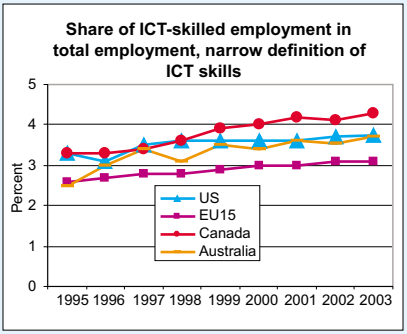
Another useful way of examining the economic impact of the ICT sector is through the analysis of trade in ICT goods and services. Data on exports of ICT goods and services are important because they measure the strength and importance of a country's ICT sector and its international competitiveness. Both the European Union (EU) and the Organisation for Economic Co-operation and Development (OECD) collect data on ICT imports and exports and their share in GDP. Within the OECD, the US clearly leads in both, exports and imports. At the same time, the US's imports clearly exceed exports of ICT goods and services. This is also the case in the UK, France, Canada and Australia. The majority of EU countries, as well as Japan and the Republic of Korea have a higher level of exports than imports, suggesting a net income from the ICT industry. To evaluate the importance of the ICT sector on the overall economy, it is useful to monitor the share of ICT exports in terms of total exports. In Ireland, for example, total exports of ICT products and services amounted to almost EUR 30 billion in 2002, representing 34 percent of all of Ireland's exports.

The UN Conference on Trade and Development (UNCTAD) collects data on exports in ICT goods for developed and developing countries and regions. According to the last Information Economy Report "*Trade in ICT goods continues to be highly concentrated: the top ten exporters account for 72 percent of global ICT exports, and the top ten importers for slightly less (66 percent of global ICT imports). Concentration is even higher in developing countries: the top ten developing country exporters amount for over 98 percent of all developing countries' exports in ICT goods*". The top ten exporters in terms of market shares include a number of developing economies: China (at 11 percent just behind the US), Hong Kong, China (6.9 percent), Taiwan, China (5.4 percent) and Malaysia (4.7 percent). Data comparability and regional estimates, however, are hampered by the fact that many developing countries do not provide data on trade in ICT goods and services.

Overall impact of the ICT sector

Ideally – to evaluate the impact of the overall ICT sector – it should be possible to compare countries in terms of their ICT services and manufacturing industries, and in terms of employment, revenues, investments, and imports/exports. A number of organisations and some countries collect and publish data on overall ICT turnover and employment. However, internationally comparable (national) indicators are scant and when data are not limited to highly industrialized countries, results are based on estimates.

Figure 3.4: ICT-skilled employment
ICT-skilled employment in total employment, selected regions and countries, 1995-2003



Source: ITU adapted from OECD.
Note: The narrow definition of ICT skills refers to *"ICT specialists, who have the ability to develop, operate and maintain ICT systems. ICTs constitute the main part of their job – they develop and put in place the ICT tools for others"*.

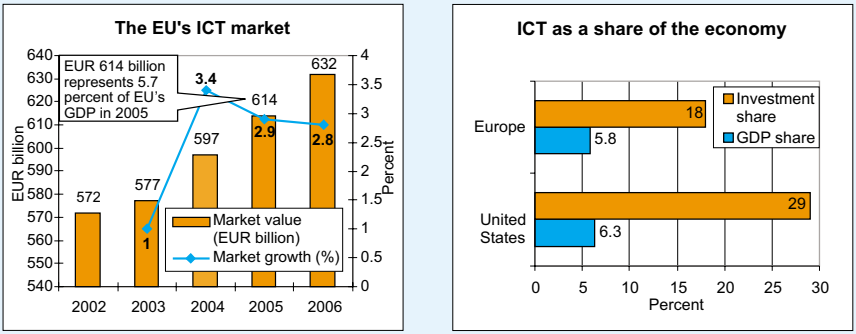
The share of ICT-skilled employment in the total economy is an indicator that is collected by the EU and OECD. An international comparison shows that at the end of 2003, overall ICT-skilled employment stood at just over three percent in the EU15 countries, compared to 3.8 percent in the USA and 3.7 percent and 4.3 percent in Australia and Canada, respectively (Figure 3.4). Data show that the share has been increasing over the years.

Studies that analyze the overall impact of the ICT market on the economy highlight its substantial share, as well as its growing importance. A report by the European Information Technology Observatory (EITO) shows that the European Union's ICT market value has risen steadily since 2002; a market value of EUR 614 billion in 2005 represented 5.7 percent of the EU's GDP (Figure 3.5, left). A study commissioned by the UK Department of Trade and Industry (DTI) shows similar results. Europe's ICT sector represents 5.8 percent, compared to 6.3 percent of GDP in the United States (Figure 3.5, right).

In terms of global coverage, most studies on the economic impact of ICTs focus on a limited number of industrialized countries and there are few studies that try to analyze or measure the impact of ICTs on the economies of developing nations. The main reason is that the underlying data necessary to carry out these studies are either not available or not comparable.

Figure 3.5: The ICT market as a share of GDP

The EU's ICT market value and growth, 2002-2006 (left) and ICT share of GDP, Europe and the US (right)



Source: ITU adapted from EITO (left) and ITU adapted from UK Department of Trade and Industry (right).

Note: Right chart: Data is based on IMF 2004, O'Mahony and van Ark CD-Rom (2003) and Timmer, Ypma and van Ark (2003).

4. The indirect economic impact of ICTs

As with any form of industrial development, the presence and growth of industries producing ICT goods and services is clearly important to the growth of the economy. The size of the direct benefits depends on how large the ICT (goods and services) producing sectors are relative to the economy and how fast they have grown. With the exception of major ICT producing countries, and countries with low economic activity, the impact of the overall growth of the ICT production and services industry is likely to have a limited direct impact.

Instead, the most important economic impact of the spread and use of ICTs is indirect, by transforming the way individuals, businesses and other parts of the society work, communicate, and interact. The beneficial impact of ICTs on productivity – which can help reduce poverty – is of particular interest as ICT diffusion levels across all countries rise.

One way of understanding the difficulty of measuring the impact that ICTs have, is to imagine the impact that electricity has had on the economy and society. As with ICTs, there is no denying that electricity has had important impacts on individuals, businesses and society at large but its measurement is elusive. Part of

Box 4.1: You want to know the difference ICTs have made? Try to live without them: The difficulty of measuring General Purpose Technologies

Like electrical power before it, ICTs have been recognized as a "*General Purpose Technology*" (GPT) that transforms economic relations, enhances productivity and creates new services and markets. GPTs have the following three characteristics:

Pervasiveness: GPTs spread to most sectors. This suggests that impacts should be measured at a higher level than the firm or disaggregated sectors. Higher levels of aggregation internalise the externalities or spill-over impacts that arise at low levels of aggregation.

Improvement: GPTs get better over time and, hence, should keep lowering the costs of its users. In fact, one of the problems associated with the study of ICTs is that it is constantly evolving. Apart from making quality adjustments for improvements in current technology, new technologies will emerge. ICTs are a moving target.

Innovation spawning: GPTs make it easier to invent and produce new products or processes. That is, they allow us not only to do things better but to do better things. New possibilities are created and specialization raises productivity.

Source: ITU adapted from Bresnahan T. and Trajtenberg M. (1995).

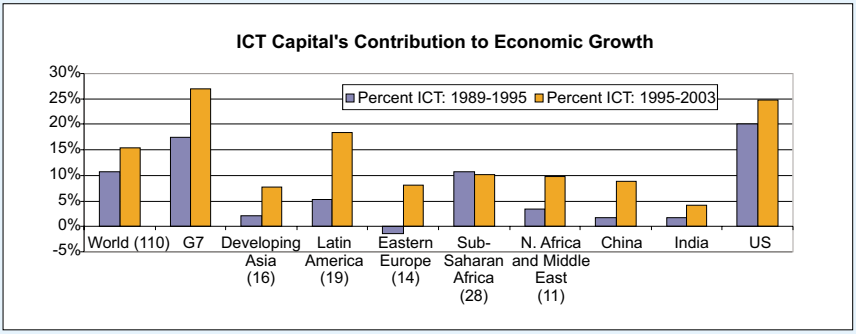
the difficulty is that both ICTs and electricity are "enabling" or "General Purpose Technologies" (Box 4.1), which means their use and their impacts are ubiquitous yet difficult to measure because they are mainly indirect. It is not electricity or ICTs as such that make the (bulk) impact on economy and society but how they are used to transform organisation, processes and behaviours.

Most studies analyzing the impact of ICTs on the economy (outside the ICT sector itself) center around 'productivity' effects. In developed countries, considerable resources and creativity have been devoted to analyze productivity gains in the whole economy, and at sector and firm levels. Several comparative studies have been carried out to analyze the difference in productivity gains in different countries and regions of the world. While the extent of the impact may differ, there is a general consensus that ICTs have a clear impact on economic growth by increasing productivity.

A comprehensive international study comparing the time periods 1989-1995 with 1995-2003 uses separate measures of ICT investment, non-ICT investment, and several measures of labour, to determine the correlation between changes in ICT investment levels and GDP growth across different regions. According to this study, the group that benefited the most from ICTs was the G7, where almost one third (27 percent) of the GDP growth that occurred from 1995-2003 was due to ICT investment. However, in major developing and transition countries, ICT capital played a smaller (although

Figure 4.1: ICT's contribution to economic growth

ICT capital contribution to economic growth, in percent, by region, 1989-1995 and 1995-2003



Source: ITU adapted from Jorgenson and Vu. 2005.

Note: The Group of 7 (G7) refers to the following countries: Canada, France, Germany, Italy, Japan, UK, and US.

Box 4.2: The "Wal Mart Phenomenon": it's not just ICTs

Macro economic research, as well as firm-level data, confirms that ICT investment and higher infrastructure and usage levels alone are not sufficient to produce tangible benefits. This has been described as the "Wal Mart phenomenon" and refers to Wal Mart's (the world's largest retailer) enormous productivity gap, which it was able to develop over its competitors in the industry by combining managerial with technological innovations. It highlights that ICTs have the largest beneficial impact in conjunction with other changes, including a new set of ICT skills/training, structural changes within business models and the economy, and institutional and regulatory adjustments.

increasing) role. Sub-Sahara Africa shows similar economic impact from ICT capital growth over time – about 10 percent – while most other groups showed a greater impact in the later period. Latin America jumped considerably from the first time period to the second (Figure 4.1). The results suggest that the contribution of ICT to economic growth depends on a number of factors outside the ICT area, including a market's regulatory framework and the ability of countries to develop skills and transform their organisational environment. These findings are confirmed by business-level research (Box 4.2).

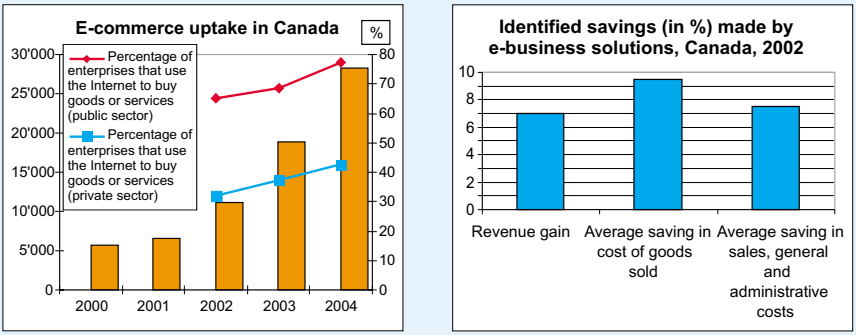
Besides increasing productivity, ICTs are transforming economic relationships and processes in the private and public sectors. While ICTs have had many different impacts across countries worldwide, the transformation of economic relationships and processes is particularly visible on a large scale in those countries and areas that have the highest ICT penetration levels. The spread of broadband also seems to have a particularly important role, for example for the emergence of e-commerce, e-education and teleworking.

E-commerce

There are clear indications that in countries with relatively high ICT levels, B2B (business to business) and B2C (business to consumer) transactions are taking up an increasing market share. Broadband uptake is closely linked to this development. In the UK, the value of Internet sales rose by 81 percent between 2003 and 2004, by when Internet sales accounted for about 3.4 percent of the total value of sales by businesses in the non-financial sector. In Canada, combined private and public sector online sales rose to over CAN$ 28 billion in 2004, from CAN$ 19 billion in 2003, an increase of almost 50 percent. By 2004, close to 80 percent of Canadian public sector businesses and 43 percent of private sector businesses used the Internet to buy goods or services (Figure 4.2, left).

There are a number of financial benefits linked to e-commerce, which allow companies to reduce production, administrative and sales costs and increase revenues (Figure 4.2, right).

Figure 4.2: Spread of e-commerce and net impact of e-business in Canada
Value of online sales, CAN$, and percentage of enterprises that use the Internet to buy goods or services, public and private sector, Canada, 2000-20004 (left) and identified savings (in percent) made by e-business solutions, Canada, 2002 (right)



Source: ITU adapted from Statistics Canada (left) and Canadian e-Business Initiative (CeBI, 2002) (right).

The major barriers to e-commerce uptake include concerns on authentication and security of transactions. Other impediments include the lack of credit cards and convenient payment methods, legal issues, and the lack of broadband Internet access.

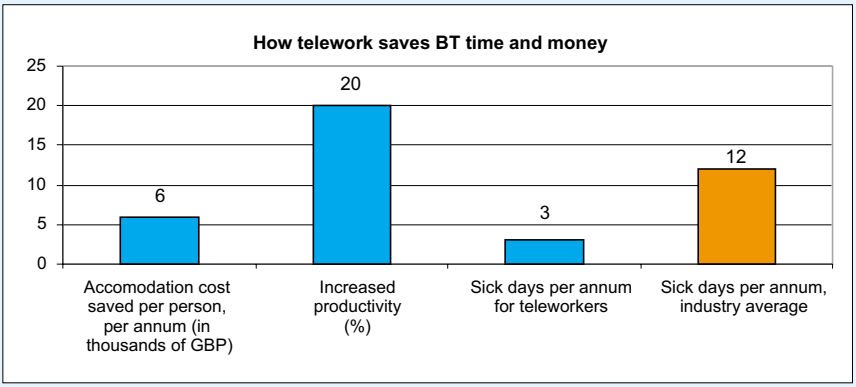
Teleworking

There are many examples of the beneficial impacts of teleworking and a number of countries and businesses have acknowledged the public and business interest of having people work from at home. Besides reduced congestion and environmental impacts due to reduced traffic, telework saves people and businesses time and money.

By early 2006, eleven thousand of the 100'000 employees at British Telecom (BT) were working from home. These teleworkers each save the company accommodation costs of some GBP 6'000 per annum; they have an increased productivity rate between 15 and 31 percent, and each average only three days sick absence per annum against an industry average of 12 days (Figure 4.3). Based on these changes alone, British Telecom estimates that ICT-enabled telework allows the company to save over GBP 60 million per year. In addition, BT also has 70'000 flexible (nomadic or occasional home based) workers, which helps the company to make efficiency savings by cutting down on travel costs.

Figure 4.3: The benefits of teleworking

Telework saves British Telecom accommodation costs, increases productivity and saves time and money lost to sick leave



Source: ITU adapted from Broadband Stakeholder Group (BSG, 2004).

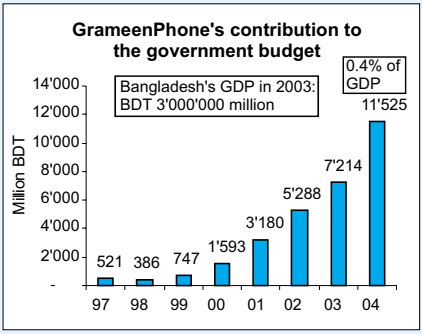
The booming mobile sector

Over the last five years, mobile phones have been the outstanding ICT platform in terms of growth and impact in the developing world. Apart from the evidence about how mobile phones have created business opportunities, incomes and revenues particularly in low-income countries, there is an emerging literature examining the link between the use of mobile phones and economic growth in developing countries. One of the most popularly cited mobile business success stories is that of GrameenPhone, taking place in Bangladesh (Box 4.3). In Nigeria, Africa's most populated country, the telecommunication industry, and particularly the mobile industry, has been recognized as the fastest growing employer of labour. The telecommunication regulator (NCC) estimated that in March 2004 alone the telecom sector created 5'000 new jobs directly and primarily due to the growth in the mobile sector. In the same month, it was estimated that the spin-offs in new businesses – dealerships, retail outlets for GSM handsets and accessories, and one-man phone booth operations – created no less than 400'000 new jobs.

In economic terms, mobiles have spawned new content and equipment industries to serve the booming mobile sector and its users. Since in developing countries mobiles are primarily substitutes, not complements, for fixed lines, the growth dividend is very high. The impact of mobile telephony on economic growth is likely to be much larger in developing countries compared to developed countries since mobiles have opened up entirely

Box 4.3: Mobile creates businesses, jobs, and government revenues – GrameenPhone

Since it first launched its services in Bangladesh in 1997, GrameenPhone has made an important contribution to the country by combining social and economic development. Through its low-pricing strategy, the company was able to increase competition, quickly bring down prices in the telecommunication sector and help increase mobile penetration from 0.3 percent in 1997 to over six percent in 2004. Besides connecting previously remote and unconnected areas, the company's Village Phone (VP) Program has allowed mainly low-income women in rural areas to borrow enough money to buy a handset, a subscription and cover incidental expenses so as to start their own pay phone service. The idea of the VP Program, which is implemented by Grameen Telecom (GTC) in cooperation with Grameen Bank, a micro-credit lending institution is simple: Once the women have received training about the technical operations and tariffs, they are set to start up their own business. The average earning of a Village Phone Operator is about BDT 5000 per month, which is more than twice the country's per capita income. GrameenPhone has also had a major macroeconomic impact and created new employment opportunities. In addition to employing over 1'000 people, the company has created more than 100'000 jobs, including for dealers, agents, contractors, suppliers, and Village Phone operators. GrameenPhone is also one of Bangladesh's largest private sector investors, as well as one of largest taxpayers in the country. By 2004, its contribution to the government represented 0.4 percent of the country's entire GDP (see left Figure).

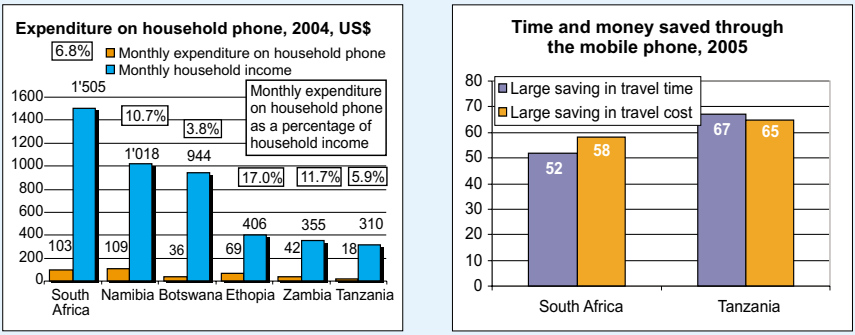


Source: ITU adapted from GrameenPhone.
Note: BDT refers to Bangladesh's currency (Taka).

new communication means. In other words, mobile phones can do for underserved areas what fixed telephone lines did in many other regions and countries years ago: widen markets, create better information flow, lower transaction costs, and substitute for costly physical transport. The use of mobile phones can also improve revenue yields, for example by farmers and fishermen, but it is more difficult to track concrete impacts.

A recent African study that looked at the value of ICTs from the users' perspective highlights the value of the telephone by comparing households' spending on the phone

Figure 4.4: Why people are prepared to spend so much on a (mobile) phone
Monthly expenditure on a household phone as a percentage of household income, in selected Sub-Saharan countries, 2004 (left), and savings (in terms of time and money) made through the use of the mobile phone, 2005 (right)



Source: ITU adapted from researchICTafrica.net (left) and ITU adapted from Vodafone (right).

to their income in 10 Sub-Saharan countries. The survey showed that people are prepared to spend relatively large amounts of their income on telecommunications. In Namibia, Ethiopia, and Zambia, for example, households spend more than ten percent of their monthly household income on the phone. Households in South Africa and Tanzania spend 6.8 and 5.9 percent, respectively (Figure 4.4, left). This compares to an estimated three percent in most developed countries.

People in remote areas, where other forms of communication (such as postal systems, roads and fixed-line phones) are often poor, may be prepared to spend relatively large amounts of their revenue on telecommunications because it helps them save money in other areas. A survey carried out in South Africa and Tanzania, for example, showed that mobile phones helped save money and time. In Tanzania, two thirds of the surveyed population reported large saving in travel time and cost (Figure 4.4, right). The same study produced evidence that mobiles improve relationships with friends and family and help small businesses operate more effectively. In South Africa, 62 percent of small businesses affirmed that they had increased their profits as a result of the mobile phone and 85 percent of those surveyed in Tanzania said they had more contact and better relationships with family and friends as a result of mobile phones.

E-government, e-health and e-education

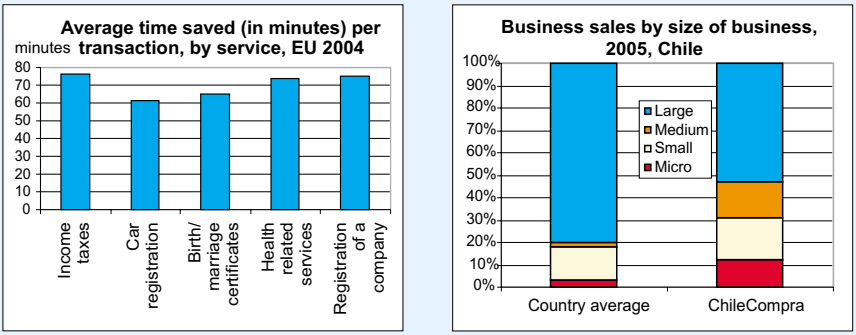
While it is not easy to measure the impact of ICTs in the area of government, health and education, the repercussions that information and communication technologies are having in these sectors are real and a number of studies and surveys have produced some concrete results.

There are a number of impacts that can be identified with regard to e-government, including improved information flows, reduction of process time and cost, and an increase in efficiency and transparency. There have been some efforts to measure benefits, including a 2005 study by the EU, which confirmed that e-government services were producing real benefits for EU citizens, governments and businesses – namely in terms of saving time and gaining flexibility. Online income tax declarations save European taxpayers an estimated seven million hours per year. When generally available and widely used in all member states, such e-services could save over 100 million hours each year. Compared to the same transaction completed offline, the average online transaction saves 69 minutes for citizens and 61 minutes for businesses (Figure 4.5, left).

ChileCompra, the Chilean government's online procurement system, that was launched in 2000, has saved the government over USS 70 million, including through savings in notices in publications, and increased efficiency. ChileCompra has contributed to transparency by giving any citizen access to the details of all contracts for goods or

Figure 4.5: How e-government saves time and increases transparency

Average time saved per e-government transaction, in minutes, EU, 2004 (left) and business sales by size of business, Chile, 2005 (right)



Source: ITU adapted from European Union (left) and ITU adapted from ChileCompra.

services procured by the public sector. The system also has a distinct advantage for the private sector since it provides an equal opportunity to all companies to obtain contracts. While in the overall Chilean economy 80 percent of all business sales are generated by large companies (and only three percent by micro companies and 17 percent by small and medium enterprises), 53 percent of sales through ChileCompra went to large companies and 35 percent went to small and medium enterprises. Twelve percent of contracts were signed by micro enterprises (Figure 4.5, right).

There are many ways in which ICTs can make a difference in education and health; providing access to information and training material is only one of them. At the organisational level, ICTs can bring about major changes to traditional methods of educational and health planning, management, monitoring and evaluation. Because computers are fast, accurate and consistent, they are a tremendous asset to administrations. Information networks and electronic data storage, too, can help schools and health care institutions improve communication and efficiency by doing more in less time.

Information and communication technologies have also created telemedicine and distance education. Education through the Internet has become a real option in developed countries and is significantly changing the way people learn. A recent US survey of more than 1'000 colleges and universities revealed that by 2005, more than three out of five institutions were complementing their face-to-face undergraduate level courses by online courses. The number of online students is increasing at a much faster rate than the overall number of higher education students and online enrollment grew from 1.98 million in 2003 to 2.35 million in 2004.

Given the shortage of educational institutions and teachers in many developing countries, distance education could have a substantial impact on providing training and education, for example in the area of teacher's training. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) estimates that an additional 15-35 million educated and trained teachers will be needed over the next decade if all countries are to achieve the MDGs of universal primary education by 2015. ICT-based distance training can overcome the shortage of primary school teachers by accelerating instruction. ICTs can also supplement primary school teaching, thereby helping to overcome shortages. While the extent of the impact of distance education is not known, there are a number of educational institutions providing distance education in developing countries, including the University of the South Pacific and the African Virtual University.

5. Measuring the impact of ICTs on social development

It is widely accepted by policy makers, politicians, industry and citizens alike that information and communication technologies (ICTs) play a critical role not only in economic but also social development. There are growing examples of ICTs being used to address social development goals, including the Millennium Development Goals (MDGs). These are as various as monitoring food security in Africa, using geo-spatial mapping to identify food-insecure communities in Cambodia, providing informal education in Mexico, enhancing teacher training in Tanzania, and identifying rises in disease incidence during the Tsunami. The World Summit on the Information Society (WSIS), highlighted "*the growing importance of the role of ICTs, not only as a medium of communication, but also as a development enabler, and as a tool for the achievement of the internationally-agreed development goals and objectives, including the Millennium Development Goals" (Tunis Agenda for the Information Society, paragraph 12).*

Although an increasing amount of data has been compiled to track the diffusion of ICTs, there has been far less work on the *impact* they have had on people's lives, particularly in the developing world. Quantitative data are almost non-existing. A useful way of developing indicators to measure the impact of ICTs on the MDGs is through a system that is based on inputs, outputs and outcomes (Figure 5.1):

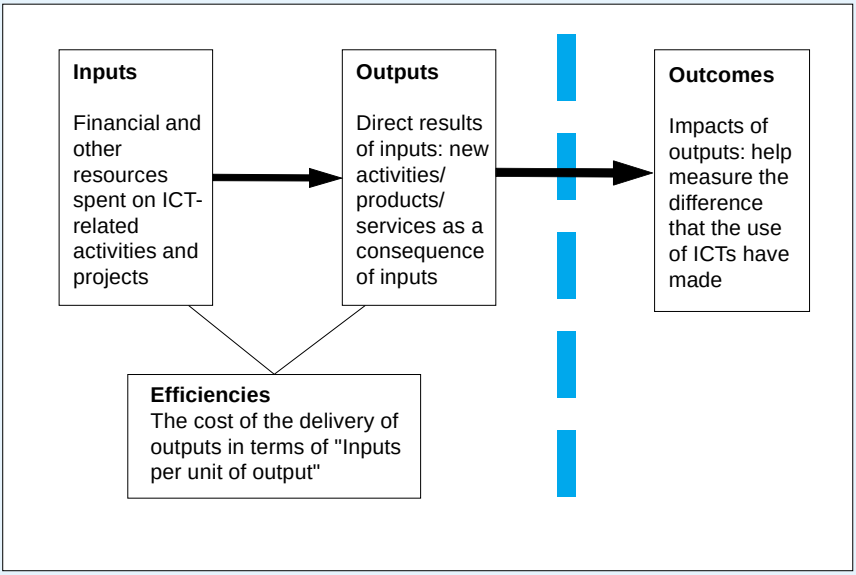
- The financial (and other) resources invested to use ICTs to address a specific social objective can be described as **inputs**: for example the amount spent on connecting a teacher training college.

- Once inputs are in place, it is possible to measure **outputs**, which are the direct results of inputs: for example, online training courses for teachers provided at the connected teacher training colleges. Merely counting outputs often does not say much about qualitative improvements as such and cannot always reflect the full level of gains made.

- Finally, **outcomes** are the impact of outputs and help measure the difference that the use of ICTs has made: Outcomes can be measured through a combination of hard or soft performance measures. A hard measure is usually quantitative in nature, while soft measures could be less tangible and include proxies to measure objectives. For example, if the objective of an organisation was to publicize malaria, the level of media coverage could be a proxy indicator.

- Efficiencies refer to the cost of the delivery of outputs. One of the key arguments for using ICTs is that if they work well, they are capable of delivering social services both more effectively and at a lower cost. Therefore it is important to measure the cost of delivery, in terms of input per unit of output.

Figure 5.1: How to measure the impacts of ICTs on social development: inputs, outputs and outcomes



Source: ITU.

To understand whether real progress is being made towards the MDGs with the use of ICTs it is necessary to measure progress at two different levels:

1. at the country level for government policy makers and for comparisons
2. at an organisational level for organisations and donors to judge and measure progress

Based on the input/output/outcome scheme and the dual (country and organisation) level approach, it is possible to illustrate ways of measuring the impact of ICTs on the MDGs. Table 5.1 demonstrates how an ICT input (an ICT training facility) will generate certain outputs (for example, youth trained) and how the impact of the outcomes of this process can be measured (in terms of a reduction of youth unemployment). On the organisational level, the purpose is to provide a way of giving an organisation (for example a development agency) a focused goal for the commitment it has to the MDGs.

In order to be useful for diagnostic purposes – like identifying "hot-spots" of MDG-related needs – country level indicators should be capable of being broken down to a local government level and, if possible, in some areas, to the village level.

The difference between organisational and national indicators is that the former will be generated much more quickly. A health organisation, for example, may be identifying the spread of disease in the wake of a disaster and need to correlate data quickly to respond. Broader national indicators will take longer to collect and may have to be complemented by case studies, for example to highlight the successful use of ICTs in the area of training in the health sector, or the increase of incomes by those who have access to ICTs. Some outcome (impact) may be observed with the help of data provided by the national surveys, for example in the area of employment or child mortality rates.

However, in order to make judgements about the effectiveness of ICTs that go beyond parading anecdotal success stories, it is necessary to have an underlying process that can compare processes aimed at addressing MDGs with or without the use of ICTs. In this way, it will be possible to discover whether ICTs are delivering on the promises made for them and in a diagnostic way to discover why not, if this should be the case.

Of course this also means that governments need to be able to track *inputs* that show, for example, how many hospitals and clinics are carrying out their MDG-related activities supported by ICTs. They also need to be able to track the *outputs* and finally, *outcomes*. Ultimately the question of efficiency needs to be addressed. For example, was the delivery of treatment to patients more effective or cost-efficient than its non-ICT-supported equivalent? With efficiency indicators, it is important to look at the cost of delivery (for example, per patient or per pupil) and see whether the use of ICTs over a reasonable period might affect both the effectiveness and cost of delivery. Efficiencies can be viewed not only in terms of immediate savings but whether the same amount of money produces a better result.

In order to be able to "read across" from inputs to outcomes, national governments need to be able to collect the inputs like technology diffusion data. Each ministry should be able to identify from one year to the next how many computers it has in MDG-related areas, how many are actively connected and where they are located. This data is vital for assessing ICT impact because it should – either at local, national or regional level – enable governments to compare the relative performance of, for example, health districts with very little ICT support against those with more ICT support. Without the ability to make these kinds of comparisons, it becomes significantly harder, if not impossible to track the impact of ICTs.

It has to be possible to draw a fairly clear line between what the intended consequence was and what actually happened. Failure to achieve the required outcomes will allow governments and the agencies involved to look at the reasons for this failure; whether there were external factors or whether something was wrong in terms of delivery.

Table 5.1: Measuring the impact of ICTs on the MDGs

Indicators at the organisational level

MDG	*Inputs*	*Outputs*	*Outcome (impact)*
1. Eradicate extreme poverty and hunger	Provide ICT-based agricultural pricing information	Access to price information for farmers	Increased income for farmers
2. Achieve universal primary education	Networking teacher training colleges	ICT- delivered, (lower cost) training for teachers	Increased number of teachers trained
3. Promote gender equality and empower women	Set up multi-purpose community centres (run for/by women) that provide ICT training	Number of women trained in ICTs	Increased number and type of jobs obtained by women
4. Reduce child mortality	Connected rural health clinics to a telemedicine network	Number of web-based consultations	Reduced child mortality
5. Improve maternal health	Targeted online information for rural health clinics	Improved advice and diagnosis	Reduced maternal mortality
6. Combat HIV/ AIDS, malaria, and other diseases	Introduce call centres for HIV/ AIDS info	Advice given to potential patients	Reduction in the number of new people infected with HIV/AIDS
7. Ensure environmental sustainability	E-group network on environmental issues	Exchange of info & issues	Raised awareness
8. Develop a global partnership for development	Set up ICT training facilities at colleges/ universities	Increase the number of IT graduates	Reduced youth unemployment

Table 5.1: Measuring the impact of ICTs on the MDGs (cont'd)

Indicators at the national level

MDG	*Inputs*	*Outputs*	*Outcome (impact)*
Underlying	*Number of ICT-supported activities addressing MDGs*	*Number of ICT-supported MDG transactions*	*Changes in MDGs brought about by using ICTs compared to without ICTs*
1. Poverty	Wider diffusion of ICT access	Increased market income	Increased annual income
2. Universal primary education	Increased number of teachers trained, using ICT-supported in-service training	Larger number of available teachers	More pupils taught where training supported by ICT
3. Gender equality	Number of ICT activities directed at women trained	Increased number of women taking part in ICT training/ activities	Positives changes in women's status and employment based on ICTs
4. Child mortality	More connected rural clinics	More ICT-delivered or supported advice for nurses	Lower mortality rates in ICT-supported clinics
5. Maternal health	More ICT supported training and consultations to health staff	Increased ICT-delivered diagnosis and expertise	Reduced maternal mortality rates where staff have received ICT-supported training
6. Combat HIV/AIDS	New opportunities to access advice by phone or online	Number of people taking advice by phone or online	Fewer new cases of HIV/AIDS and improved treatment for those who sought advice by phone or online
7. Ensure environmental sustainability	National reporting of specified sustainability issues using ICTs	Exchange of info & networking using ICTs	More effective actions taken to curb patterns of environmental abuses
8. Develop a global partnership	Global professional networks	Sharing of best practice	Faster improvements in achieving MDGs

Source: ITU.

6. Conclusions

Old and new divides

Access to information and communication technologies continues to grow at high speed and the digital divide – in terms of mobile subscribers, fixed telephone lines and Internet users – keeps getting smaller. At the same time, the world continues to be separated by major differences and disparities in terms of ICT levels. High growth rates in some areas, and particularly the mobile sector, are not sufficient to bring digital opportunities to all and many developing countries risk falling behind, particularly in terms of Internet access and newer technologies such as 3G and broadband. It is important to counteract such a new technology divide, particularly since broadband is playing a crucial role in transforming countries into Information Societies. Some of the applications that are having the greatest impact on people and businesses are closely linked to broadband uptake. Since access to basic communications in the developing world has largely been achieved through mobile communications, broadband wireless access is expected to play a key role for developing countries seeking to foster the Information Society.

The lack of and need for impact indicators

The world has made some important progress in agreeing upon a common set of Information Society access and usage indicators and efforts continue to improve the availability and comparability of core Information Society indicators. At the same time, the work carried out in the area of impact measurement is still at a nascent stage, and often restricted to developed countries. Despite the potential of ICTs to be an engine for social and economic development, there is limited quantifiable proof and little internationally comparable data. The debate on the role of ICTs for development and their potential to reduce major development concerns (including those of the MDGs) calls for the identification of appropriate impact indicators.

The impacts of ICTs are multiple and real

Even if the ICT sector is growing faster than the overall economy, and representing a substantial (and often growing) part of GDP in some countries, the real potential of ICTs is not the direct impact of the ICT sector itself. The key economic impact of the spread and use of ICTs is indirect, by transforming the way individuals, businesses and other parts of the society work, communicate and interact. Of particular interest is the ability of ICTs to raise productivity. Different macro-economic and firm-level studies confirm high potential productivity gains from ICTs but emphasize that the benefits of ICTs depend on a number of other factors. To maximize the effects of ICTs, other changes, including a new set of ICT skills, structural changes within business models and institutional and regulatory adjustments within the economy, must be made. Most of the existing studies apply to developed countries and regions and more research needs to be carried out on the impact of ICTs on sector and firm-level productivity in developing countries.

Besides increasing productivity, ICTs are transforming economic relationships and processes in the private and public sector. Positive impacts have been observed and measured across developed and developing countries. Just as e-commerce and teleworking allow companies to reduce costs and increase revenues, e-government has the potential to save money, increase efficiency and raise transparency in the public sector. There have been a number of successful efforts by governments, organisations, and industry to quantify the positive impacts of ICTs. It is obvious that both administrative data and case studies and sector-specific surveys need to be carried out to measure the impact of ICTs.

The sector that so far has had the strongest impact in developing countries is the mobile sector, particularly since mobiles are not just a different or complementary way of communication but have opened up entirely new communication means in many parts of the developing world. The boom of the mobile industry has not just created new jobs and revenues but also contributed to economic growth by widening markets, creating better information flow, lowering transaction costs, and substituting for costly physical transport.

Apart from the impact of the mobile sector, the transformation of economic relationships and processes is particularly visible in those countries and areas that have the highest Internet penetration levels. The spread of broadband seems to have a particularly important role in certain areas, including for the emergence of e-commerce, teleworking, and e-education and health. This highlights the need for developing countries to pay special attention to broadband deployment and strategies.

ICTs are also having a real impact on social development, although the quantification of this impact and the development of indicators are complex and must be seen as a constantly evolving process. The report has suggested a way of measuring the impact of ICTs on the achievement of the Millennium Development Goals (MDGs) through a system that distinguishes between inputs, outputs and outcomes (Table 5.1). This approach could help organisations (such as development agencies) as well as governments track the efficiency of using ICTs in achieving the MDGs. Efficiencies must be viewed not only in terms of providing more but also better results through the incorporation of ICTs.

Annex Table 1

Core indicators on ICT infrastructure and access

Basic core

A1 Fixed telephone lines per 100 inhabitants

A2 Mobile cellular subscribers per 100 inhabitants

A3 Computers per 100 inhabitants

A4 Internet subscribers per 100 inhabitants

A5 Broadband Internet subscribers per 100 inhabitants

A6 International Internet bandwidth per inhabitant

A7 Percentage of population covered by mobile cellular telephony

A8 Internet access tariffs (20 hours per month), in US$, and as a percentage of per capita income

A9 Mobile cellular tariffs (100 minutes of use per month), in US$, and as a percentage of per capita income

A10 Percentage of localities with public Internet access centres (PIACs) by number of inhabitants (rural/urban)

Extended core

A11 Radio sets per 100 inhabitants

A12 Television sets per 100 inhabitants

Core indicators on access to, and use of, ICT by households and individuals

Basic core

HH1 Proportion of households with a radio

HH2 Proportion of households with a TV

HH3 Proportion of households with a fixed line telephone

HH4 Proportion of households with a mobile cellular telephone

HH5 Proportion of households with a computer

HH6 Proportion of individuals who used a computer (from any location) in the last 12 months

HH7 Proportion of households with Internet access at home

HH8 Proportion of individuals who used the Internet (from any location) in the last 12 months

HH9 Location of individual use of the Internet in the last 12 months (various options available in the full report)

HH10 Internet activities undertaken by individuals in the last 12 months (various options available in the full report)

Extended core

HH11 Proportion of individuals with use of a mobile telephone

HH12 Proportion of households with access to the Internet by type of access

HH13 Frequency of individual access to the Internet in the last 12 months (from any location) (various options available in the full report)

Annex Table 1 (cont'd)

Core indicators on access to, and use of, ICT by households and individuals (cont'd)

Reference indicator

HHR1 Proportion of households with electricity

Core indicators on use of ICT by businesses

Basic core

B1 Proportion of businesses using computers
B2 Proportion of employees using computers
B3 Proportion of businesses using the Internet
B4 Proportion of employees using the Internet
B5 Proportion of businesses with a Web presence
B6 Proportion of businesses with an intranet
B7 Proportion of businesses receiving orders over the Internet
B8 Proportion of businesses placing orders over the Internet

Extended core

B9 Proportion of businesses using the Internet by type of access
B10 Proportion of businesses with a Local Area Network (LAN)
B11 Proportion of businesses with an extranet
B12 Proportion of businesses using the Internet by type of activity (various options available in the full report)

Core indicators on the ICT sector and trade in ICT goods

Basic core

ICT1 Proportion of total business sector workforce involved in the ICT sector
ICT2 Value added in the ICT sector (as a percentage of total business sector value added)
ICT3 ICT goods imports as a percentage of total imports
ICT4 ICT goods exports as a percentage of total exports

Source: Partnership on Measuring ICT for Development.

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