International Telecommunication Union

Measuring the Information Society

The ICT Development Index

2009

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Foreword

It is my pleasure to present to you the latest edition of *Measuring the Information Society,* which features the new ITU ***ICT Development Index***. The Index captures the level of advancement of information and communication technologies (ICTs) in more than 150 countries worldwide and compares progress made between 2002 and 2007. Its main objective is to provide policy makers with a useful tool to benchmark and assess their information society developments and to monitor progress that has been made globally to close the digital divide.

The need to develop an ICT index was emphasized in the outcome documents of the two World Summits on the Information Society (WSIS). The Geneva Plan of Action calls for a realistic international performance evaluation and benchmarking through comparable statistical indicators, and the creation of a composite index. This was reiterated in the Tunis Agenda, which calls for periodic evaluation through indicators and benchmarking, and an assessment of the magnitude of the digital divide.

This publication has been produced in response to those calls and following the request from ITU members to develop a single ITU index to track the digital divide and to measure countries' progress towards becoming information societies.

The ICT Development Index takes into consideration, as much as possible, the many, and varied comments and suggestions provided by members and experts on the creation of the single index. While we are aware of the fact that we cannot do justice to everyone – in reality no composite index can fulfil this goal – we are confident that we have produced an index that will be useful to all member countries – those that are more ICT advanced as well as those that are still developing their ICT infrastructure and services. The index can be easily replicated by interested countries; it also allows to measure the magnitude of the global digital divide, and to monitor its evolution.

This Report examines global and regional ICT developments during the past five years based on the index results. They reveal that despite huge improvements that were made in the access and use of ICTs worldwide, large disparities remain among countries. The top ranking economies are primarily high-income countries from the developed world, whereas the least developed countries rank towards the bottom of the index. Despite impressive growth in the uptake of mobile telephony in many countries, the magnitude of the digital divide remains almost unchanged. However, the divide is slightly closing between countries with very high and those with low ICT levels.

An important element in monitoring ICT developments is to examine the cost of ICT services. High tariffs are often a major barrier to ICT uptake, in particular among poor people. I am pleased to present to you our new ICT Price Basket, which combines fixed telephone, mobile cellular and fixed broadband tariffs into one measure and compares it across countries, not only in absolute values, but relative to countries' national incomes. The results show that fixed and mobile telephony is becoming more and more affordable worldwide; however, fixed broadband Internet is still out of reach – in terms of affordability – for the majority of the world's inhabitants. This is clearly one of the main policy challenges that need to be addressed in this sector in the years to come. We foresee to publish the new ICT Price Basket annually and therefore countries will be able to monitor global price developments over time.

The Report comes out at a time when the global economy is facing one of its greatest challenges in decades. We do not know yet how long the crisis will last or how profound its impact will be on future ICT developments. This will be revealed only in the next edition of Measuring the Information Society. But given the fact that ICTs are one of the most powerful engines of growth, that there has been strong and uninterrupted growth in most ICT services over the past few years and that the demand for ICTs from large developing countries is high, I am confident that ICTs will continue to spread and serve their purpose as critical development enablers.

It is my hope that this Report will be useful to policy makers, the ICT industry, market analysts and others who are monitoring global ICT developments. After all, it is evidence-based policy making that will have the greatest impact on countries' efforts to become inclusive information societies.

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ITU is grateful to the comments and suggestions received from participants attending the 6th World Telecommunication/ICT Indicators Meeting held in Geneva in December 2007, and from members of the ITU single index online discussion forum. Helpful comments on the construction of the index were also provided by Michael Minges (Telecommunications Management Group, Inc.), George Sciadas (Statistics Canada) and Philippa Biggs (ITU). David Cieslikowski (World Bank) provided useful inputs into the development of the ICT Price Basket.

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ITU also appreciates the cooperation of countries that have updated the data included in the index.

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Chapter 1

Introduction

During the past year, information and communication technologies (ICTs) continued to spread throughout the world, and more and more people have access to the Internet and its wealth of information and applications. Access to the Internet via mobile cellular networks has grown rapidly with the increasing availability of IMT-2000/3G networks and enabled devices, including mobile handsets and data cards that allow users to access the Internet over the mobile cellular network using their computers. Internet access speeds are also increasing, with fixed broadband replacing dial-up in most developed countries, accompanied by a decline in tariffs.

In the developing world, mobile phones have revolutionized telecommunication and have reached an estimated average 61 per cent penetration rate at the end of 2008 – from close to zero only ten years ago. This is not only faster than any other technology in the past, but the mobile phone is also the single most widespread ICT today. The number of Internet users, on the other hand, has grown at a much slower rate, in particular in the developing world, where at the end of 2007 only 13 out of 100 inhabitants used the Internet. Fixed Internet access in developing countries is still limited, and, where available, often slow and/or expensive. High-speed (broadband) connections are rare and mobile broadband, while increasing steeply in high-income countries, is still insignificant in most developing countries.[1]

In light of such developments, the question remains as to whether the global digital divide is widening or narrowing, what the contributing factors are, and what progress has been made by individual countries to close the digital divide.

This Report will address these issues by providing an analysis of global ICT developments based on quantitative indicators.

Continuous monitoring of ICT trends and developments is crucial to policy makers, ICT service providers and market analysts. Given the potential impact of ICT use on social and economic development, countries strive towards making the benefits of ICT available to all people. But evidence-based policy making requires measurable facts and comparable indicators. Comparing individual countries' ICT achievements with those of others is an important benchmark to assess regional and global competitiveness and provides incentives to deploy policies that enhance ICT development at the national level.

Therefore, calls for benchmarking information society developments have been made at the international level during the World Summit on the Information Society (WSIS).[2] In its 2003 outcome document (Geneva Plan of Action), members request a realistic international performance evaluation and benchmarking through comparable statistical indicators, and the creation of a composite ICT development index. This was reiterated in the Tunis Agenda (paragraphs 113-119), which calls for periodic evaluation through indicators and benchmarking, and an assessment of the magnitude of the digital divide. Compared to individual indicators, composite indices allow grouping several key performance indicators into one single figure that captures a variety of information society developments and provides a more comprehensive picture of where countries stand in their evolution towards an information society.

One of the objectives of this publication is to respond to those calls and provide policy makers with a useful tool to benchmark and assess their information society developments, as well as to monitor progress that has been made globally to close the digital divide.

In conjunction with the WSIS process, a number of ICT composite indices have been published, including by the

ITU. This Report builds on these indices and presents the ICT Development Index (IDI), which incorporates different aspects and lessons learned, from earlier indices. In particular, the development of the IDI has been guided by previous ITU composite indices, such as the Digital Access Index (DAI), the Digital Opportunity Index (DOI) and the ICT Opportunity Index (ICT-OI). The IDI has been produced as a response to calls by ITU Member States to merge previous ITU indices into a single index in order to track the digital divide and benchmark information society developments.

The ICT data presented in the Report and used to construct the Index are all collected by ITU, mostly through its annual questionnaire sent to Governments. They are complemented by data capturing literacy and enrolment, sourced from UNESCO.

The Report first provides a brief overview of the latest global trends in selected key ICT indicators, including the latest estimates for year-end 2008 (Chapter 2).

Then, the ITU ICT Development Index (IDI) will be presented for two years, 2002 and 2007. Chapter 3 explains the background and context for developing the IDI and presents the conceptual framework and the methodology used to compute the IDI. It is followed by a discussion of the results in Chapter 4. The chapter will show progress made between 2002 and 2007, for individual countries, regions, as well as by level of development. It features the overall Index as well as its three subcomponents (access, use, and skills) and explains why countries are doing better in one or another area, and how their ICT levels changed during the five-year period.

Chapter 5 takes a closer look at the global digital divide. Based on the IDI values, statistical methods were applied to measure the changes in ICT developments by groups of countries at different ICT levels, from 2002 to 2007. Although results have to be interpreted with caution, they suggest that globally the digital divide is as prevalent as before, but is slightly closing between countries with very high and low ICT levels.

A new ITU ICT Price Basket was created to track changes in tariffs charged for key ICTs (Chapter 6). The ICT Price Basket, which combines prices for fixed and mobile telephony, and broadband Internet access, provides for the first time a measurement tool for assessing ICT affordability globally. It compares prices among countries for the three ICTs in US$ values, in Purchasing Power Parity (PPP) values, and as a percentage of Gross National Income (GNI). The results reveal that while fixed telephone tariffs are relatively cheap in most countries, fixed broadband tariffs are often prohibitive and thus a major impediment for countries embracing ICTs. While the ICT Price Basket is presented here for one year only (2008), the objective is to track it annually and thus provide policy makers with a tool to monitor ICT price developments over time. Data on tariffs were collected by ITU directly from commercial offers advertised on operators' websites.

Chapter 7 summarizes the main findings of the Report, draws conclusions and provides some policy recommendations.

Endnotes

[1] This Report uses the United Nations classification of developed/developing countries. See http://unstats.un.org/unsd/methods/m49/m49regin.htm.

[2] For more information on the WSIS and its outcome documents, see http://www.itu.int/wsis/index.html.

Chapter 2

ICT Market Overview

The last decades have seen uninterrupted growth in terms of telecommunication and ICT infrastructure development and service uptake. By the end of 2008, an important milestone in the ICT development race was achieved: over 4 billion mobile cellular subscriptions worldwide, translating into a penetration rate of 61 per cent.[1] At the same time, ITU estimates that the world had 1.3 billion fixed telephone lines – or 19 per 100 inhabitants – and that almost a quarter of the world's 6.7 billion people were using the Internet. However, fixed and mobile broadband penetration levels remained relatively low and stood at 6 and 5 per cent respectively (Chart 2.1).

Despite high growth rates, record numbers, and all-high penetration rates, major differences in ICT levels between regions and between developed and developing economies remain.

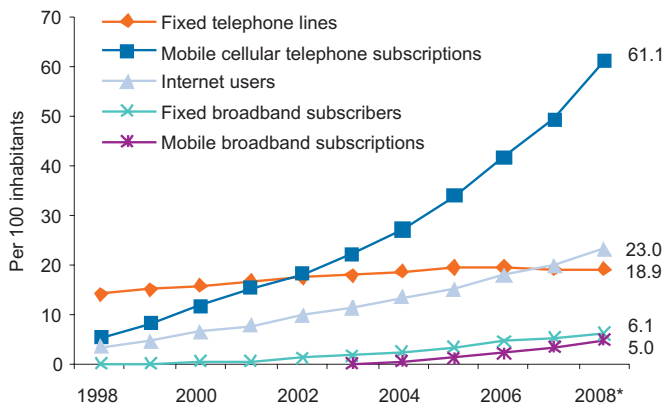
2.1 Fixed and mobile cellular telephony

There has been a clear shift from fixed to mobile cellular telephony, especially since the turn of the century. By the end of 2008, there were over three times more mobile cellular subscriptions than fixed telephone lines (Chart 2.2, top left). In contrast to the growth in the mobile sector, fixed telephony has experienced nearly no growth in the last decade. Indeed, fixed line global penetration has been stagnating at just under 20 per cent for the last years. While the number of fixed telephone lines is actually decreasing in many developed countries, it tends to show very small growth rates in developing countries, where penetration rates stand at 14 per cent.

The spread of mobile cellular services and technologies has made great strides towards connecting the previously unconnected, with growth most significant in developing regions, where, by the end of 2007, mobile cellular penetration had reached close to 40 per cent (Chart 2.2, top right). By the end of 2007, 64 per cent of the world's mobile subscriptions were from developing countries. Five years earlier, in 2002, they represented only 44 per cent (Chart 2.2, bottom left).

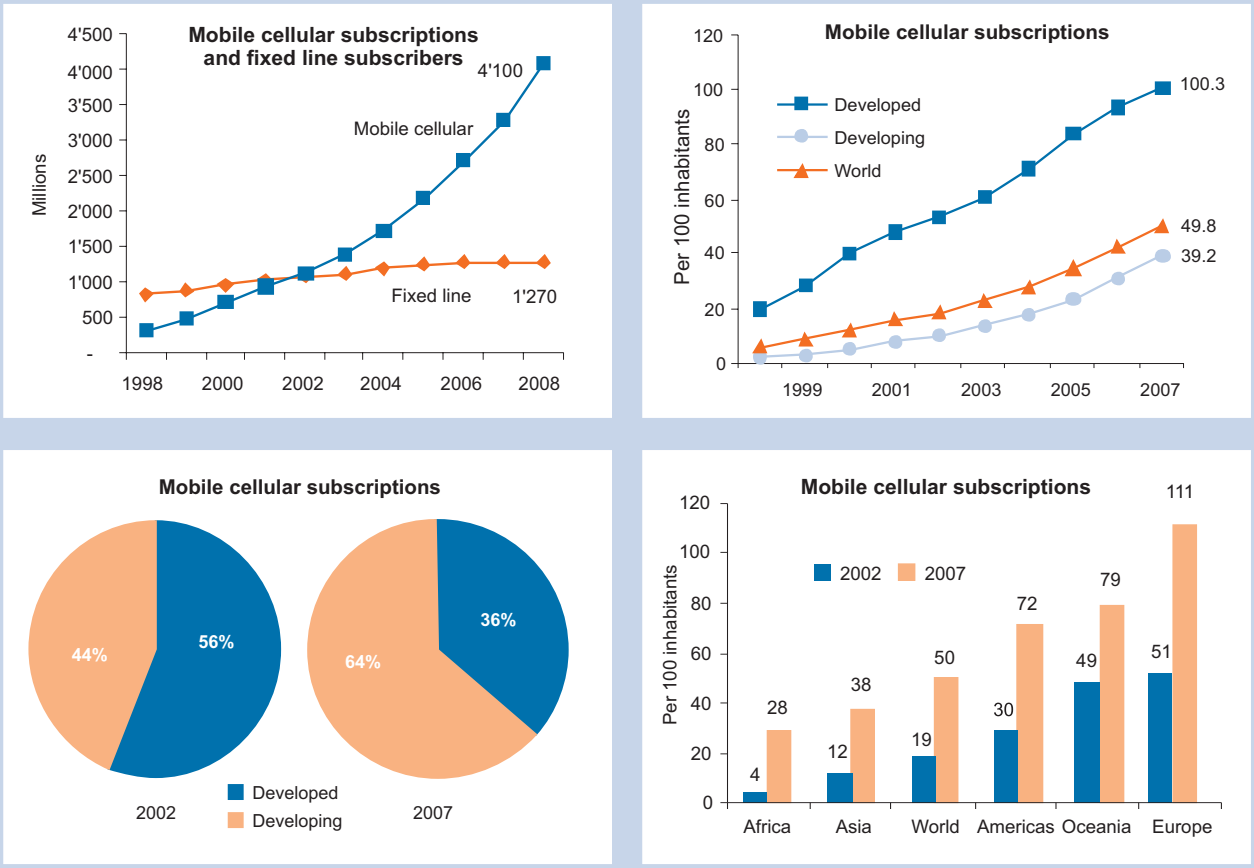
Amongst the developing regions, Africa continues to have the highest mobile growth rate (32 per cent in 2006/2007) and mobile penetration has risen from just one in 50 people at the beginning of this century to over one fourth of the population today. Africa's mobile penetration of 28 per cent compares to 38 per cent in Asia, 72 per cent in the Americas, 79 per cent in Oceania, and 111 per cent in Europe[2] (Chart 2.2, bottom right). Since growth rates continue to be

Chart 2.1: Global ICT developments, 1998-2008



Note: * Estimates.
Source: ITU World Telecommunication/ICT Indicators database.

Chart 2.2: Mobile cellular growth and distribution



Note: * Estimates.
Source: ITU World Telecommunication/ICT Indicators database.

strongest in those regions where penetration is relatively low, the mobile cellular divide is expected to be reduced further over time.

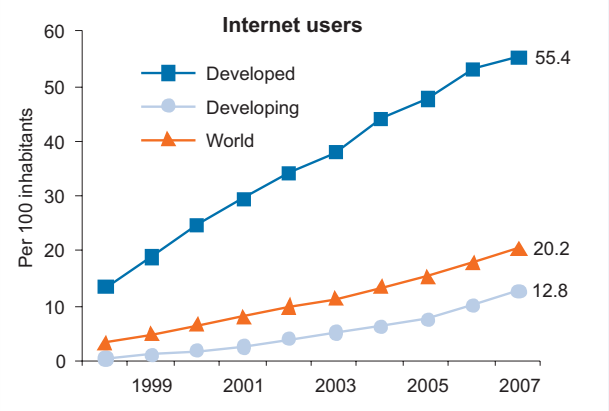
2.2 Internet and broadband developments

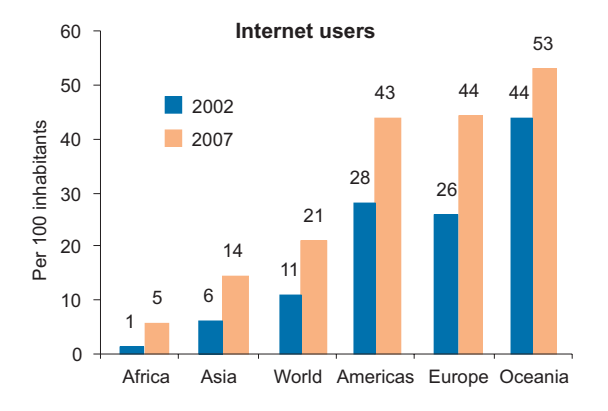
While the number of estimated Internet users worldwide continues to grow rapidly – by the end of 2007 an average of one out of five people were online – penetration levels in the developing world remain low, at around 13 per cent (Chart 2.3, left). Especially Africa, where less than 5 per cent of the population use the Internet, is lagging behind. In Asia, less than 15 per cent of people use the Internet, compared to 43 and 44 per cent in Europe and the Americas (Chart 2.3, right).

ITU has repeatedly highlighted the importance of broadband for development. Many of the most effective applications and services that can foster development are only available through a high-speed Internet connection, for example those related to e-commerce, e-government or e-banking.

ITU data on Internet and fixed broadband subscribers suggest that more and more countries and people are going high speed. By the end of 2007, over 60 per cent of all Internet subscribers had a broadband connection. Dial-up is being replaced by fixed broadband across developed and developing countries, including Senegal, Chile and Turkey, where broadband subscribers represent over 90 per cent of all Internet subscribers. At the same time, the shift from dial-up to broadband hides major differences in broadband penetration levels, which remain very low in the developing economies and regions. While in 2007 fixed broadband penetration stood at less than 0.2 per cent in Africa, it had reached much higher levels in Europe (14 per cent) and the Americas region (11 per cent) (Chart 2.4, left). The difference in

Chart 2.3: How many are online?





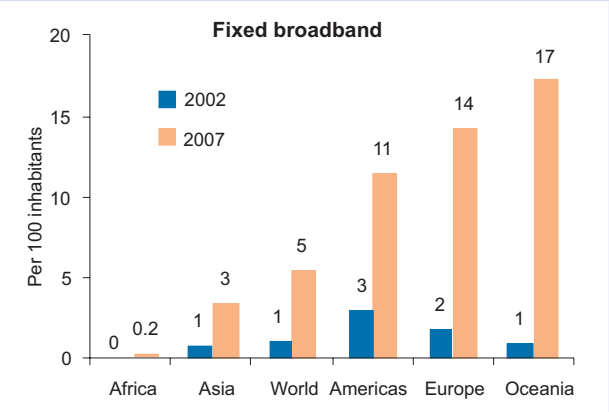
Source: ITU World Telecommunication/ICT Indicators database.

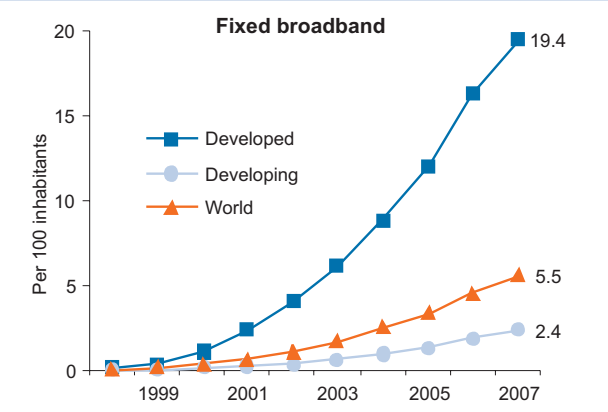
the uptake of fixed broadband is also reflected by the penetration gap that separated the developed from the developing world (Chart 2.4, right).

With limited availability of fixed networks in many developing countries, where wired access is often restricted to major urban centers, it is difficult to provide people with fixed broadband access. However, mobile broadband has a major potential to expand the availability of high-speed Internet access, especially given the spread of mobile cellular networks and their wide population coverage. This is also supported by the growing use of mobile phones for data applications (SMS, MMS, m-commerce and m-banking), the rise in the number of countries that are launching IMT-2000/3G networks and the increased use of data cards that allow people to use the IMT-2000/3G networks to connect their computer to the Internet. ITU estimates that by the end of 2008, there were close to 335 million mobile broadband subscribers.[3] It should be noted that this figure needs to be treated with caution since not all mobile broadband subscribers are actual users of mobile broadband services.

By the end of 2007, about 85 countries worldwide had launched and were commercially exploiting IMT-2000/3G networks. A comparison of developed versus developing economies shows that, similar to fixed broad-

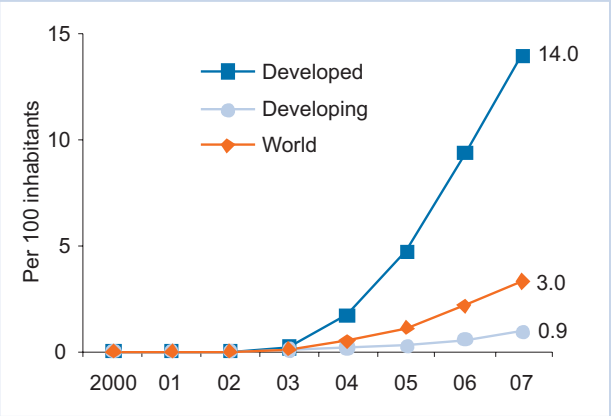
Chart 2.4: Fixed broadband subscribers by geographic region and by level of development





Source: ITU World Telecommunication/ICT Indicators database.

Chart 2.5: Mobile broadband subscriptions



Source: ITU World Telecommunication/ICT Indicators database.

band subscribers, mobile broadband uptake is dominated by the developed world, where mobile broadband penetration has reached 14 per cent, compared to less than one per cent in the developing world (Chart 2.5). While these trends suggest that developing economies have much catching up to do, technological advances especially in the mobile sector are offering new possibilities and the potential to help more and more people communicate, and take advantage of Internet services at increasingly at high speed.

2.3 Market outlook

At the time of the publication of this Report, the world is subject to a profound global economic crisis. It is not yet possible to foresee how the economic downturn will affect ICT markets in general and in the developing world, in particular. While most of the recent news are focusing on how the crisis has reduced revenues of telecommunication carriers and operators and forced ICT manufacturers and service providers to cut jobs, the impact on consumers will depend on a number of factors. While network operators may see themselves confronted with limited capital and reluctant to follow through with costly network investments (for example IMT-2000/3G, Wimax or optical fibre networks), the need to keep and attract new customers, and increase market shares and revenues may also increase competition and bring down service prices. It might also encourage and force businesses to increase their attention to developing markets and low-income users, where much lower, yet highly dynamic penetration rates in the last years hint at greater market opportunities.

The dynamics and potential of the developed and developing markets will also depend on how the crisis will alter spending patterns. While higher unemployment rates and lower revenues certainly reduce discretionary incomes, it is the choice of consumers how and in which areas to reduce spending. Depending on the importance they attach to their telecommunication and ICT services, they may, or may not, cut the cord, or give up their mobile cellular or broadband service.

Despite the economic downturn, current global ICT developments are unlikely to change drastically, given the pervasive nature of information and communication technologies. The use of modern telecommunication devices and the Internet will continue. Given the uninterrupted growth in almost all ICT services, a decline in growth rates – rather than an actual reduction in subscriber numbers – seems more likely.[4]

2.4 From indicator to index

ITU's subscriber and usage indicators, which were presented in this chapter, provide impartial insights into the growth of certain ICTs and their development across regions. The ICT Development Index (IDI) is based on these, as well as several other indicators that are considered essential (and that are available) in terms of measuring ICT developments. By combining multiple indicators into a single value, the IDI will provide a holistic picture on the state of ICT development within a country. It will allow policy makers to put their countries' achievements into context, by benchmarking them to other countries at similar income levels, or with similar geographic, social or regional characteristics. Through this, the IDI will also help Governments set realistic targets and track and evaluate developments over time. The sub-indices on which the IDI is based will further provide policy makers with the opportunity to identify strengths and weaknesses and to adapt and develop policies accordingly.

Endnotes

[1] See Press Release ITU (2008a).

[2] This number, which surpasses the 100 per cent mark, refers to mobile subscriptions rather than mobile subscribers or mobile phone users. Double counting takes place, especially when one person owns multiple SIM cards and when operators do not identify and count only active subscribers.

[3] ITU considers those IMT-2000/3G mobile technologies that are supportive of broadband speeds in line with fixed broadband – i.e. CDMA2000 1X EVDO, W-CDMA and HSDPA – as mobile broadband.

[4] For further analysis on the effects of the economic crisis on ICT, see ITU (2009).

Chapter 3

The ITU ICT Development Index (IDI): background and methodology

3.1 Background to the creation of a single ITU ICT index

Given its leading role in the collection and dissemination of telecommunication and ICT statistics worldwide, ITU is naturally well placed to develop a statistical tool that would allow countries to benchmark their information societies globally and regionally. With the revolutionary spread of ICTs during the past two decades, and the resulting impact on societies and economies, international calls for monitoring and benchmarking have increased. At the same time, since the turn of the century the availability of Internet-related data globally has increased, making it feasible to construct a composite index that combines several indicators into one single statistical value and compare it over a number of years. This is when ITU's work on composite indices began.[1]

THE DIGITAL ACCESS INDEX

In 2003, ITU developed the "Digital Access Index (DAI)", which was presented at the first phase of the World Summit on the Information Society (WSIS).[2] The main objective of the DAI was to measure the overall ability of individuals in a country to access and use ICTs. It was thus built around five categories: infrastructure, affordability, knowledge, quality and actual usage of ICTs. It was based on a methodology that used goalposts (or upper value limits), which were averaged to obtain category scores. Categories were then averaged to obtain the overall index value. The DAI included eight indicators and was calculated for 178 economies for the year 2002. Comparative DAI scores for the years 1998 and 2002 were calculated for 40 countries. Although it was published once only, it received considerable interest from Governments and other users and showed that there was a clear international demand for such a benchmarking tool.

THE ICT OPPORTUNITY INDEX

In 2005, ITU and Orbicom[3] decided to merge the DAI with another index, the Orbicom "Infostate Index" (also published at WSIS 2003) to create the "ICT Opportunity Index (ICT-OI)". The decision to merge the two indices was taken in order to benefit from the experiences gained in producing the two indices and to avoid publishing two ICT indices that were similar in terms of the data they were based upon. It was also in response to calls from the international community and following the WSIS Geneva Plan of Action recommendation (paragraph 28) "to develop a composite ICT Development (Digital Opportunity) Index" combining statistical indicators with analytical work. The first edition of the ICT-OI was published jointly by Orbicom and ITU at WSIS 2005.[4] The WSIS Tunis Agenda made reference and acknowledged the ICT-OI as one of the two indices (the other one was the "Digital Opportunity Index – DOI", see below) to measure information society progress. An updated version of the ICT-OI was published by ITU in 2007.[5]

The ICT-OI was particularly designed to monitor the global digital divide and to track country progress over time and between countries of similar income levels. Based on the Orbicom Infostate conceptual framework, which is closely linked to economic theory, the ICT-OI distinguished between infodensity (including ICT infrastructure and skills) and info-use (including ICT uptake and intensity of use). It thus grouped ten indicators into

four sub-indices, each of which could be tracked separately and allowed to identify strengths and weaknesses in different ICT areas. The ICT-OI adopted most of the indicators from the DAI. By reducing the number of indicators from 17 to 10, the ICT-OI could be calculated for a much larger number of countries (183) compared to its predecessor, the Orbicom Infostate Index (139 countries). The methodology used by the ICT-OI (and the Infostate Index) was more complex compared to that of the DAI. Based on the understanding that the digital divide is a relative concept, the ICT-OI calculated values for a reference country and reference year, which served as the basis for calculating changes in "infostate" developments. It was thus less designed as a tool for benchmarking and ranking countries, but rather for tracking country and group differences across time and in relation to each other. One of the drawbacks of the index was that countries could not easily replicate the computation in order to calculate a national index as it was based on values of other countries, which would change for every year.

THE DIGITAL OPPORTUNITY INDEX

Also in 2005, another ITU index, the "Digital Opportunity Index (DOI)" was developed in response to the WSIS Geneva Plan of Action call for an ICT Development (Digital Opportunity) Index. A preliminary version of the DOI was launched at WSIS 2005, and the WSIS Tunis Agenda made reference and acknowledged the DOI as one of the two indices to measure information society progress. A full version of the DOI was published in 2006, and an updated version in 2007.[6]

The main objective of the DOI was to measure "digital opportunity" or the potential of countries to benefit from access to ICTs. The DOI was based on three main categories: opportunity, infrastructure and utilization. Out of 11 indicators used in the index, 9 corresponded to a subset of the internationally agreed core list of ICT indicators developed by the Partnership on Measuring ICT for Development.[7] The DOI included indicators measuring new technologies, such as fixed and mobile broadband, as well as price data to reflect affordability (called opportunity). The methodology used by the DOI was close to that of the DAI, with the use of goalposts and absolute values rather than relative performance, as the ICT-OI. It was thus easier for countries to replicate the methodology, and indeed a number of countries used the DOI methodology to produce a national index.[8]

TOWARDS A SINGLE INDEX

With the publication of both the ICT-OI and the DOI, discussions emerged in 2006 about the usefulness of ITU publishing two ICT indices. Resolution 131 of the outcome of the ITU Plenipotentiary Conference held in Antalya, Turkey (2006), requested the ITU Telecommunication Development Bureau (BDT) to develop a *single* ICT index.[9] The World Telecommunication Development Conference (WTDC) 2006, through its Doha Action Plan, called upon ITU to further develop and improve benchmarking efforts, including the ICT Opportunity Index (Resolution 8).[10]

Therefore, work commenced in 2007 to consider merging the two indices and creating a single ITU ICT index. Although the two indices (ICT-OI and DOI) differed considerably in terms of the indicators included as well as their statistical methodologies, a basic statistical analysis showed that the results were closely correlated, with a correlation coefficient of 0.94. This is primarily because the underlying indicators are closely correlated with country's income levels. A major difference between the two indices concerns the methodology, whereby the ICT-OI uses a reference country and year, which allows individual countries to track real progress on the index score, whereas the DOI uses a simpler methodology, with no normalization of the data (all indicators are expressed as a percentage), and which compares countries' index values and ranking across different years.

The methodology used by the ICT-OI reflects its main underlying assumption, which viewed the digital divide as a relative concept and therefore progress made by one country depends on the progress made by other countries (or group of countries) during the same time period. The methodologies used by the DAI and DOI were particular user- and dissemination-oriented and therefore a number of countries used these indices to measure ICT progress at the national level. An important consideration in the process of merging the two indices was thus whether to apply one or the other methodology, or a mix of both.

In 2007, ITU engaged in a process to examine the feasibility, and make concrete proposals, for the construction of a single index. A background paper was prepared and presented during the 6th World Telecommunication/ICT Indicators Meeting (WTIM) held in Geneva on 13-15 December 2007, as a basis for discussion on

the topic.[11] Participants in the meeting supported the decision to have a single ITU index to track the digital divide and to measure countries' progress towards becoming information societies. A number of specific points were raised concerning the future development of the index, such as:[12]

- To reconsider whether to include the international outgoing telephone traffic indicator since it does not adequately reflect the intensity of use, especially with the increased use of IP networks.
- To reconsider whether to include the indicator measuring 'international Internet bandwidth' since some countries consider domestic bandwidth more important.
- To include household data, based on surveys, when possible (i.e. available).
- To choose indicators which reflect all countries' levels of development.
- To consider including indicators on broadband and wireless Internet services in view of recent technological developments.
- To consider including ICT skills indicators.
- To keep the index simple and easily understood.

The WTI Meeting also recommended that the technical aspects of the single index should be further discussed and finalized by a group of experts. To this end, ITU launched an online discussion forum (Single Index Forum), to which close to 100 members signed up and posted several contributions concerning the single index. During the subsequent period of constructing the index, ITU regularly posted on the forum updated versions of a discussion paper reflecting work in progress. Furthermore, bilateral discussions were held with interested experts. Comments received during this process, as well as during the WTIM were taken into account when developing the single index.

It should be noted that composite indices by nature are subject to questioning and have to be interpreted with caution (OECD and European Commission, 2008). They do serve one important purpose, though: they raise awareness among policy makers of areas that deserve particular attention in future policy decisions. This is also the case for information-society related policies.

This chapter presents the single index. The new name chosen (ICT Development Index – IDI) reflects not only the name that was proposed in the WSIS Geneva Plan of Action, but also the main objectives of the index – to track progress in the development of ICTs in countries, and to monitor the global digital divide. The construction of the index took into consideration, as much as possible, the previous ITU indices, and comments received from member states and experts. Moreover, prior to computing the index, ITU consulted with its members on the data included in the index, to take into account any available updates. The overall process of constructing the index was undertaken following the guidelines recommended by the OECD.[13] In the future, it is foreseen to publish the ICT Development Index on an annual basis.

The following key elements were incorporated from the previous two indices.

From the DOI:

- Indicators related to households.
- Indicators related to broadband.
- Simple and easy to understand methodology and presentation (goalposts).

From the ICT-OI:

- Indicators related to skills (also included in the DAI).
- Normalization method (distance to a reference value).
- Digital divide analysis and methodology (as an application of the IDI).

What has been added/modified:

- The conceptual framework, based on a basic three-stage information society model (readiness-use-impact).
- The use of principal components analysis (PCA) to eliminate indicators that have less influence on the index calculation.

One of the key considerations when developing the index was whether to include a price component that would measure the affordability of ICTs (it was included in the DOI but not in the ICT-OI).

For several reasons, it was decided not to include prices in the index. First, the conceptual framework presented below does not include the notion of affordability. Se-

cond, results from the DOI have demonstrated that the opportunity sub-index (which included two indicators on prices) was generally speaking the most advanced, with the highest relative scores compared to the other two sub-indices, even among poor countries. Third, and perhaps most importantly, prices are often a key explanatory variable for ICT uptake and therefore need to receive special attention in the overall analysis. Results of the Principal Components Analysis showed that prices are highly correlated with other variables, such as those related to ICT infrastructure, suggesting that it was not essential to include them in the index itself. Furthermore, telecommunication and Internet tariffs are complex and cannot easily be captured by one indicator only.

Therefore, ITU decided to construct a specific, stand-alone ICT Price Basket, which is based on the 2008 prices of key ICT services (fixed and mobile cellular telephony and fixed broadband Internet access). ITU plans to publish this Price Basket annually, so that it can be used as a basis for countries to monitor ICT-related price developments over time. The ICT Price Basket can also be used as an analytical tool in information society research, as well as a policy tool. This Report provides initial research results comparing the IDI and the ICT Price Basket and draws some conclusions relevant to information society policy makers (Chapter 6).

3.2 Concept and methodology of the IDI

MAIN OBJECTIVES AND CONCEPTUAL FRAMEWORK

At the outset, it is necessary to define the main objectives and purposes of the index, in other words, what exactly should be measured. This is critical as it determines the broader framework of the index, the main indicators to be included, and the methodology used to construct the index.

The index should measure:

- The development of ICT in countries and relative to other countries (i.e. track ICT progress *over time*).
- The level of advancement of ICT in *all* countries (i.e. the index should be global and reflect changes in both developed and developing worlds).
- The *digital divide*, i.e. differences among countries with different levels of ICT development.
- The *development potential* of ICT or the extent to which countries can make use of ICT to enhance growth and development, based on available capabilities and skills.

Conceptual Framework

The framework for the index departs from the basic assumption that ICTs can be a development enabler if applied and used appropriately. This has been extensively discussed in the literature during the past ten years.[14] ICTs are also critical to countries that are moving towards knowledge-based societies. The index should therefore give an indication of the extent to which countries have advanced in the area of ICT for development and track progress thereof.

A useful conceptual framework to describe the process countries are going through in their evolution towards information societies is based on the basic three-stage model:

Stage 1: ICT readiness, reflecting the level of networked infrastructure and access to ICT,
Stage 2: ICT intensity, reflecting the level of use of ICTs in the society, and
Stage 3: ICT impact, reflecting the result of efficient and effective ICT use.

The three-stage framework or model has been applied widely for defining statistical indicators for measuring the information society. For example, the OECD Working Party on Indicators for the Information Society (WPIIS) has applied this framework since its early work on measuring e-commerce and reflecting the state of development of e-commerce activities in a given country. This has later been expanded to describe the status of ICT-related activities in countries more broadly. Other organizations, such as UNCTAD, and the Partnership on Measuring ICT for Development have adopted a similar framework in its ICT measurement work.[15]

Thus the Partnership work distinguishes between the measurement of ICT infrastructure and access, ICT use and ICT impact. The Partnership core list of indicators reflects this distinction and includes indicators on ICT infrastructure and access, ICT access and use by individuals and households, and ICT use by businesses. The core indicators on the ICT sector and ICT trade are specific to the ICT producing industry and important indicators for countries that are developing

this sector. The new core set of indicators on ICT in education include both access and usage indicators, and also cover ICT skills. Future core indicators may include ICT access and use by the Government and health sectors.

Indicators measuring ICT impact, on the other hand, if collected through statistical surveys, are difficult to compare since they often rely on opinion-based questions. They are therefore not part of the Partnership core list. Usually ICT impact indicators can only be computed once the statistical measurement of ICT infrastructure, access and particular ICT use, is in place.

Therefore, a composite index will also have to reflect this sequence and can only include indicators referring to stage 1 (ICT readiness, referring to infrastructure and access) and stage 2 (ICT use and intensity of use) of the three-stage model. In addition to these two components (access and use), the evolution towards an information society and the reaching of the final stage (ICT impact) will depend on a third component, capturing ICT capability or skills (as captured by the Partnership new core set of indicators on ICT in education).

In the analysis, the three components can be considered apart, while at the same time they are closely linked. Without ICT infrastructure and access there is no ICT use. Having access to ICT infrastructure is thus always a prerequisite for subsequent use.

ICT use indicates the level of absorption of the technologies. During the ICT use stage, countries increase their use in terms of numbers (i.e. more users of a specific ICT) and in terms of level of intensity (for example, more SMS being sent) and sophistication of use (for example, online banking or purchasing). This could vary considerably between ICTs and countries. For example, mobile phone use can be very intensive in developing countries, with relatively sophisticated applications such as m-banking and m-commerce, while Internet use can still be limited to e-mail. The best known example is the Philippines, with the highest numbers of SMS per subscriber globally. At the same time, bandwidth – which is necessary to use more sophisticated Internet-based applications – may still be limited.

ICT skills are needed to make best use of ICTs. They are critical to the potential impact that ICTs can have on development, in particular the achievement of value-added from ICT use. If countries are not capable to exploit the new technologies and realize their potential benefits, development and progress will be hampered. ICT impact therefore largely depends on the availability of skills and knowledge and the capability to use ICTs efficiently and effectively. ICT capability or skills are therefore an indispensable input measurement required to achieve maximum ICT impact. This is also why several ICT indices include a skill component,[16] including the ICT-OI, where the inclusion of ICT labour was key to the economic framework applied and one of the strengths of its model. Knowledge, measured through literacy and school enrolment, was also one of the components of the DAI.

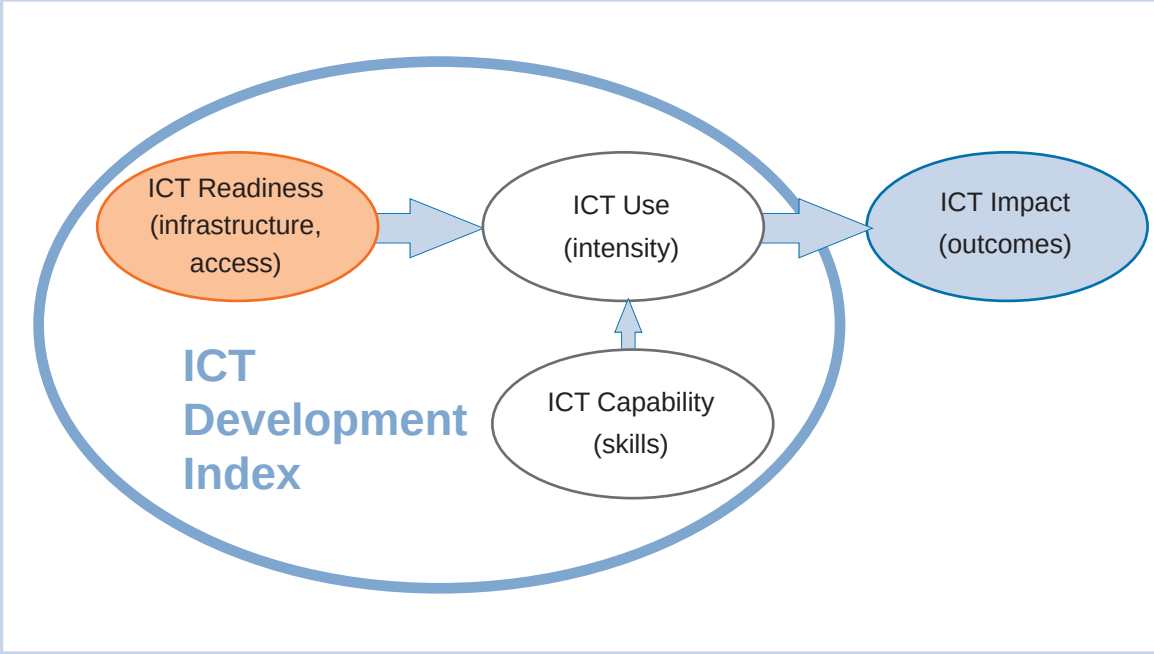
These three elements of ICT for development cannot be tracked by a single indicator and therefore it becomes necessary to develop a composite indicator or index. The three elements combined measure a country's path towards becoming an information society (Figure 3.1).

The approach is a sequential one, where a country's development towards an information society is following a certain sequence of ICT access and increased use on the path to transformation. Certain indicators in the sequence can be leapfrogged – for example, mobile networks substituting fixed ones. While the indicators may change, however, the basic stages will still remain.

In the information society model, what is important is that the indicators characterizing (and used to measure) each stage are likely to change over time. For example, what is considered basic infrastructure today – such as fixed lines – may not be sufficient tomorrow, with mobile networks on the rise. Similarly, broadband today is considered an advanced technology characterizing intense Internet use and therefore in stage 2, but it may move to stage 1 in the future and another, new technology may appear in stage 2. This is also why the indicators collected by ITU, as well as the Partnership core list of ICT indicators, are being revised regularly, reflecting the dynamic nature of ICTs.

Because ICTs are very dynamic, and because technologies are converging (for example, fixed/mobile networks or types of services provided), there may not be saturation of each technology – in fact, the saturation level becomes a moving target making it difficult to assign upper values (see Moore's law applied to chip performance, which is still valid after more than 30 years). In the case of fixed telephone lines, the upper target may have been 80 (or more) per 100 inhabitants

Figure 3.1: Three stages in the evolution towards an information society



Source: ITU.

only a few years ago; today, we can observe a stagnation in growth in fixed line subscriptions globally, a growing trend towards fixed lines being substituted by mobile networks in developing countries, and a potential decrease of fixed lines in developed countries in the near future (see Chapter 2).

The index thus aims to capture the development of the information society as it goes through its different stages taking into consideration technology convergence and the emergence of new technologies. The individual indicators included in each of the sub-indices may change over time and should be adapted to reflect the technological developments related to ICT. What counts is that the type of indicators included in each of the sub-indices reflects that particular stage – ICT readiness, characterized by relevant infrastructure and access indicators; ICT use, characterized by relevant ICT usage indicators; and ICT capability or skills as indispensable input indicators.

The index should have a certain timeframe – the MDG and WSIS target year of 2015, after which it should be revisited. It is likely that by that year, new technologies will have emerged which will have replaced the indicators included now in the index.

SELECTION OF INDICATORS AND STATISTICAL PROCESSES FOR CONSTRUCTING THE IDI

Based on the above described framework, the selected indicators should correspond to the following three subcomponents of the index (or sub-indices):

- ICT infrastructure and access.
- ICT use (primarily by individuals, but also households, businesses, others as data become available in the future) and the intensity of use.
- ICT skills (or capacity necessary to use ICTs effectively).

For each type of subcategory, a list of potential variables (or indicators) was established, from which a final selection of 11 indicators was made. The selection was based on:

- The availability of the data (and their quality) for a large number of countries, given that the index should be as global in nature as possible. Since the ICT data availability in the majority of developing countries is poor, this was the main restrictive factor in the selection.

- The results of multivariate analyses carried out. Principal components analysis (PCA) was carried out to analyse the underlying nature of the data, to explore whether the different dimensions are statistically well-balanced and to reveal how different indicators are associated and change in relation to each other. Annex 1 provides a detailed description of the results of the PCA.

- The relevance of a particular indicator for contributing to the main objectives and conceptual framework of the index. For example, the selection of indicators should reflect the situation in all countries (developed as well as developing).

- The recommendations made by experts and participants at the 6th WTIM (2007).

ICT infrastructure and access

Indicators included in this group should provide an indication on the available ICT infrastructure and individuals' access to basic ICTs. The following indicators were selected. Data for all of these indicators are collected by ITU. A definition of each indicator is provided in Annex 1.

1. Fixed telephone lines per 100 inhabitants

Even though slightly decreasing worldwide, fixed telephone lines are still a critical infrastructure indicator in all countries. Despite the high growth of mobile subscriptions, and their role in replacing fixed telephony in developing countries, fixed lines remain essential for both voice traffic as well as a basis for upgrading to broadband infrastructure.

2. Mobile cellular telephone subscriptions per 100 inhabitants

This indicator is widely available and especially important for developing countries where fixed line infrastructure is limited. Mobile cellular telephony is increasingly replacing fixed telephony in many countries and by the end of 2008, mobile subscriptions represented over 77 per cent of total (fixed and mobile) telephone subscriptions. It is therefore a key indicator for measuring telephone access and uptake.

3. International Internet Bandwidth (bit/s) per Internet user

There has been some discussion among experts as whether to include this variable in the index or not. It is argued that while there is no doubt about the importance of bandwidth for ICT uptake, it is not only international, but also domestic bandwidth that plays an important role. In the absence of data on domestic bandwidth, only international bandwidth can be considered in the index at this stage. However, national/last mile bandwidth is also captured through the indicator on 'broadband subscribers' (see below).

International Internet bandwidth is crucial backbone infrastructure to provide IP-based services. Without the necessary international Internet bandwidth, access to the Internet remains slow and expensive. IP networks are increasingly replacing the PSTN network and with a move towards more and more next generation network (NGN) technologies, IP will dominate. As a result, countries with little international Internet bandwidth will be left behind.

International bandwidth is of particular concern in developing countries where local content is scarce and Internet users consult foreign websites for information. For example, in many African LDCs, English, French or Portuguese is either the mother tongue or widely spoken. In the absence of local content, people can access information from websites in France, the United States, United Kingdom, Brazil etc. The lack of international bandwidth also poses a significant barrier to developing countries' ability to participate in ICT-enabled trade and international outsourcing. Today's information society is a global one where individuals must be able to interact and exchange knowledge and know-how globally. Also, in the absence of national or regional Internet Exchange Points (IXPs), international Internet bandwidth is used/needed for domestic traffic, to transport data from users within the same country.

Based on these reasons, it was decided to include the bandwidth variable in the index. It was also a critical indicator based on the results from the PCA. Unlike in previous indices (DAI, ICT-OI), it is computed with the denominator Internet users instead of inhabitants. This will provide a more realistic indicator for countries with low Internet penetration and a large population.

Concerning the data, there are huge differences among countries in terms of available international bandwidth, even among developed countries. Therefore, the data were normalized in order reduce the variation among countries and bring the data on a scale which allows meaningful comparison among countries (see below on normalization).

4. Proportion of households with a computer

This is a Partnership core indicator and an important indicator concerning people's access to computers. Having access to a computer at home can be a key enabler for developing ICT skills, in particular among children and young people.

5. Proportion of households with Internet access at home

This indicator provides the most complete information about access to the Internet by individuals. Home is the most inclusive of all locations (public Internet places can often target specific groups, for example, young people, foreigners etc.). This variable also resulted as the strongest explanatory variable in the PCA.

ICT use and the intensity of use

Based on available infrastructure and access indicators, ideally ICT use indicators should show the actual use of the ICTs included in the previous component/subgroup, and the level of intensity of use. Unfortunately, available data on ICT use are still rather limited at the global scale. Although several ICT use indicators have been included in the Partnership core list, most developing countries are only starting to collect such indicators and therefore data are not available for inclusion in the index at this stage. In the future, more targeted ICT use indicators could be included in this component of the index.

Based on these considerations, and on the results of the PCA, three indicators were selected for this subgroup (data are collected by ITU). A definition of each indicator is provided in Annex 1. In the future, as more Internet use data become available (they are part of the Partnership core list), they can be included in this subgroup.

1. Internet users per 100 inhabitants

Besides capturing the use of the Internet, the indicator Internet users per 100 inhabitants is able to measure the uptake of Internet access and use that would not be captured by, for example, the number of Internet subscribers. Furthermore, it functions as a proxy for the number of computers, as well as the prevalence of public Internet access. In a country where many people access the Internet at work, at school, at cybercafes or other public locations, this indicator would make up for the limited number of Internet subscribers, as well as the limited number of households with Internet access. Especially developing countries tend to have many Internet users per subscriber, reflecting the reality that the home is not (yet) the primary location of access.

2. Fixed broadband Internet subscribers per 100 inhabitants

Today, narrowband Internet use is often limited to basic applications such as sending and receiving e-mails or getting basic information. Broadband is therefore critical to measuring the level of Internet usage. Broadband enables users to take advantage of Internet applications requiring high speed. For companies, broadband is essential to promote e-business; but also for other Internet users, high-speed access is increasingly important. Research has shown that broadband is an important enabler for development as it provides access to innovative applications in the area of e-learning, e-government, e-health, etc.

Therefore, broadband indicators are important for measuring the uptake and intensity of Internet use and the quality of the Internet experience.

3. Mobile broadband subscribptions per 100 inhabitants

With the increasing availability of IMT-2000/3G networks and devices (including mobile handsets and data cards that allow users to access the Internet over the mobile cellular network using their computer) the use of mobile broadband will rapidly increase, in particular in countries with limited fixed line infrastructure. Therefore it is an important variable to measure the use (and intensity of use) of Internet in both developed and developing countries.

ICT skills and the capacity to use ICTs effectively

Ideally, this component of the index would include indicators that capture the level of ICT skills in countries. However, such data currently are not collected by most developing countries. A good proxy is therefore the level of education and literacy. Especially in developing countries, where education levels are often still poor, it can be a major barrier to the effective use of computers and the Internet. Despite the availability of simple ICT devices requiring little reading skills, their use and impact is much more limited compared to, for example, advanced software applications. With the increase in the inclusion of ICT in school curricula, school attendance can provide an acceptable proxy for students' exposure to computers or the Internet. In the future, and as more specific data on ICT skills become available (they are included in the new

core set of ICT in education indicators developed by the Partnership), they will replace the current proxies. There are three indicators in the skills component. The data are sourced from the UNESCO Institute for Statistics (UIS). A definition of each indicator is provided in Annex 1.

1. *Adult literacy rate*

2. *Secondary gross enrolment ratio*

3. *Tertiary gross enrolment ratio*

Statistical processes

Following the selection of the indicators, the data set was completed for the years 2002 to 2007, whereby missing values were estimated using different techniques (see Annex 1). A total of 154 countries were included in the index.

The data were then **normalized** using a methodology that measures the distance to a reference value. Since one of the main objectives of the index is to measure the digital divide, it was important to select a normalization methodology that allows measuring the relative performance of countries (i.e. the divide among countries). Furthermore, the index results should allow countries to track progress of their evolution towards an information society over time.

A further important criterion for the selection of the normalization method was to choose one that could be replicated by countries. As mentioned earlier, there has been a strong interest by some countries to apply the index methodology at the national or regional level. Therefore, it was decided to determine a fixed value as a reference measure for the normalization of the data, which could be replicated by other users.

The reference measure is the ideal value that could be reached for each indicator (similar to a goalpost). In all of the indicators chosen, this will be 100, except for four indicators:

- Main fixed telephone lines per 100 inhabitants range between 0.1 and 65 in 2007. The ideal value was computed by adding two standard deviations to the average of the observed 2007 values, resulting in a rounded value of 60 per 100 inhabitants.

- Mobile cellular subscriptions per 100 inhabitants, which in 2007 range from 0.56 to 176. The ideal value was computed by adding two standard deviations to the average of the observed 2007 values. The resulting reference value was 150 subscriptions per 100 inhabitants.

- International Internet bandwidth per Internet user, which in 2007 ranges from 10 (bits/s/user) to more than 1 million. To diminish the effect of the large number of outliers at the high end of the value scale, the data were first transformed to a logarithmic (log) scale. The ideal value was then computed by adding two standard deviations to the average of the observed 2007 values, resulting in a log value of 5, which corresponds to 100'000 bits/s.

- Fixed broadband subscribers per 100 inhabitants. This is a fairly recent indicator and values range from zero to over 40. In line with the indicator main fixed telephone lines, the ideal value was defined at 60 per 100 inhabitants.

After the data had been normalized, they were rescaled from 1 to 10. This was necessary in order to compare the values of the indicators and the sub-indices.

Within each sub-index, equal **weights** were applied to the indicators to calculate the value of each sub-index, in order to keep the methodology as simple as possible. For the final index computation, the ICT access and ICT use sub-indices were given 40 per cent weight each, and the skills sub-index (because it is based on proxy indicators) 20 per cent weight. Figure 3.2 illustrates the various weights and reference values used in the IDI calculations.

International and national benchmarking

The overall objective of the IDI is to benchmark ICT progress among countries at the global level. This also clearly reflects the broad mandate of ITU as an international organization aiming to ensure the access to, and use of, telecommunication and ICT globally, particularly in developing countries.

Therefore, the indicators included in the index were chosen based on their availability for as many countries as possible. Since data availability in many developing countries is poor, it is a major limiting factor to the construction of a global index. As a result, the index is broad in nature, and relies on proxies for certain indicators.

At the same time, countries may be interested in replicating the methodology to compute an ICT index to

Figure 3.2: ICT Development Index – Weighting of indicators

ICT access	Ref. Value	(%)
1. Fixed telephone lines per 100 inhabitants	60	20
2. Mobile cellular telephone subscriptions per 100 inhabitants	150	20
3. International Internet bandwidth (bit/s) per Internet user	100'000*	20
4. Proportion of households with a computer	100	20
5. Proportion of households with Internet access at home	100	20

40

ICT use	Ref. Value	(%)
6. Internet users per 100 inhabitants	100	33
7. Fixed broadband Internet subscribers per 100 inhabitants	60	33
8. Mobile broadband subscribers per 100 inhabitants	100	33

40

ICT skills	Ref. Value	(%)
9. Adult literacy rate	100	33
10. Secondary gross enrolment ratio	100	33
11. Tertiary gross enrolment ratio	100	33

20

ICT Development Index

Note: * This corresponds to a log value of 5, which was used in the normalization step.
Source: ITU.

measure regional (i.e. among countries of a particular region) or national (within a particular country) digital divides. Indeed, this was the case with the DAI and DOI, where a number of developing countries have applied the methodology to construct their own index.[17]

In principle, the index was therefore designed in a rather user-friendly way. However, it should be noted that in certain regions or countries, data availability may be of better quality than at the global level and go beyond the indicators included in the IDI. This should be taken into consideration when applying an international index at the national level. In this case, the general framework and methodology of the index could be applied, and complemented or replaced by additional indicators.

Furthermore, at the national level, the application of the index will require the availability of data (for each indicator) at a disaggregated level, by national geographic scope (e.g. localities, municipalities, country states, etc.). Missing data need to be imputed using the proper methodologies.

Endnotes

[1] In 2002, ITU published its first composite index, the " Mobile/Internet index" (ITU, 2002), which measured the relative levels of mobile and Internet developments in a total of 177 economies.

[2] The DAI was published in the ITU World Telecommunication Development Report 2003 (ITU, 2003), see: http://www.itu.int/ITU-D/ict/publications/wtdr_03/index.html.

[3] Orbicom is a network of 250 associate members and 31 UNESCO chairs in Communications from around the world. It links communications leaders from academic, media, corporate and Government circles with the aim of fostering the exchange of information and the development of shared projects. One of its main research projects concerned the development of the information society, including the monitoring of the digital divide, which resulted in the Infostate Index.

[4] See Orbicom and ITU (2005).

[5] ITU (2007): "Measuring the Information Society". The ICT-OI was also included in the ITU World Information Society Report 2007 (along with the DOI).

[6] See ITU (2006a) and ITU (2007).

[7] See Partnership on Measuring the ICT for Development (2005) and (2009).

[8] For example, Trinidad and Tobago, Peru, Mauritius and Ururguay.

[9] See ITU (2006d).

[10] See ITU (2006b).

[11] See Jensen and Mahan (2007).

[12] See ITU (2008b).

[13] See OECDand European Commission (2008).

[14] See ITU (2006c), OECD (2003b, 2006), UNCTAD (2006, 2008), Oliner and Sichel (2002), Jorgensen et al. (2002), Van Ark et al. (2003).

[15] See OECD (2003a, 2005, UNCTAD (2003), Partnership on Measuring ICT for Development (2008).

[16] World Bank Knowledge Economy Index, UNDP Technology Achievement Index.

[17] See endnote 8.

Chapter 4

The ITU ICT Development Index (IDI): presentation and discussion of results

4.1 Overall IDI results

Five years is a relatively long period in terms of information society developments. By nature, ICTs are very dynamic, and infrastructure and access values may change considerably as a result of changes in the market environment, enhanced investments, price cuts, or the introduction of new technologies in the market. Therefore, the sub-index access shows greatest changes over the five-year period, followed by the sub-index use (Table 4.1). Changes in education and literacy, on the other hand, are usually less dynamic, hence the smaller value changes of the sub-index skills. The improvement in the sub-index skills is still notable, though, given that it mainly reflects improvements in the developing countries – most developed countries already had very high skills values in 2002.

Table 4.2 shows the results of the ICT Development Index (IDI) for two years, 2002 and 2007, ranked by 2007 index values. Data refer to fiscal year-end values.

Table 4.1: IDI changes 2002-2007

	Average value 2002	Average value 2007	Change in value 2002-2007
IDI	2.48	3.40	0.92
Sub-index access	2.68	3.91	1.23
Sub-index use	0.54	1.43	0.89
Sub-index skills	5.95	6.31	0.37

Source: ITU.

Overall, all countries (except for one) improved their scores over the five-year period. This is to be expected, as growth in ICT access and usage is globally increasing. Countries with relatively high IDI values in 2002 already had relatively high ICT access values. By 2007, many of these countries had increased their ICT use values. On the other hand, those countries with low IDI values in 2002 mainly increased their ICT access values by 2007 (and not as much the use values). This finding corresponds to the conceptual framework presented in the previous chapter and its sequential nature where ICT access is followed by ICT use.

With the exception of the Republic of Korea, all top ten countries are from Europe. These countries have primarily gained on the sub-index ICT use, having already fairly good ICT access, and top ICT skills, in 2002. In particular, broadband use has increased significantly among the top ten countries. As Chapter 2 of the Report has shown, fixed broadband penetration in Europe has grown steeply during the past few years. Mobile broadband, which practically didn't exist in 2002, has been introduced in most of these countries, rising their ICT use levels significantly.

Countries with low ICT levels (and hence low ranks) are primarily from the developing world. Given the close relationship between ICT level and GDP, many of the poorer countries, in particular the Least Developed Countries, rank further down in the IDI, with little change in ranking since 2002.

The following section will present the IDI results by taking a closer look at different geographic regions and highlighting selected economies, including those that

Table 4.2: ICT Development Index (IDI) (2002 and 2007)

Economy	Rank 2007	IDI 2007	Rank 2002	IDI 2002
Sweden	1	7.50	1	6.05
Korea (Rep.)	2	7.26	3	5.83
Denmark	3	7.22	4	5.78
Netherlands	4	7.14	6	5.43
Iceland	5	7.14	2	5.88
Norway	6	7.09	5	5.64
Luxembourg	7	7.03	21	4.62
Switzerland	8	6.94	7	5.42
Finland	9	6.79	8	5.38
United Kingdom	10	6.78	10	5.27
Hong Kong, China	11	6.70	12	5.10
Japan	12	6.64	18	4.82
Germany	13	6.61	14	5.02
Australia	14	6.58	13	5.02
Singapore	15	6.57	16	4.83
New Zealand	16	6.44	19	4.79
United States	17	6.44	11	5.25
Ireland	18	6.37	26	4.36
Canada	19	6.34	9	5.33
Austria	20	6.32	20	4.64
Macao, China	21	6.25	23	4.41
Italy	22	6.18	24	4.38
France	23	6.16	25	4.37
Belgium	24	6.14	15	4.91
Taiwan, China	25	6.04	17	4.82
Estonia	26	5.97	31	3.93
Spain	27	5.91	28	4.10
Slovenia	28	5.88	22	4.47
Israel	29	5.60	27	4.24
Malta	30	5.54	29	4.04
Portugal	31	5.47	32	3.87
United Arab Emirates	32	5.29	40	3.27
Lithuania	33	5.29	43	3.17
Greece	34	5.25	30	3.94
Hungary	35	5.19	36	3.49
Latvia	36	5.01	39	3.30
Cyprus	37	4.97	33	3.78
Slovak Republic	38	4.95	35	3.51
Poland	39	4.95	37	3.34
Czech Republic	40	4.88	34	3.74
Brunei Darussalam	41	4.80	41	3.27
Bahrain	42	4.69	38	3.30
Croatia	43	4.68	42	3.19
Qatar	44	4.44	47	2.84
Bulgaria	45	4.37	51	2.74
Romania	46	4.16	60	2.48
Argentina	47	4.12	44	3.06
Chile	48	4.00	45	2.97
Uruguay	49	3.88	46	2.90
Russia	50	3.83	52	2.71
Ukraine	51	3.80	59	2.50
Malaysia	52	3.79	50	2.74
Jamaica	53	3.78	48	2.79
Belarus	54	3.76	57	2.53
Saudi Arabia	55	3.62	73	2.13
Trinidad & Tobago	56	3.61	58	2.50
Kuwait	57	3.57	49	2.77
Bosnia	58	3.54	66	2.33
Turkey	59	3.49	63	2.41
Brazil	60	3.48	54	2.55
Panama	61	3.46	62	2.42
Mauritius	62	3.45	61	2.45
Thailand	63	3.44	70	2.17
Lebanon	64	3.43	56	2.53
TFYR Macedonia	65	3.42	53	2.65
Costa Rica	66	3.41	55	2.54
Venezuela	67	3.34	69	2.18
Moldova	68	3.31	74	2.13
Kazakhstan	69	3.25	68	2.18
Colombia	70	3.25	72	2.13
Maldives	71	3.16	88	1.96
Armenia	72	3.12	81	2.03
China	73	3.11	90	1.95
Peru	74	3.11	71	2.15
Mexico	75	3.09	64	2.38
Jordan	76	3.06	65	2.36
Oman	77	3.00	76	2.12
Iran (I.R.)	78	2.94	92	1.93
Palestine	79	2.92	67	2.20
Georgia	80	2.91	75	2.13
Libya	81	2.84	78	2.08
Ecuador	82	2.75	85	1.97
Tunisia	83	2.73	94	1.86
Fiji	84	2.73	83	2.00
Albania	85	2.73	93	1.92
Azerbaijan	86	2.71	100	1.71
South Africa	87	2.70	77	2.11
Mongolia	88	2.67	84	1.97
Syria	89	2.66	102	1.69
Dominican Rep.	90	2.65	87	1.97
Philippines	91	2.63	79	2.07
Viet Nam	92	2.61	107	1.59
Kyrgyzstan	93	2.61	86	1.97
Egypt	94	2.54	95	1.81
Cuba	95	2.53	91	1.94
Paraguay	96	2.52	82	2.02
Algeria	97	2.51	105	1.61
Bolivia	98	2.45	80	2.03
El Salvador	99	2.43	99	1.74
Sri Lanka	100	2.38	97	1.75
Morocco	101	2.34	111	1.37
Honduras	102	2.28	114	1.31
Guatemala	103	2.28	106	1.60
Turkmenistan	104	2.23	89	1.96
Cape Verde	105	2.18	103	1.67
Tajikistan	106	2.14	96	1.76
Gabon	107	2.14	110	1.48
Indonesia	108	2.13	109	1.54
Botswana	109	2.10	101	1.70
Uzbekistan	110	2.05	98	1.75
Nicaragua	111	2.03	112	1.37
Namibia	112	1.92	108	1.58
Swaziland	113	1.73	113	1.32
Ghana	114	1.63	122	1.10
Bhutan	115	1.63	118	1.17
Kenya	116	1.62	116	1.21
Lao P.D.R.	117	1.60	125	1.08
India	118	1.59	117	1.19
Myanmar	119	1.57	104	1.64
Sudan	120	1.56	131	1.03
Cambodia	121	1.53	126	1.07
Gambia	122	1.49	139	0.96
Lesotho	123	1.48	119	1.15
Yemen	124	1.47	129	1.04
Cameroon	125	1.46	120	1.12
Zimbabwe	126	1.46	115	1.29
Pakistan	127	1.46	146	0.89
Côte d'Ivoire	128	1.41	134	1.01
Zambia	129	1.39	124	1.08
Nigeria	130	1.39	123	1.09
Senegal	131	1.38	142	0.95
Congo	132	1.37	121	1.10
Madagascar	133	1.36	140	0.96
Mauritania	134	1.36	135	1.00
Benin	135	1.28	149	0.76
Haiti	136	1.27	127	1.05
Togo	137	1.26	130	1.03
Bangladesh	138	1.26	132	1.02
Nepal	139	1.23	133	1.01
Uganda	140	1.21	143	0.92
Malawi	141	1.17	141	0.95
Comoros	142	1.17	145	0.91
Rwanda	143	1.17	136	0.99
Papua New Guinea	144	1.14	128	1.05
Tanzania	145	1.13	138	0.96
Mali	146	1.12	150	0.75
Ethiopia	147	1.03	147	0.78
Mozambique	148	1.02	148	0.77
Eritrea	149	1.00	137	0.96
Burkina Faso	150	0.97	151	0.68
D.R. Congo	151	0.95	144	0.92
Guinea-Bissau	152	0.90	153	0.56
Chad	153	0.83	152	0.65
Niger	154	0.82	154	0.51

Source: ITU.

have improved significantly their ICT levels during the five-year period, either based on absolute IDI gains, or relatively to other economies. Western and Northern Europe, and Northern America are the regions with the highest IDI scores (Chart 4.1), and most countries from these regions are among the top twenty ICT economies. In general, all regions improved their IDI values between 2002 and 2007, but average changes range between 20.8 per cent for Northern America (already having had the highest IDI values in 2002), and 48.5 per cent and 48.2 per cent in Northern Africa and Eastern Europe, respectively. In particular, Eastern Europe not only had high relative growth but also one of the highest IDI value gains (1.40 points) and can thus be considered as the most dynamic region in terms of ICT developments during this time period. Countries that were driving this process, such as the Baltic States or Romania, are highlighted below.

Table 4.3 presents so-called "spider" charts for selected economies, which illustrate the changes of each of the 11 indicators (normalized values) between the IDI 2002 and the IDI 2007.

EUROPE

Europe's **Nordic countries** are the most advanced when it comes to ICTs. All of them are among the top ten countries in the IDI 2007, unchanged from the situation in 2002.

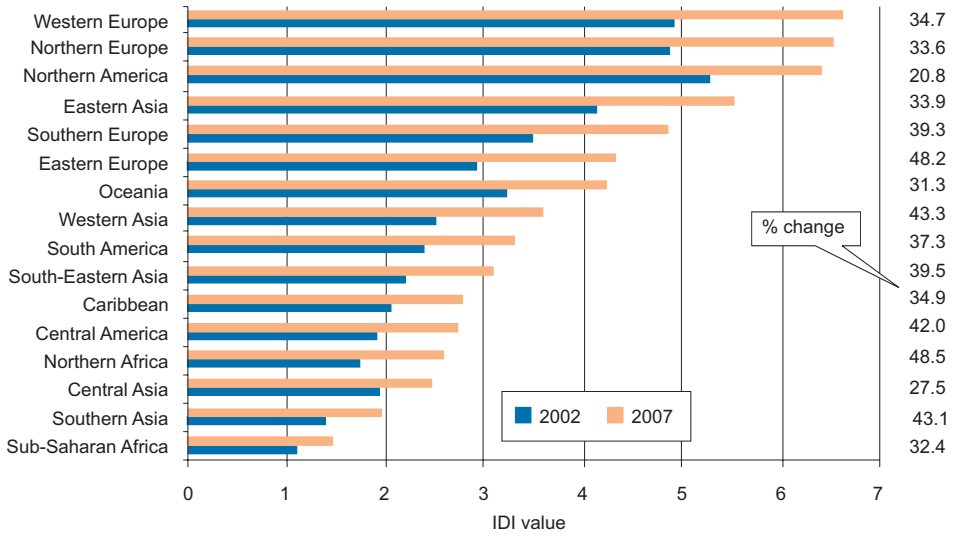
- **Sweden** tops the IDI 2007, unchanged from 2002. Sweden has maintained its leading position in many of the ICT indicators, and made strong gains on the ICT use sub-index (2.60 points). In particular, Internet use is very high in Sweden, whereas mobile cellular subscriptions (part of ICT access) are with 114 per 100 inhabitants lower than some other top ranking countries.

- **Denmark** ranks 3rd in the IDI 2007, unchanged from its position in 2002. It has gained on all three sub-indices, but in particular on ICT use (2.51 points), such as fixed broadband, and on household Internet access.

- **Iceland** has moved down 3 places, to place 5 in 2007. Among the top ten countries, it is the one that has gained least in terms of index value points (1.25), although gains on the ICT skills sub-index were highest among the top ten countries, with an increase in tertiary enrolment from 54 per cent in 2002 to 75 per cent in 2007. With no mobile broadband available in Iceland by the end of 2007, the country is likely to increase its value even more as soon as this service becomes available.

- **Norway** moved down one place between 2002 and 2007, ranking 6th in the IDI 2007. It has gained on the ICT use sub-index, on both fixed and mobile broadband, but not as much on ICT access, with a decrease in fixed telephone line penetration.

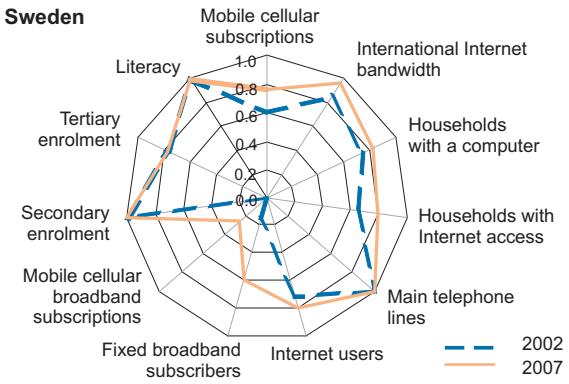
Chart 4.1: IDI by geographic region (2002-2007)*



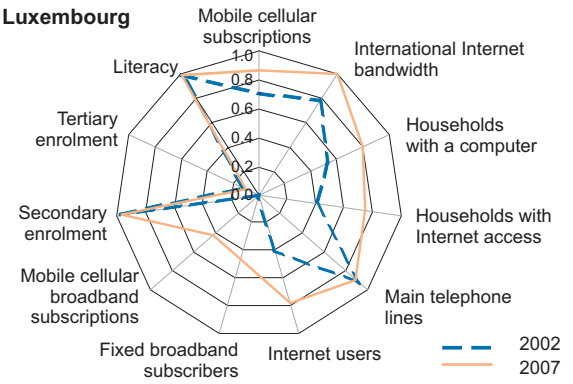
Note: * See Annex 3 for the list of economies included in each geographic region.
Source: ITU.

Table 4.3: Spider charts of selected economies, illustrating IDI changes between 2002 and 2007

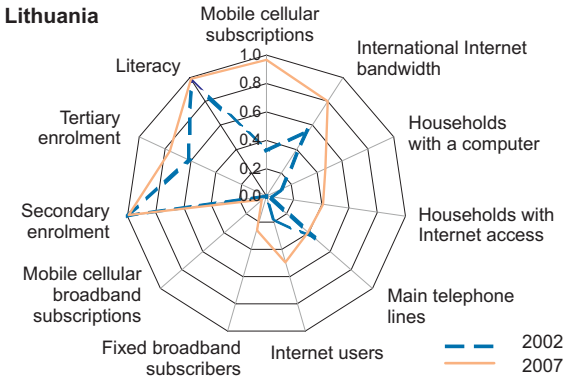
Sweden



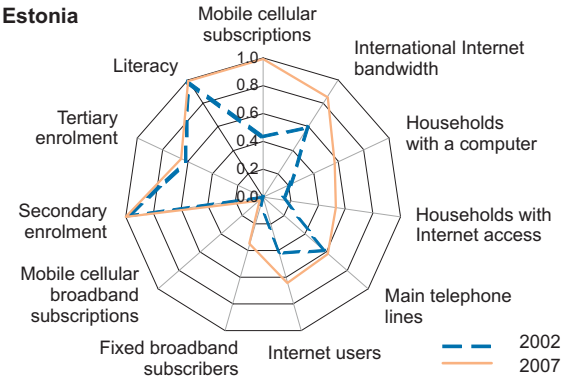
Luxembourg



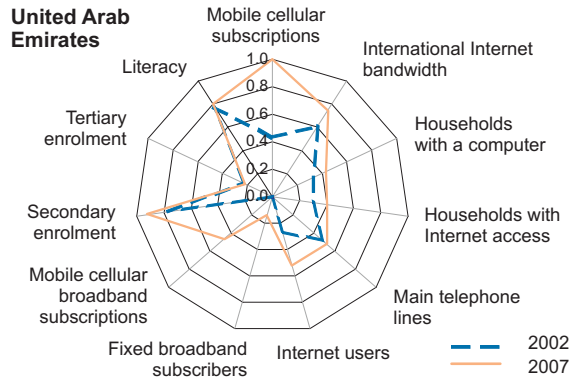
Lithuania



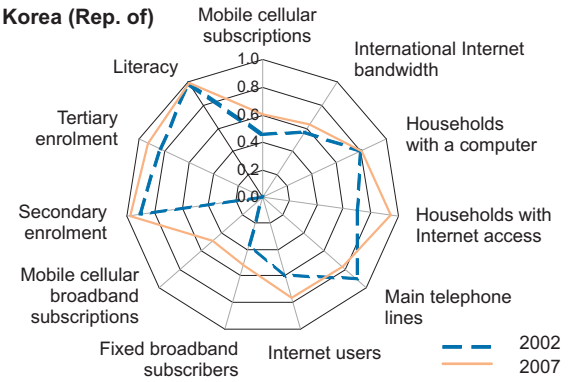
Estonia



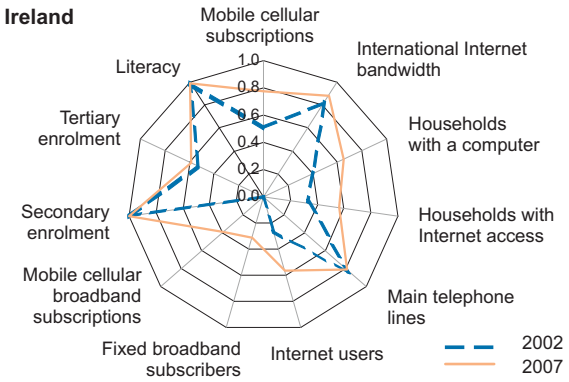
United Arab Emirates



Korea (Rep. of)



Ireland



Macao, China

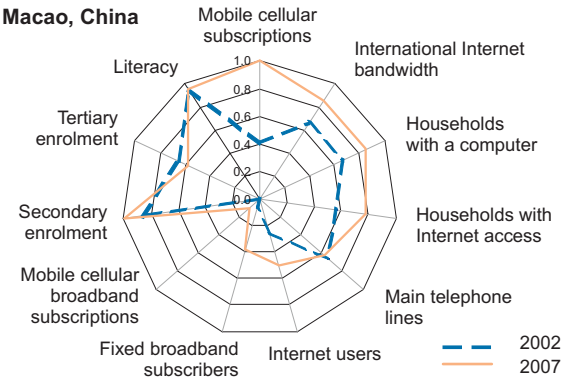
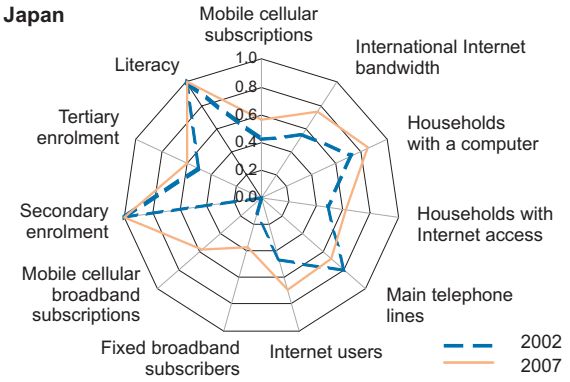
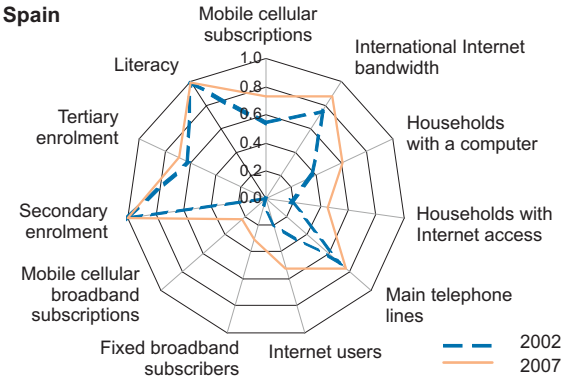


Table 4.3: Spider charts of selected economies, illustrating IDI changes between 2002 and 2007 (cont'd)

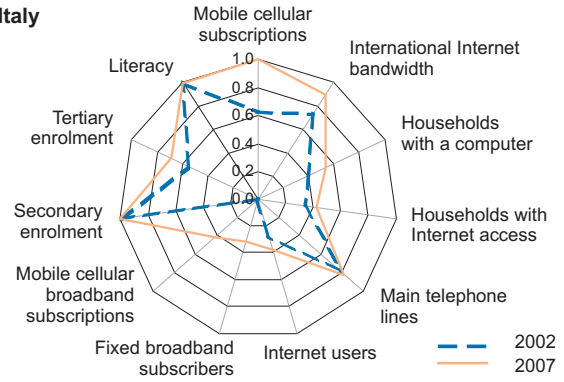
Japan



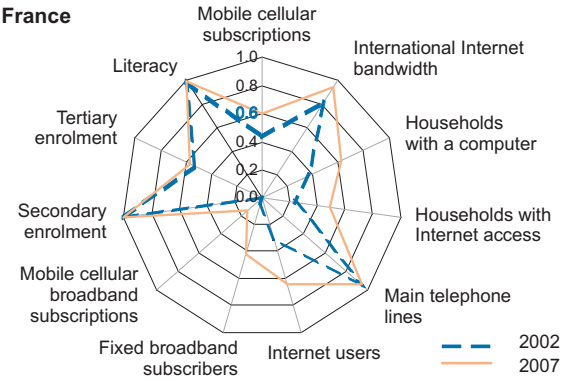
Spain



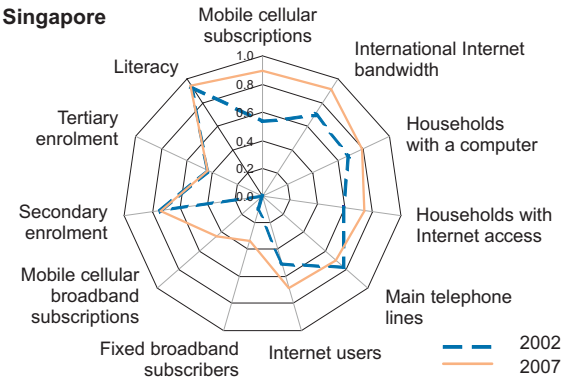
Italy



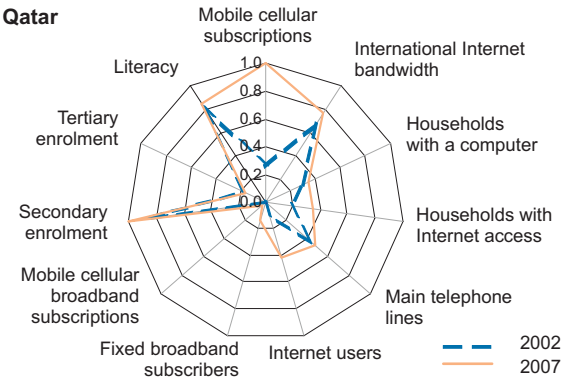
France



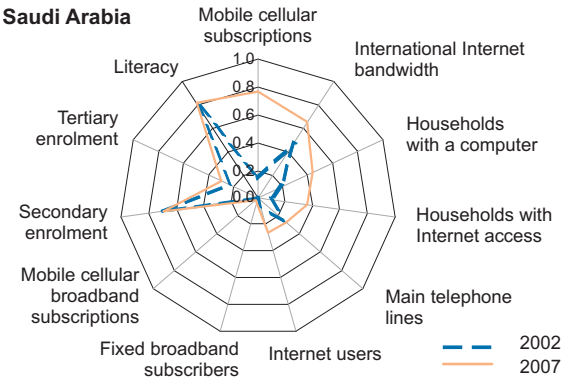
Singapore



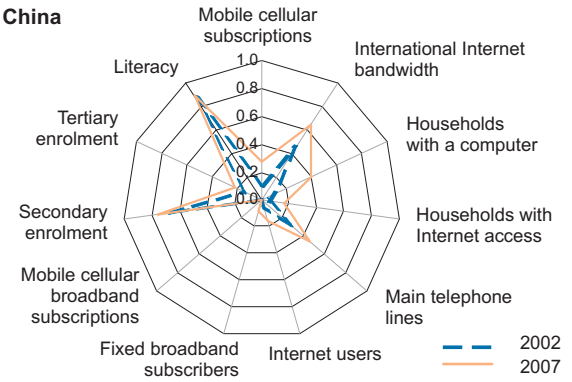
Qatar



Saudi Arabia



China



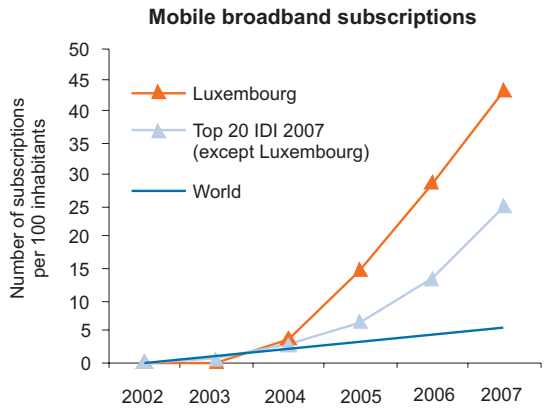
Box 4.1: Broadband in Luxembourg

Luxembourg advanced 14 places in the IDI ranking in the five-year period, reaching 7th place in 2007. It had the strongest growth in IDI value (2.42 points) of all countries during this period, based on impressive ICT improvements in access and usage. In both sub-indices, Luxembourg ranks second. On the other hand, Luxembourg's skill values are not very high (in particular, tertiary enrolment) and they have remained nearly constant between 2002 and 2007, which shows that there is still room for improvement.

The most remarkable increase was achieved in the use sub-index. As shown in the Chart below, mobile broadband penetration reached 43 per cent in 2007, with a growth rate well above that of the top twenty 2007 IDI economies. Only Japan and Korea (Rep.), the only two countries that already had mobile broadband in 2002, achieved clearly higher mobile broadband penetration in 2007. Between 2002 and 2007, Internet penetration in Luxembourg grew from 40 to 78 per cent and fixed broadband penetration from 1 to 27 per cent.

Access to ICT also improved remarkably between 2002 and 2007, with increases in all access indicators. The only exception was the number of fixed telephone lines per 100 inhabitants, which, as in most "high" IDI countries, remained stagnant, and even decreased somewhat.

Households with computers increased from 53 to 80 per cent and households with Internet access at home from 40 to 75 per cent. The number of households with Internet access at home followed a parallel increase to that of GNI per capita as both had a compound annual growth rate of around 13 per cent and a steep increase in 2004. In 2002, in both household access indicators, Luxembourg was more than 10 per cent below the average top 20 IDI economies, but caught up during the five-year period. In 2002, cellular penetration was already well above the average of the top 20 IDI economies, and remainded high in 2007 (129 per cent compared to 116 per cent).



Source: ITU.

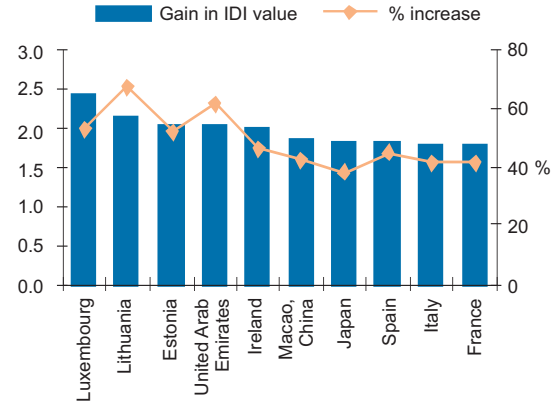
International Internet bandwidth increased sharply between 2002 and 2007 (from 1.5 Gbit/s to 3.5 Tbit/s). This was due to a new fibre network deployed by Luxembourg's incumbent operator P&T, which entered into operation in 2007 and which connects the country with Belgium, the Netherlands, France, Germany and the United Kingdom.

- **Finland** lost one place and ranks 9th in the IDI 2007. It has gained on all three sub-indices, but less than some of the other top ten countries, in particular on ICT access (fixed line penetration decreased from 52 to 33 per cent). Also, mobile broadband penetration in Finland is (still) behind some of its neighbours.

The **Netherlands** moved up two places, to become fourth in the IDI 2007. It has gained both on ICT access and ICT use. Together with Iceland, Norway, and Denmark, it has one of the highest Internet user penetration rates worldwide.

Luxembourg jumped up 14 places, from rank 21 in 2002 to rank 7 in 2007. Among all countries, Luxembourg gained most in IDI value within the five-year time period (2.42 points or 52 per cent,

Chart 4.2: Top ten economies in IDI growth 2002-2007



Source: ITU.

see Chart 4.2). It increased its performance in all of the sub-indices (access, usage and skills), but especially the use sub-index (4.16 points in value gained, or almost 300 per cent (Chart 4.8), the highest of all countries). In particular, household access to computers and the Internet grew significantly during this time period, reaching one of the highest values globally. In addition, fixed and mobile broadband use has increased steeply during the five-year period (see Box 4.1).

Switzerland lost one place between 2002 and 2007 and is now ranked 8th on the IDI 2007. Although it improved on both the ICT access and use sub-indices, it gained less compared to some of the other top ten countries (for example, on mobile penetration). Switzerland has made little improvements on the ICT skills sub-index (for example, relatively low tertiary enrolment) during the five-year period.

The **United Kingdom** ranks 10th in 2007, unchanged from 2002. The United Kingdom has gained on both ICT access (in particular international bandwidth) and usage, including on the two broadband indicators, however, not as much as some of the other top ten countries. Also, little progress was made on the skills side – in fact, tertiary enrolment decreased over the five-year period (from 63 to 59 per cent).

Among the European countries not included in the top ten, **Germany, Ireland, Austria, Italy** and **Spain** all moved up or remained unchanged, and all are among the top 30 countries worldwide. Spain, Ireland and Italy are among the top ten countries that gained most in the index value over the five-year period (Chart 4.2). **France** has gained two places (23 compared to 25 in 2002), and still has relatively low mobile telephone and Internet penetration (both households and individuals) compared to some other EU countries. However, it is among the ten countries worldwide that have gained most in the IDI value between 2002 and 2007. **Belgium** lost 9 places, mainly due to lower mobile cellular penetration and mobile cellular broadband values, compared to some other EU countries.

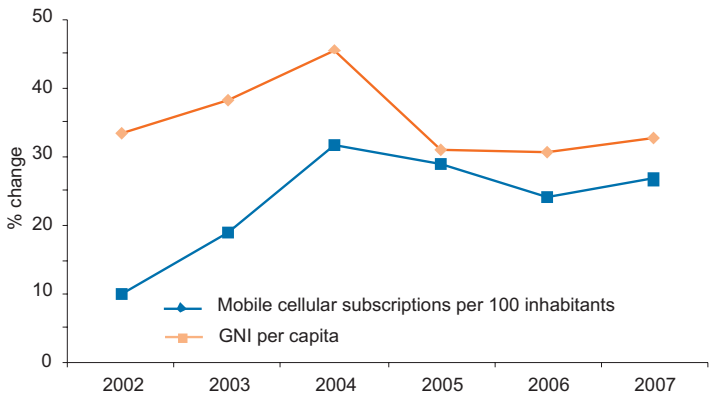
Romania has moved up 14 places, to rank 46th in the IDI 2007. Romania's improvement in the index is primarily based on increased ICT access (2.44 points value increase of the use sub-index, or 102 per cent). For

Box 4.2: Romania – moving towards an information society

Romania has moved up from rank 60 in 2002 to rank 46 in 2007 in the ICT Development Index. The improvements, gaining 14 places, have been due to the continuous increase in mobile cellular subscriptions during that period, at an average annual growth rate of 36 per cent. Growth in the number of households with computers and access to the Internet, as well as in the number of Internet users has also motivated the improvements in the ranking. During this period, Internet user penetration grew at an average rate of 30 per cent, raising from 6.6 per cent in 2002 to 24 per cent in 2007.

The Romanian economy has also been growing constantly between 2002 and 2007. GNI per capita, which in 2002 was 1'930 US$, increased more than three-fold, reaching 6'150 US$ in 2007. The year where it grew most was 2004, at a rate of 38 per cent. The favorable economic growth between 2002 and 2004 stimulated investment in the domestic mobile market. In 2004 Romania had already four operators in the mobile market, with two main competitors. Recent studies also show that economic growth and the increase of disposable income have favored ICT consumption.[1] For instance, the penetration of fixed broadband Internet subscribers and mobile broadband subscriptions increased from almost zero (each) in 2002 to 9.1 and 4.9 per 100 inhabitants in 2007, respectively.

Growth of mobile penetration and GNI per capita, Romania



Source: ITU.

The growth in disposable income also favored the acquisition of computers by households, increasing from 6 per cent in 2002 to 34 per cent in 2007. This, together with an increase in access to the Internet by households from 3.9 to 22 per cent has also led to an increase in the value of the IDI.

example, mobile cellular penetration increased from 23 to 107 per 100 inhabitants. Also, international Internet bandwidth increased significantly during the five-year period. In addition, Romania gained much on the ICT skills sub-index (mainly on tertiary enrolment, which increased from 32 per cent in 2002, to over 60 per cent in 2007). With 1.00 points increase it is among the top ten countries that increased this sub-index. (see Box 4.2).

The **Baltic states** have made significant improvements in their evolution towards becoming information societies. Estonia, Latvia and Lithuania all increased their ranks (by 5, 3 and 10 places respectively). Lithuania and Estonia are among the top ten countries that have increased their index values most between 2002 and 2007 (Chart 4.2). This is due to improvements in both access and usage indicators. For example, Estonia and Lithuania have one of the highest mobile subscription penetration rates globally (148 per cent up from 65 per cent and 146 per cent up from 47 per cent in 2002, respectively). Latvia has considerably improved household access to computers and Internet (49 and 51 per cent respectively, up from 15 and 8.5 per cent in 2002).

Russia ranks 50 (up two places) on the overall index. While the country has improved significantly on the access sub-index (2.09 points) over the five-year period, ICT usage is still limited and mobile broadband is only starting to become available.

ASIA AND OCEANIA

The Republic of Korea comes second in the IDI 2007, up two places from 2002. Korea has gained 1.43 points in the index value and has the highest ICT use sub-index value of all countries (5.85, with a gain of 2.64 points). Korea has mainly improved in the area of intensity of use, which is measured by the indicators on broadband. During the past few years, Korea has increased its broadband penetration significantly and comes second globally, after Japan, in mobile broadband penetration.

Australia ranks 14th in 2007, down one from 2002, based mainly on the relatively low values for international Internet bandwidth, and a decrease in fixed telephone line penetration. On the other hand, Australia has made significant progress in broadband use, reaching 33 per cent penetration on mobile broadband in 2007.

Japan moved up 6 places, to place 12 in 2007. This is primarily based on improvements in the use sub-index (3.45 points or 176 per cent, see Chart 4.8). Japan increased significantly its international Internet bandwidth, and had the highest mobile broadband figures worldwide in 2007, with a penetration of 57 per cent.

China ranks 73rd, with a large gain since 2002 (17 places up). China has mainly gained on the ICT access sub-index (1.92 points) and on the skills sub-index (especially tertiary enrolment), while it still scores relatively low on ICT usage (very little broadband use, also low Internet user penetration). On the other hand, China has significantly improved its fixed line penetration (from 16.5 to 27.5 per cent). Since most of the indicators are measured by number of inhabitants or households, economies with huge populations, such as China (and India, see below) face a big challenge in improving their penetration rates (see Box 4.3).

Macao (China) (rank 21) has improved ICT access over the five-year period, in particular mobile cellular penetration and international Internet bandwidth. Also, household ICT access has increased significantly and reached levels similar to those of European economies.

India has more or less maintained its position in the index, ranking 118th in 2007 (in 2002, it was 117th). While it has somewhat improved on the access sub-index (for example, mobile cellular penetration has increased sharply, from 1 to 20 per cent), it still has very limited bandwith per Internet user, and low home computer and Internet penetration rates. Mobile broadband was virtually non-existent in 2007, and fixed broadband use was very limited. On the skills sub-index, however, India has increased all indicator values.

Azerbaijan has gained 14 places, ranking 86th in the IDI 2007, mainly because it started from very low levels in 2002. It has improved significantly in ICT access, in particular mobile cellular penetration and international Internet bandwidth (see Box 4.4).

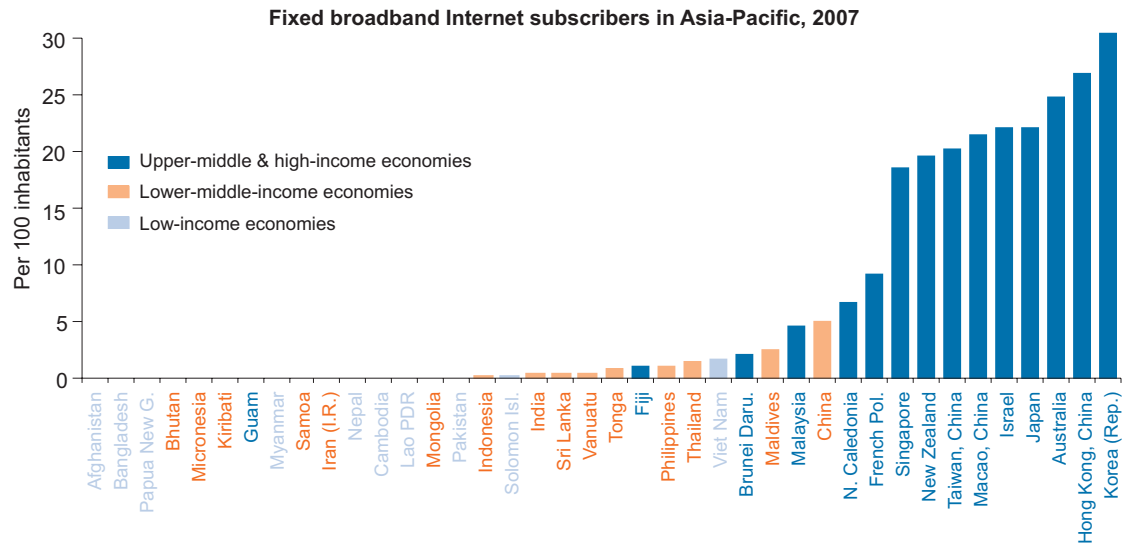
The country that gained most worldwide in ranking is **Pakistan**, moving up 19 places (see Chart 4.3). With a rank of 127 it is still low and has a long way to go towards becoming an inclusive information society. But progress has been significant in the past five years, mainly because in 2002 there was almost no ICT access and usage in the country, whereas in 2007, 8 per cent of households had computers and Internet user penetration reached 10.7 per cent. Pakistan has made less progress on the skills sub-index, which scores relatively low (see Table 4.6).

Box 4.3: China – leveraging on economies of scale[2]

Up 17 ranks from 90th to 73rd, China is one of the top 10 economies in terms of improving its IDI rank between 2002 and 2007 (Chart 4.3). The country has gained on all sub-indices (access, use and skills), and has dramatically increased the number of both fixed telephone lines and mobile cellular subscriptions. While globally, the average annual growth rate for fixed lines stood at 3.4 per cent, China's was 11 per cent, mainly due to large investments in Wireless Local Loop (WLL) technologies. During the same period, the number of mobile cellular subscriptions grew from 200 to 550 million, today accounting for almost one out of five mobile cellular subscriptions in the entire world.

By providing services at relatively low cost, the country has been able to connect millions to ICTs, despite its "limited and state-orchestrated competition".[3] Until 2008, the mobile sector, for example, was run by a duopoly but the penetration level is approaching close to 50 per cent. China's fixed broadband penetration is five subscribers per 100 inhabitants, the highest of any economy with comparable income levels in Asia-Pacific (Chart below). While some economies in Asia-Pacific have started to roll-out fibre to urban business districts, leveraging on existing metropolitan fibre rings, China is noteworthy in that it has also begun offering fibre-to-the-home; at the end of 2007, 1.5 per cent of Chinese households had fibre, ranking the country 11th in the world.[4]

Reasons for China's relatively high broadband and mobile cellular penetration include its rapid economic development – GNI per capita doubled between 2002 and 2007 – which has raised incomes, enabling more people to afford ICT services. The large population base and size of the broadband and mobile markets have created economies of scale, helping to reduce costs and hence prices. China has also nurtured a growing ICT industry, allowing Chinese operators and manufacturers to supply large amounts of mobile handsets, DSL and cable modems, fibre optic cable and other ICT equipment at competitive prices for the domestic market. Finally, China, similar to the Republic of Korea and Japan, has shown that the development of content in its local language and character sets is possible. By the end of 2008, more than one fifth of the Chinese used the Internet, with the country reporting over 1.5 million local web sites.[5]



Source: ITU.

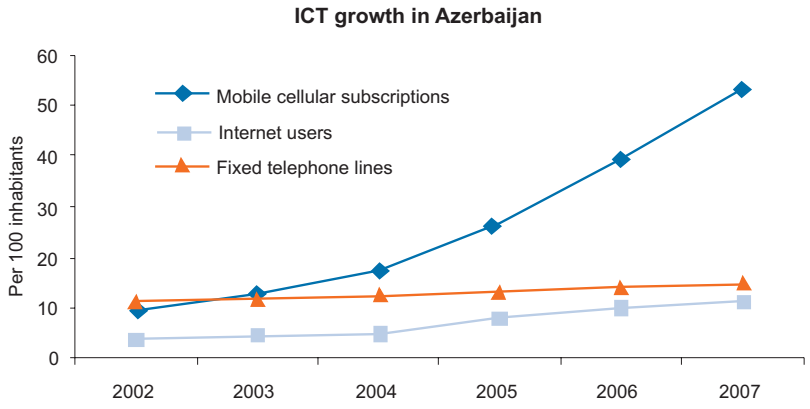
Despite these advances, China is facing a number of challenges. For example, home ownership of ICTs remains low in rural areas. Also, the country is lagging behind in terms of mobile broadband. Although current trends suggest that the Chinese are ready for mobile data applications, the Government has delayed the tender and launch of 3G mobile networks.

According to the China Internet Network Information Center (CNNIC), 50 million Internet users (or 24 per cent of the total) in China access the Internet through their mobile phones (at low speeds). The Government decision to finally issue IMT-2000/3G licenses by early 2009 and to restructure the market to increase competition between operators offering wired and wireless services, is likely to drive mobile broadband, and to further increase penetration levels in other ICT areas, too.

Box 4.4: Azerbaijan – making ICT the second most developed sector of the economy

Azerbaijan has shown remarkable improvements in terms of its position in the ICT Development Index (IDI), moving up from 100th place in 2002 to 86th place in 2007. This was due to improvements in access to ICTs, particularly in the number of mobile cellular subscriptions, which has grown from 10 per 100 inhabitants in 2002 to 53 in 2007 (see Chart below). Internet usage penetration has increased from 3 to 11 per cent during the same period. However, the level of Internet usage is still low compared to the world average (21 per cent in 2007). Modest levels of computer and Internet penetration in households (10 per cent and 9.3 per cent, respectively, in 2007) encouraged its citizens to access Internet in privately-owned Internet cafes. With growth in the number of subscriptions and usage, the communication sector has contributed around 2 per cent of the total GDP in 2007.[6]

Growth in access, to and use of, ICTs can be attributed to a number of factors. Increase in gas and oil investments provided opportunities for other sectors of the economy, including the telecommunication sector.[7] At the same time, market-oriented reforms created favorable conditions for telecommunication operators.[8] It has also become a priority for the Azerbaijani Government to restructure and modernize the sector,[9] which has received around 170 million dollars worth of local investment in 2007 alone.[10]



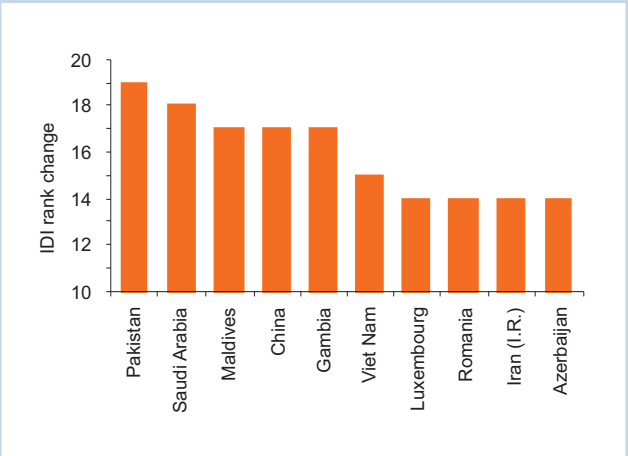
Source: ITU.

Despite recent developments in mobile telephony and Internet services, the country is still lagging behind in some of the new services. For example, IMT-2000/3G service is still not available in the country. It was expected to take off in 2008, but there was no official launch at the time this Report was published. However, current low levels of ICT penetration and usage and the growing demand for different ICT services show strong development potential. This could be an opportunity both for local and international service providers and investors.

The **Maldives** are among the top ten economies that have gained most in value on the ICT access sub-index between 2002 and 2007 (2.30 points or 114 per cent, see Chart 4.5). During this time period, mobile cellular subscriptions have grown from 13.7 per 100 inhabitants to 102.6, and international Internet bandwidth from 466 bits/s/user to over 37'000.

Also in Asia, **Vietnam** has jumped 15 places, to rank 92 in 2007. Improvements have been made on ICT access (mobile cellular subscriptions, starting from very low levels in 2002) and Internet usage (increasing from 2 per cent in 2002 to 20 per cent in 2007). Furthermore, the country has significantly improved on fixed line penetration: while in 2002, there were only 4.8 fixed line subscribers per 100 inhabitants, this figure increased to 32.6 in 2007 (see Box 4.5).

Chart 4.3 Top ten economies in IDI rank change 2002-2007



Source: ITU.

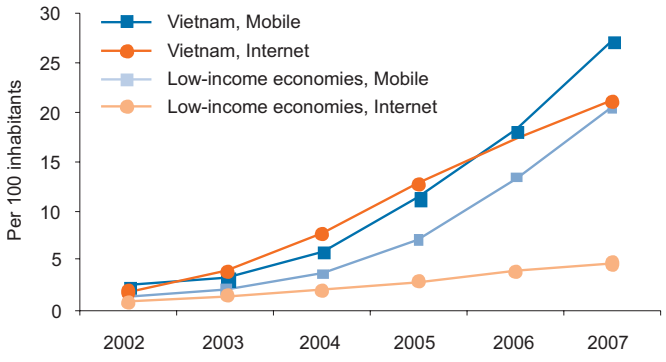
Box 4.5: Vietnam – Government sees ICTs as a driving force for socio-economic development

Vietnam's ICT developments have been impressive between 2002 and 2007 and the country moved up 15 places in the ICT Development Index, from rank 107 to rank 92. Improvements have been made in the area of ICT access, particularly the number of mobile cellular subscriptions. These increased more than ten-fold, from below 2 million in 2002, to over 24 million in 2007. Recent developments and operators' data suggest that this growth has continued, with penetration levels expected to double and reach over 55 per cent by end 2008.[11] During the same time period, Internet penetration has increased from 1.8 to 20 per cent. With one-fifth of its population online, Vietnam clearly stands out among countries with similar income levels (Chart below).

The country's booming economy (GNI per capita has almost doubled, from 430 US$ in 2002 to US$ 790 in 2007) and its large youth population[12] have led to higher disposable incomes and increased consumer demand for ICTs. This has been matched by an enabling market environment; especially competition has played a major role in fostering growth, with half a dozen mobile operators competing for customers.[13] Market liberalization has also opened up international gateways and ensured favorable conditions for new entrants, including in the ISP market.

At the same time, the Vietnamese Government has taken a strong commitment to make ICT one of its key development goals. The Ministry of Information and Communication (MIC) *"National Strategy for ICT Development Until 2010"* is based on a holistic approach that addresses the need for ICT infrastructure, industry, application and human resources. Its key stakeholders include the Government, enterprises and citizens.[14] Concretely, the Government has set a number of targets, including public access and broadband deployment and provided Government funding to operators. Projects include the connection of all schools and tertiary institutions by the end of 2010. And *"to accelerate the universalization of telephone and Internet services in rural, deep-lying and remote areas, especially in border communes. By 2010, all communes will have public telephone booths, 50 per cent of communes will have public Internet access points; all districts and most communes in the region will be provided with broadband Internet services"*.[15] In terms of broadband subscribers, the Government is aiming at a penetration rate of about 3-4 per cent by end 2010, about twice as much as the country had at the end of 2007.

Mobile cellular subscriptions and Internet users, Vietnam vs low-income economies



Source: ITU.

ICT use has significantly increased in the **United Arab Emirates**, with a gain in the IDI use sub-index value of 2.82 or more than 300 per cent, among the highest of all countries (following Luxembourg, Japan, Ireland and France). This places the United Arab Emirates on rank 32, up from 40 in 2002. Mobile broadband penetration in the United Arab Emirates was already at 46.6 per cent in 2007. Similarly, mobile cellular penetration has reached one of the highest values globally in 2007 (176 per 100 inhabitants).

Saudi Arabia has jumped impressively from rank 73 in 2002 to rank 55 in 2007. ICT infrastructure and access has significantly improved during this time period, corresponding to a gain of 2.66 points on this sub-index, one of the highest gains among all countries. For example, mobile subscriptions have increased from 22 per 100 inhabitants in 2002 to 115 in 2007. On the other hand, progress on the skills sub-index has been slow and here the country still has great potential to improve its index value (Box 4.6).

Iran also moved up considerably, 14 places, to rank 78 in the IDI 2007. Starting from very low levels in 2002, mobile penetration reached 42 per 100 inhabitants in 2007, and Internet user penetration 32 per cent. Fixed line penetration increased from 19 to 33 per cent during the five-year period.

Syria moved up 13 places between 2002 and 2007, to rank 89. It has made gains particularly on ICT access and ICT skills. For example, secondary school enrolment has increased from 41 per cent in 2002, to 67 per cent in 2007.

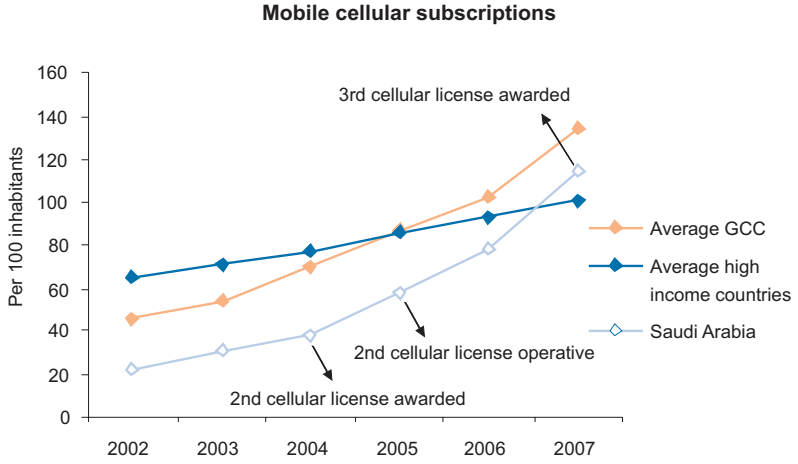
Box 4.6: Saudi Arabia – liberalising the mobile market (1)

Saudi Arabia improved its IDI position from rank 73 in 2002 to rank 55 in 2007, mainly due to significant gains in ICT access and ICT use. On the other hand, little progress occurred in the skills sub-index, with all skill indicators being below the world average in 2007.

ICT access was improved by an outstanding increase in mobile penetration, from 22 per cent in 2002 to 115 per cent in 2007. As shown in the Chart below, Saudi Arabia's growth in mobile cellular subscriptions was above that of high-income countries, following a similar trend in other countries of the Gulf Cooperation Council (GCC).[16]

In the case of Saudi Arabia, mobile penetration growth has been spurred by competition and by the launch of new services. At the end of 2004, a second cellular license was awarded. The new entrant launched its services in 2005 (see upturn in the Chart). In 2006, the first IMT-2000/3G service was launched. In 2007, a new license was awarded, and the third mobile operator commercial launch took place in mid-2008.

Contrary to the dynamism in the mobile segment, fixed line liberalization did not take place until 2008. Fixed line penetration stood at 16 per cent in 2007, well below the world's average, with nearly no growth from 2002.



Source: ITU.

Internet users per 100 inhabitants increased from 6.2 in 2002 to 25.8 in 2007. However, broadband penetration was still very low in 2007 – less than 3 per cent for both mobile and fixed subscribers. Broadband demand is reported to be rising in Saudi Arabia, yet supply constraints hamper its development.[17] Moreover, international Internet bandwidth (per 100 Internet users) was in 2007 below the world's average (1932 bits/s compared to 2290 bits/s). Therefore, there is still room for improvement in the data segment, especially in fixed line penetration, since it is a prerequisite for DSL connections.

AMERICAS

The **United States** is down six places, ranking 17th in 2007. Although gaining on both the access and the usage sub-indices, the United States has not yet reached the same high ICT penetration levels as several European countries. For example, in the United States 62 per cent of households had Internet access in 2007, compared to 79 per cent in Sweden.

Canada has also lost 10 places, moving down to rank 19 in 2007. Similar to the US, Canada improved in both ICT access and usage, but less than other top countries. For example, mobile cellular penetration was only 62 per cent in 2007, and fixed telephone line penetration decreased in the five-year period. Mobile broadband just started, with only 1.5 subscriptions per 100 inhabitants at the end of 2007.

Among the larger Latin American economies, **Argentina** and **Chile** are the top ones (ranks 47 and 48 respectively), with some losses in ranks between 2002 and 2007. Brazil (rank 60) lost six places in the five-year period and made relatively little value gains (0.93). This is true for both ICT access (e.g. mobile phone penetration is only 63 per cent) and use. Also, very little improvements were made on the skills sub-index; for example, tertiary enrolment is rather low – less than 30 per cent, compared to, for example, Argentina with over 60 per cent.

Improvements in both ICT access and the skills sub-index have been made in **Honduras**, moving it up 12 places (to 102). Particularly, Honduras has improved enrolment in secondary schools, but it also has made important improvements in mobile cellular penetration and international bandwidth (see Box 4.7).

AFRICA

South Africa, the largest African economy, ranks 87th (10 places down from 2002) and is the top among Sub-Saharan economies. The country has relatively low access and usage values and little progress was made during the past five years, in particular on ICT usage. For example, international Internet bandwidth is only 852 bits/s/user (which is similar to Ethiopia, compared to, for example, Tunisia with 1800 bits/s/user) and only 4.8 per cent of households had access to the Internet in 2007.

Among the smaller African countries, The **Gambia** should be highlighted. It has moved up 17 places, to rank 122 in the IDI 2007. While this is still low, some progress has been made in the area of ICT access and education (Box 4.8). **Mauritius** (rank 62, down one place from 2002) is the country that has gained most on IDI value among the African countries, improving in all areas (access, use and skills). In 2007, mobile cellular penetration was 74 per cent and fixed broadband penetration almost five per cent, being one of the highest in the region.

Tunisia moved up 11 places (to 83 in the IDI 2007). This is due to both ICT access and skills. For example, mobile cellular telephone penetration is 76 per cent, up from 6 in 2002, and tertiary enrolment increased from 23 per cent in 2002 to 32 per cent in 2007.

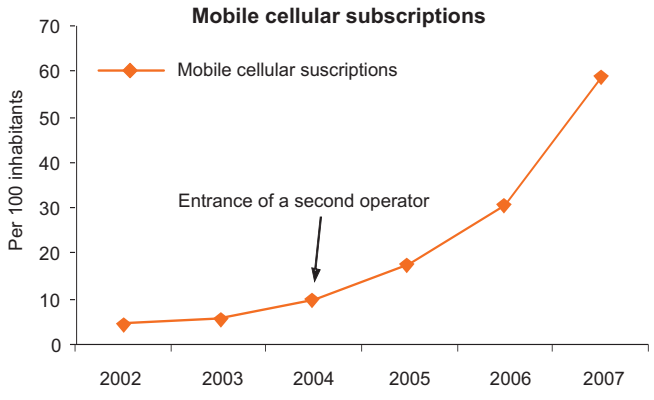
Morocco (up ten places from 111 in 2002, to rank 101 in the IDI 2007) has also improved its ICT level significantly (second highest gains in Africa, after Mauritius). Similar to Tunisia, Morocco has gained mainly on access (mobile cellular penetration and international Internet bandwidth) and skills (secondary enrolment).

Box 4.7: Honduras – liberalising the mobile market (2)

Between 2002 and 2007, Honduras moved up 12 places in the IDI, from rank 114 to rank 102. Improvements have been made in the area of ICT access, particularly in the number of mobile cellular subscriptions and in the total capacity of international Internet bandwidth per Internet user, as well as in the area of skills, almost doubling secondary enrolment.

The number of mobile subscriptions increased more than twelve-fold, from 326,508 in 2002, to over 4 million in 2007. One of the main reasons was the increase of competitors in the market. In 2003, the National Telecommunications Commission (CONATEL) awarded a license for integrating a second operator to the mobile market, leading to an annual average growth in mobile subscriptions of 82 per cent between 2004 and 2007. The entrance of two additional operators in 2007 and 2008 will probably further contribute to the increase in the number of subscriptions. The main increases in mobile subscriptions occurred in 2004 and 2007, which correspond to years of economic boom and growth in GNI per capita of 8 and 33 per cent, respectively.

These improvements have also led to a growth in the number of households where at least one member has access to a mobile cellular phone. According to data produced by the National Statistical Institute of Honduras, these increases have been more remarkable in the rural households, where the average annual growth rate of mobile access between 2004 and 2007 was 102 per cent, compared to 43 per cent for urban households. By 2007, the percentage of households with access to mobile phones was 71.6 (urban) and 45.5 (rural)[18], similar to other Central American countries.



Source: ITU.

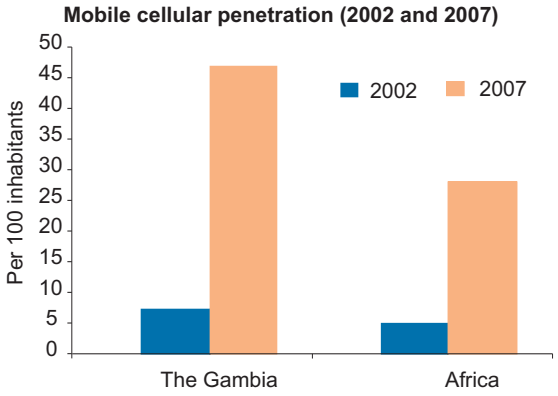
International Internet bandwidth capacity, which in 2002 was 100.9 bps per Internet user, increased significantly to reach 4,081 bps per Internet user in 2007, with 2006 and 2007 being the years with major growth. This increase, however, has not yet allowed the country to improve Internet access and use, both remaining low with 3.3 per cent of households and 6 per cent of the population, respectively, in 2007. This is mainly due to the high prices of Internet access in Honduras. According to ECLAC (2008), Honduras has the fifth most expensive broadband Internet tariff in the region.[19]

Box 4.8: The Gambia – mobile communication on the rise

Compared to countries with similar, rather low, ICT levels in 2002, The Gambia has made significant progress, moving up 17 places in the IDI 2007, to rank 122. Most of the improvement is due to higher mobile cellular penetration, but the number of Internet users and literacy rates have also increased, contributing to the relative higher ranking.

Mobile cellular subscriptions have increased steeply in The Gambia during the past few years, reflecting the stiff competition amongst mobile operators. The number of fixed telephone lines, on the other hand, has stagnated since 2006, with growth rates of 20 per cent in 2006 and only 9 per cent in 2007. Out of almost a million telephone subscribers, there are over 800'000 mobile cellular telephone subscriptions and about 50'000 fixed telephone lines in service.[20]

According to a 2008 Report by the Public Utilities Regulatory Authority (PURA), telecommunications in The Gambia "is one of the most highly competitive markets in the sub-region. This is illustrated by an increase in innovative services and pricing schemes such as peak, off-peak and free night calls." The Report concludes that the communications sector saw a tremendous growth from 7 per cent to 25 per cent in 2007, with an estimated investment in the telephone sector of US$26.3 million in 2007.



Source: ITU.

Communication and Internet costs are still relatively high, though. For example, mobile prepaid tariffs amount to 16.5 (PPP $), placing The Gambia on rank 85 in the ITU mobile price basket (PPP terms), and on rank 135 as a percentage on monthly GNI per capita (22.6 US$) (see Chapter 6). The above figures illustrate the readiness of low-income users to spend a relatively high proportion of their income on mobile communication.

A new Information and Communication Act, which was prepared with the technical assistance of ITU in collaboration with the Department of State for Communication, Information and Information Technology (DOSCIIT), is expected to be adopted in 2009, which will further enable the sector to be effectively managed (PURA, 2008).

Gamtel, the incumbent operator, is expecting that by the end of 2008, every village in the country will be connected to the PSTN, through the deployment of advanced wireless local loop technologies.[21] Broadband access is still very limited in The Gambia and its cost is prohibitive. For example, an entry broadband plan is almost US$ 400, corresponding to over 1'000 PPP $, or 1'400 per cent of monthly GNI per capita. In order to increase the service, Gamtel foresees to deploy xDSL in some parts of the Greater Banjul Area and ISDN connections for most of the rest of the country.

4.2 A closer look at the IDI sub-indices: ICT access, use and skills

Based on the conceptual framework presented earlier, the IDI was constructed around three subcomponents, access, use and skills. A breakdown of index results by these subcomponents allows the user (for example, Government policy makers) to better assess ICT performance and identify those areas which need to be addressed in future planning.

ICT ACCESS SUB-INDEX

There are five indicators included in this sub-index: fixed line penetration, mobile cellular penetration, international Internet bandwidth per Internet user, the proportion of households with computers and the proportion of households with Internet access.

It is to be expected that the economies that rank highly on ICT access correspond largely to those that rank

Chart 4.4: Top ten countries on ICT access (2007)

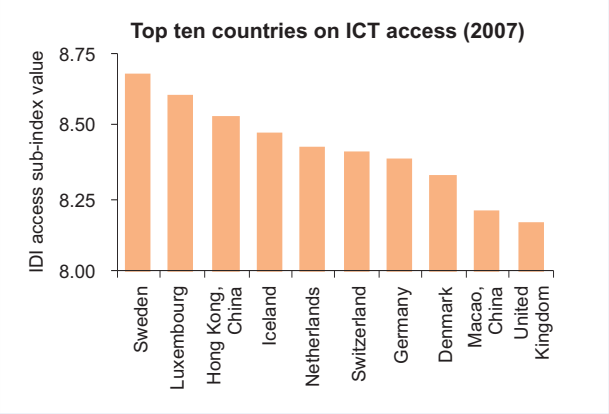
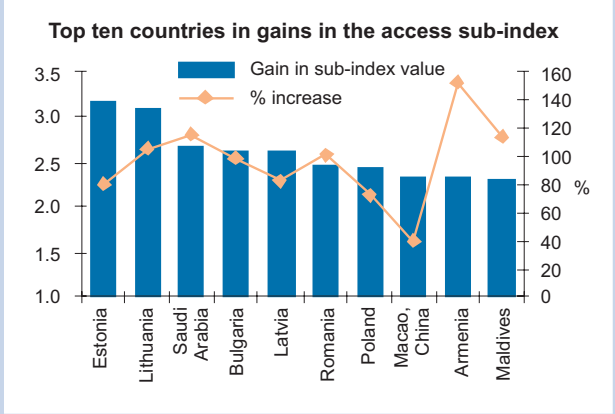


Chart 4.5: Top ten countries in gains in the IDI access sub-index (2002-2007)



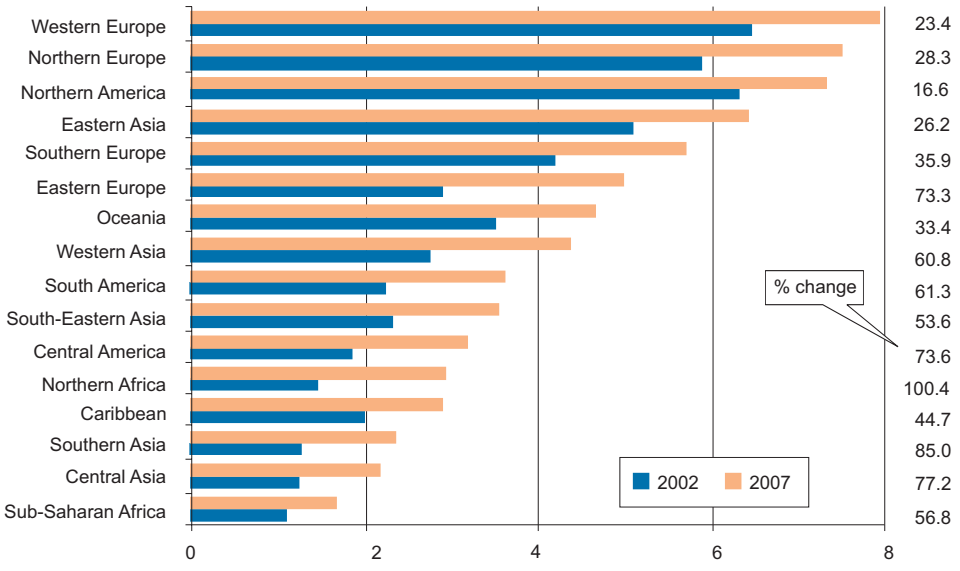
Source: ITU.

among the top economies of the overall index (see Chart 4.4 and Table 4.4) given that ICT use requires ICT infrastructure and access in the first place. Exceptions are Hong Kong (China), Germany, and Macao (China). With very high ICT access scores, these countries are likely to improve their overall index scores in the near future, provided ICT use and skills will improve.

A closer look at the economies that gained most in ICT access over the five-year period (Chart 4.5) shows that in addition to the economies highlighted in the previous sections (in particular the Baltic states and Saudi Arabia), Bulgaria, Poland and Armenia should be mentioned, all of which are among the top ten economies that improved their ICT access most.

A closer look at geographic regions illustrates that the rankings are similar to the overall IDI. The only exception is Southern Asia, which ranks above Central Asia on ICT access (it is below Central Asia on the overall IDI).

Chart 4.6: IDI access sub-index by geographic region (2007 and 2002)



Source: ITU.

Table 4.4: IDI access sub-index (2007 and 2002)

Economy	Rank 2007	Access 2007	Rank 2002	Access 2002
Sweden	1	8.67	1	7.68
Luxembourg	2	8.60	11	6.68
Hong Kong, China	3	8.53	7	6.86
Iceland	4	8.48	3	7.40
Netherlands	5	8.42	5	6.90
Switzerland	6	8.41	4	7.27
Germany	7	8.39	12	6.62
Denmark	8	8.33	2	7.47
Macao, China	9	8.21	21	5.86
United Kingdom	10	8.16	8	6.82
Singapore	11	8.06	13	6.54
Norway	12	7.89	6	6.90
Taiwan, China	13	7.63	10	6.73
Korea (Rep.)	14	7.48	9	6.82
Canada	15	7.43	15	6.34
Ireland	16	7.40	22	5.82
Austria	17	7.35	18	5.97
Italy	18	7.33	23	5.74
Australia	19	7.24	19	5.97
Finland	20	7.23	14	6.36
Belgium	21	7.23	17	6.01
United States	22	7.20	16	6.21
France	23	7.16	26	5.57
Estonia	24	7.12	37	3.96
New Zealand	25	7.11	27	5.44
Malta	26	7.09	28	5.41
Japan	27	6.89	20	5.93
Israel	28	6.86	24	5.71
Slovenia	29	6.83	25	5.65
Spain	30	6.83	29	5.06
Portugal	31	6.39	33	4.69
Cyprus	32	6.33	31	4.80
Greece	33	6.22	30	5.04
United Arab Emirates	34	6.22	35	4.30
Bahrain	35	6.09	38	3.95
Lithuania	36	6.04	49	2.94
Hungary	37	5.97	36	4.05
Slovak Republic	38	5.83	39	3.76
Qatar	39	5.83	41	3.67
Brunei Darussalam	40	5.80	34	4.37
Poland	41	5.77	43	3.34
Latvia	42	5.76	44	3.16
Czech Republic	43	5.68	32	4.73
Croatia	44	5.66	40	3.70
Bulgaria	45	5.26	54	2.64
Argentina	46	5.02	47	2.99
Trinidad & Tobago	47	4.96	50	2.88
Saudi Arabia	48	4.96	63	2.29
Romania	49	4.84	59	2.40
Chile	50	4.62	45	3.02
Kuwait	51	4.54	42	3.38
Russia	52	4.45	60	2.36
Turkey	53	4.43	58	2.46
Uruguay	54	4.37	48	2.95
Maldives	55	4.32	68	2.01
Bosnia	56	4.27	65	2.19
Jamaica	57	4.17	46	3.01
Ukraine	58	4.17	72	1.94
Panama	59	4.15	62	2.31
Malaysia	60	4.14	52	2.73
Mauritius	61	4.04	51	2.81
Belarus	62	4.01	74	1.92
Thailand	63	3.99	81	1.74
China	64	3.87	71	1.95
Moldova	65	3.87	85	1.63
Armenia	66	3.85	95	1.52
Oman	67	3.77	64	2.21
Costa Rica	68	3.75	53	2.67
Brazil	69	3.64	56	2.58
Colombia	70	3.60	67	2.06
Kazakhstan	71	3.56	93	1.55
TFYR Macedonia	72	3.56	55	2.61
Lebanon	73	3.55	57	2.48
Venezuela	74	3.45	69	1.96
Ecuador	75	3.31	70	1.96
Mexico	76	3.29	61	2.33
Syria	77	3.29	76	1.88
Jordan	78	3.28	66	2.15
Fiji	79	3.18	86	1.62
Iran (I.R.)	80	3.17	82	1.74
Azerbaijan	81	3.12	136	0.91
Georgia	82	3.09	90	1.56
Palestine	83	3.06	73	1.92
South Africa	84	3.04	77	1.88
Peru	85	3.04	94	1.52
Morocco	86	3.03	84	1.64
Tunisia	87	2.98	88	1.58
Guatemala	88	2.95	79	1.83
Libya	89	2.92	109	1.20
Viet Nam	90	2.89	118	1.05
Honduras	91	2.88	111	1.11
Algeria	92	2.86	106	1.27
Philippines	93	2.86	89	1.57
El Salvador	94	2.84	87	1.59
Paraguay	95	2.83	75	1.89
Albania	96	2.83	78	1.87
Gabon	97	2.75	99	1.39
Egypt	98	2.74	92	1.55
Sri Lanka	99	2.66	104	1.30
Dominican Rep.	100	2.61	91	1.56
Cape Verde	101	2.41	83	1.66
Nicaragua	102	2.37	130	0.96
Botswana	103	2.31	96	1.49
Mongolia	104	2.25	100	1.39
Kyrgyzstan	105	2.25	119	1.05
Indonesia	106	2.21	113	1.11
Bolivia	107	2.21	97	1.45
Mauritania	108	2.13	101	1.39
Namibia	109	2.12	98	1.42
Gambia	110	2.01	131	0.96
Senegal	111	1.97	103	1.33
Swaziland	112	1.96	112	1.11
Bhutan	113	1.96	117	1.05
Lao P.D.R.	114	1.87	141	0.85
Côte d'Ivoire	115	1.86	110	1.15
Sudan	116	1.85	128	0.97
Turkmenistan	117	1.84	102	1.37
Pakistan	118	1.84	135	0.92
Cambodia	119	1.80	114	1.10
Yemen	120	1.77	143	0.85
Benin	121	1.76	151	0.75
Tajikistan	122	1.74	108	1.22
Ghana	123	1.72	148	0.82
Cameroon	124	1.69	129	0.96
Madagascar	125	1.69	125	0.98
Mali	126	1.66	122	0.99
Bangladesh	127	1.62	127	0.97
Burkina Faso	128	1.60	115	1.08
India	129	1.57	124	0.98
Niger	130	1.49	137	0.86
Uzbekistan	131	1.49	132	0.96
Myanmar	132	1.48	80	1.78
Lesotho	133	1.45	142	0.85
Kenya	134	1.40	144	0.84
Haiti	135	1.38	107	1.23
Mozambique	136	1.33	123	0.98
Nepal	137	1.33	120	1.01
Malawi	138	1.32	145	0.83
Nigeria	139	1.31	133	0.94
Tanzania	140	1.30	121	1.00
Cuba	141	1.30	105	1.28
Uganda	142	1.30	150	0.79
Rwanda	143	1.26	116	1.07
Comoros	144	1.26	146	0.82
Ethiopia	145	1.23	134	0.94
Zambia	146	1.19	139	0.86
Togo	147	1.15	149	0.81
Zimbabwe	148	1.05	138	0.86
Congo	149	1.01	152	0.69
Papua New Guinea	150	1.00	140	0.85
Guinea-Bissau	151	0.99	154	0.29
Chad	152	0.87	153	0.63
Eritrea	153	0.86	126	0.97
D.R. Congo	154	0.80	147	0.82

Source: ITU.

Chart 4.7: Top ten countries on the IDI use sub-index (2007)

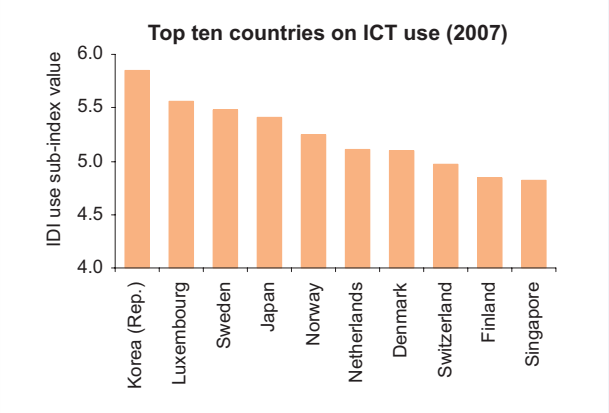
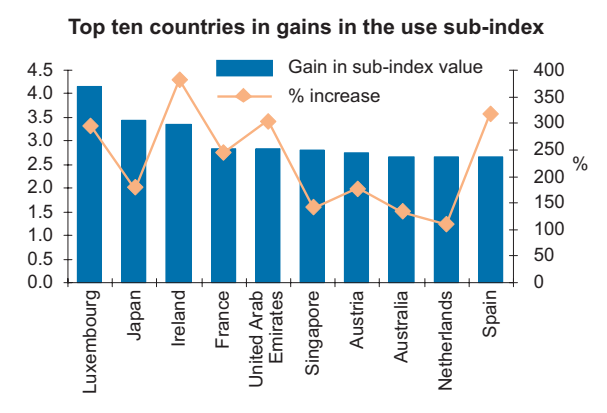


Chart 4.8: Top ten countries in gains in the IDI use sub-index (2002-2007)



Source: ITU.

While still rather low on overall ICT developments, some Southern Asian countries, such as the Maldives, Iran, Sri Lanka and Pakistan, have considerably increased ICT access, but have yet to catch up on ICT use. Another dynamic region is Northern Africa, which includes Algeria, Egypt, Libya, Morocco and Tunisia, all of which have increased their ICT access considerably during the five-year period.

ICT USE SUB-INDEX

The sub-index ICT use includes three indicators, Internet user penetration, fixed broadband penetration, and mobile broadband penetration. Generally speaking, economies that rank high, and have made most improvements on ICT use, are from the developed world, and some high income economies such as the Republic of Korea, Singapore and the United Arab Emirates (Table 4.5). Broadband Internet (measuring the intensity of ICT use) is still very limited or non-existent in most developing countries. Charts 4.7 and 4.8 confirm this by showing the top ten countries on ICT use and improvements in the ICT use sub-index, respectively.

The regional breakdown illustrates the dynamic developments Western and Northern European economies have undergone during the five-year period, surpassing Northern America on the sub-index use (Chart 4.9). Western Europe has achieved the highest gains in sub-index value (2.71), followed by Northern Europe (2.31), both regions starting from already relatively high values in 2002. In addition, Eastern Asia (due to high gains by Japan, Macao (China), and the Republic of Korea) has made huge improvements on ICT use and may catch up with the other top regions in the near future.

Most of the other regions started from very low levels in 2002, and despite large relative gains, are still far behind on ICT use, in particular when it comes to broadband use. South-Eastern Asia should be noted, as it ranks higher on the ICT use sub-index compared to the overall IDI. This is largely due to Singapore, Brunei Daressalam and Malaysia, which have relatively high ICT use values. On the other end of the scale, Sub-Saharan Africa scores low and has gained a lot less than, for example, Central Asia, both regions having a similar low ICT use sub-index value of 0.05 in 2002. While Central Asia increased this to 0.28 in 2007, Sub-Saharan Africa remains at a low 0.16 index value, with very low Internet user and broadband penetration rates.

SKILLS SUB-INDEX

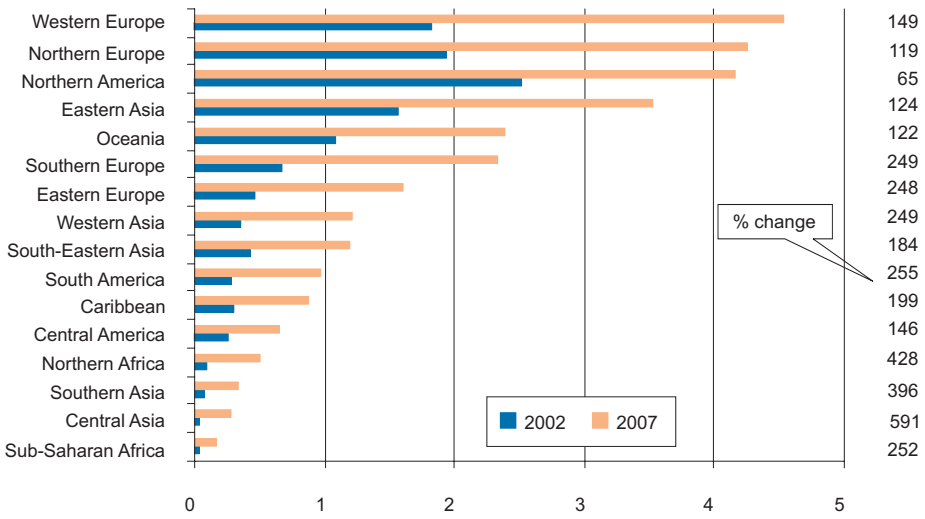
The three indicators included in the IDI sub-index skills (adult literacy, secondary and tertiary enrolment) are proxy measures, in the absence of comparable data for a large number of countries that would measure more specific ICT-related skills. They should thus be considered as a critical enabler for effective ICT use and cannot be delinked from the use component. Evidently, the availability of ICT infrastructure and access is a prerequisite in this framework. Therefore, economies that rank highly in the skills sub-index, do not necessarily rank highly in the other sub-indices, or the overall

Table 4.5: IDI use sub-index (2007 and 2002)

Economy	Rank 2007	Use 2007	Rank 2002	Use 2002
Korea (Rep.)	1	5.85	1	3.21
Luxembourg	2	5.56	22	1.40
Sweden	3	5.48	3	2.89
Japan	4	5.41	18	1.96
Norway	5	5.25	5	2.67
Netherlands	6	5.11	8	2.44
Denmark	7	5.10	6	2.60
Switzerland	8	4.97	9	2.42
Finland	9	4.84	11	2.36
Singapore	10	4.83	14	2.01
Iceland	11	4.80	2	3.10
Australia	12	4.68	15	2.00
Hong Kong, China	13	4.64	7	2.45
United Kingdom	14	4.51	16	1.99
New Zealand	15	4.40	13	2.06
United States	16	4.32	10	2.37
Austria	17	4.29	21	1.54
Taiwan, China	18	4.26	12	2.10
Ireland	19	4.23	32	0.88
Germany	20	4.07	19	1.85
Canada	21	4.01	4	2.67
France	22	3.99	25	1.16
Belgium	23	3.76	17	1.97
United Arab Emirates	24	3.75	31	0.93
Italy	25	3.67	29	1.01
Spain	26	3.50	33	0.83
Estonia	27	3.40	20	1.58
Macao, China	28	3.24	28	1.06
Slovenia	29	3.18	26	1.10
Portugal	30	3.10	37	0.77
Israel	31	3.05	35	0.79
Malta	32	2.77	24	1.21
Brunei Darussalam	33	2.76	47	0.55
Lithuania	34	2.61	42	0.63
Hungary	35	2.57	44	0.61
Slovak Republic	36	2.47	23	1.34
Czech Republic	37	2.40	34	0.80
Cyprus	38	2.29	30	0.98
Latvia	39	2.27	38	0.75
Malaysia	40	2.26	27	1.09
Poland	41	2.17	39	0.72
Croatia	42	2.12	45	0.58
Jamaica	43	2.04	36	0.78
Qatar	44	1.95	57	0.34
Bahrain	45	1.95	43	0.63
Greece	46	1.94	48	0.50
Bulgaria	47	1.57	61	0.30
Chile	48	1.48	40	0.70
Romania	49	1.47	66	0.22
TFYR Macedonia	50	1.42	46	0.58
Brazil	51	1.41	58	0.33
Mauritius	52	1.37	56	0.35
Lebanon	53	1.33	50	0.44
Costa Rica	54	1.28	41	0.66
Uruguay	55	1.24	52	0.37
Argentina	56	1.23	51	0.38
Kuwait	57	1.21	54	0.37
Iran (I.R.)	58	1.08	76	0.16
Saudi Arabia	59	1.08	68	0.21
Venezuela	60	1.04	71	0.18
Peru	61	1.02	59	0.31
Colombia	62	1.02	75	0.16
Belarus	63	1.02	62	0.30
Bosnia	64	1.01	93	0.09
Mexico	65	0.99	49	0.45
Panama	66	0.98	60	0.31
Trinidad & Tobago	67	0.95	55	0.36
Turkey	68	0.88	53	0.37
Russia	69	0.86	80	0.14
Ukraine	70	0.84	104	0.06
China	71	0.81	74	0.17
Morocco	72	0.79	96	0.08
Thailand	73	0.78	63	0.26
Viet Nam	74	0.76	105	0.06
Jordan	75	0.71	70	0.20
Moldova	76	0.68	83	0.12
Dominican Rep.	77	0.66	64	0.24
Albania	78	0.63	130	0.01
Tunisia	79	0.62	72	0.17
Ecuador	80	0.60	79	0.14
Syria	81	0.58	99	0.07
Maldives	82	0.56	73	0.17
Kazakhstan	83	0.51	109	0.06
Egypt	84	0.51	91	0.09
Oman	85	0.48	65	0.24
Guatemala	86	0.48	85	0.11
Kyrgyzstan	87	0.47	90	0.10
Mongolia	88	0.45	101	0.07
Fiji	89	0.45	69	0.20
El Salvador	90	0.44	77	0.15
Georgia	91	0.41	110	0.05
South Africa	92	0.40	67	0.22
Palestine	93	0.40	89	0.10
Algeria	94	0.39	111	0.05
Cuba	95	0.39	113	0.05
Bolivia	96	0.37	88	0.11
Azerbaijan	97	0.37	82	0.12
Pakistan	98	0.36	92	0.09
Haiti	99	0.35	120	0.03
Zimbabwe	100	0.34	81	0.13
Paraguay	101	0.34	108	0.06
Sudan	102	0.32	128	0.02
Kenya	103	0.30	115	0.04
Philippines	104	0.26	78	0.15
Cape Verde	105	0.25	87	0.11
India	106	0.25	112	0.05
Tajikistan	107	0.24	153	0.00
Indonesia	108	0.24	98	0.07
Senegal	109	0.24	119	0.03
Nigeria	110	0.23	134	0.01
Armenia	111	0.22	100	0.07
Gabon	112	0.21	103	0.06
Honduras	113	0.20	95	0.08
Gambia	114	0.20	107	0.06
Botswana	115	0.19	86	0.11
Sri Lanka	116	0.18	118	0.03
Libya	117	0.17	97	0.08
Togo	118	0.17	84	0.12
Namibia	119	0.16	94	0.09
Bhutan	120	0.15	126	0.02
Uzbekistan	121	0.15	117	0.04
Zambia	122	0.15	127	0.02
Nicaragua	123	0.14	106	0.06
Ghana	124	0.13	122	0.03
Swaziland	125	0.12	102	0.06
Uganda	126	0.12	132	0.01
Lesotho	127	0.12	116	0.04
Côte d'Ivoire	128	0.10	125	0.02
Cameroon	129	0.10	131	0.01
Comoros	130	0.09	129	0.01
Guinea-Bissau	131	0.09	121	0.03
Congo	132	0.09	149	0.00
Eritrea	133	0.08	141	0.01
Rwanda	134	0.07	138	0.01
Papua New Guinea	135	0.06	114	0.05
Lao P.D.R.	136	0.06	139	0.01
Mauritania	137	0.06	133	0.01
Benin	138	0.06	123	0.02
Mozambique	139	0.05	140	0.01
Nepal	140	0.05	136	0.01
Turkmenistan	141	0.05	137	0.01
Yemen	142	0.05	124	0.02
Tanzania	143	0.04	144	0.01
Malawi	144	0.03	143	0.01
Mali	145	0.03	146	0.01
Chad	146	0.03	147	0.01
Burkina Faso	147	0.03	145	0.01
Madagascar	148	0.02	135	0.01
Cambodia	149	0.02	142	0.01
Niger	150	0.01	150	0.00
D.R. Congo	151	0.01	151	0.00
Bangladesh	152	0.01	148	0.01
Ethiopia	153	0.01	152	0.00
Myanmar	154	0.00	154	0.00

Source: ITU.

Chart 4.9: IDI use sub-index by geographic region



Source: ITU.

index (whereas those that rank highly on ICT use also rank highly on ICT access). One example is Cuba, with its high literacy and school enrolment rates; however, in the absence of ICT infrastructure and access, it is still a long way from becoming an inclusive information society, which could benefit highly from the skills available in the country.[22]

Other countries, which rank highly on this sub-index, or which have improved significantly their skills during the five-year period, and which have not yet been highlighted before, include Greece, Slovenia, New Zealand, Malta, Mongolia and Albania (Charts 4.10 and 4.11).

Skill levels show slightly different patterns by geographic region, compared to the other two sub-indices and the overall IDI. Western Europe and Eastern Asia rank further down compared to Eastern and Southern Europe. Also, Western Asia ranks lower, whereas South America ranks higher compared to the overall IDI score.

Chart 4.10: Top ten countries on IDI skills sub-index (2007)

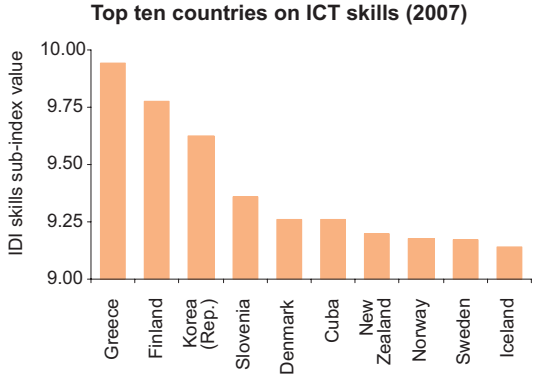
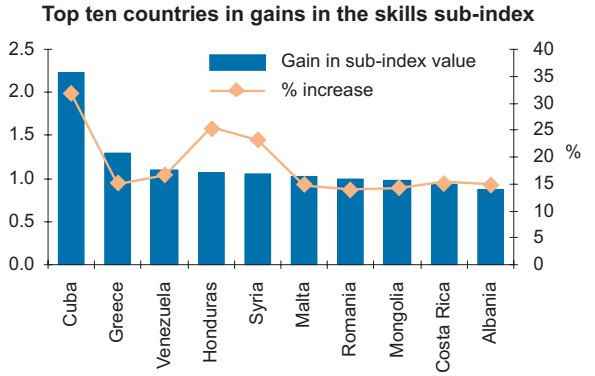


Chart 4.11: Top ten countries in gains in the IDI skills sub-index (2002-2007)



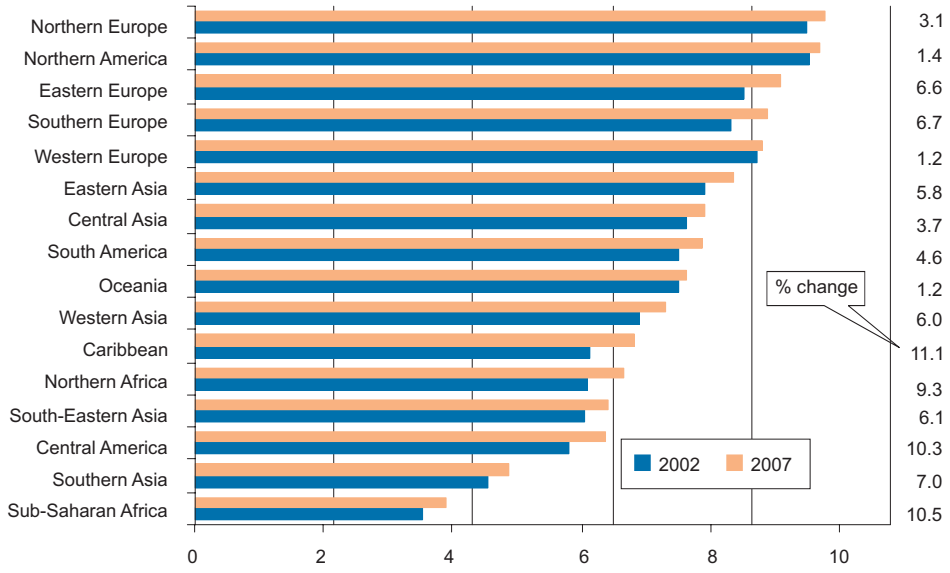
Source: ITU.

Table 4.6: IDI skills sub-index (2007 and 2002)

Economy	Rank 2007	Skills 2007	Rank 2002	Skills 2002
Greece	1	9.94	14	8.65
Finland	2	9.78	1	9.45
Korea (Rep.)	3	9.63	6	9.07
Slovenia	4	9.36	8	8.85
Denmark	5	9.26	9	8.74
Cuba	6	9.26	53	7.03
New Zealand	7	9.20	7	8.93
Norway	8	9.18	4	9.08
Sweden	9	9.17	3	9.14
Iceland	10	9.14	23	8.43
United States	11	9.13	5	9.07
Lithuania	12	9.13	12	8.68
Australia	13	9.05	2	9.17
Latvia	14	8.99	13	8.66
Ukraine	15	8.98	21	8.49
Italy	16	8.92	27	8.40
Spain	17	8.91	11	8.70
Hungary	18	8.88	34	8.12
Poland	19	8.85	17	8.57
Canada	20	8.81	15	8.63
Estonia	21	8.79	18	8.57
Belarus	22	8.76	31	8.19
Belgium	23	8.73	16	8.62
Netherlands	24	8.65	22	8.48
Ireland	25	8.60	24	8.41
Japan	26	8.60	28	8.31
Russia	27	8.54	20	8.53
United Kingdom	28	8.53	10	8.72
France	29	8.50	26	8.40
Macao, China	30	8.38	30	8.19
Portugal	31	8.34	25	8.41
Austria	32	8.32	32	8.18
Czech Republic	33	8.23	40	7.65
Bulgaria	34	8.21	37	7.81
Israel	35	8.19	29	8.20
Uruguay	36	8.17	35	7.87
Slovak Republic	37	8.17	45	7.36
Germany	38	8.17	33	8.16
Romania	39	8.16	48	7.16
Argentina	40	8.12	19	8.57
Kazakhstan	41	8.09	39	7.69
Libya	42	8.04	36	7.85
Malta	43	7.97	59	6.95
Mongolia	44	7.93	60	6.94
Switzerland	45	7.92	38	7.73
Croatia	46	7.83	44	7.37
Chile	47	7.81	42	7.41
Venezuela	48	7.72	70	6.62
Palestine	49	7.70	58	6.95
Thailand	50	7.65	67	6.83
Cyprus	51	7.61	47	7.31
Kyrgyzstan	52	7.60	41	7.54
Georgia	53	7.54	43	7.39
Armenia	54	7.46	57	6.98
Moldova	55	7.44	49	7.15
Peru	56	7.42	51	7.08
Bahrain	57	7.39	46	7.34
Lebanon	58	7.39	68	6.83
Turkmenistan	59	7.34	54	7.03
Jordan	60	7.33	50	7.11
Brazil	61	7.28	61	6.92
Hong Kong, China	62	7.16	65	6.85
TFYR Macedonia	63	7.14	64	6.89
Bosnia	64	7.14	52	7.08
Bolivia	65	7.07	55	7.03
Singapore	66	7.07	56	7.02
Panama	67	7.02	66	6.84
Colombia	68	7.00	83	6.22
Costa Rica	69	6.97	88	6.03
Uzbekistan	70	6.95	69	6.77
Philippines	71	6.94	63	6.91
Mexico	72	6.90	78	6.35
Brunei Darussalam	73	6.87	71	6.50
Turkey	74	6.85	75	6.38
Luxembourg	75	6.84	62	6.91
Tajikistan	76	6.74	74	6.38
Dominican Rep.	77	6.70	81	6.24
Albania	78	6.69	92	5.82
Qatar	79	6.67	84	6.17
South Africa	80	6.63	80	6.33
Azerbaijan	81	6.56	72	6.49
Oman	82	6.51	96	5.72
United Arab Emirates	83	6.49	90	5.89
Tunisia	84	6.49	93	5.79
Jamaica	85	6.48	77	6.36
Taiwan, China	86	6.43	73	6.43
Fiji	87	6.42	79	6.34
Mauritius	88	6.40	89	5.93
Kuwait	89	6.34	76	6.36
Paraguay	90	6.26	82	6.22
Sri Lanka	91	6.23	85	6.11
Trinidad & Tobago	92	6.22	87	6.04
Iran (I.R.)	93	6.21	91	5.83
China	94	6.21	99	5.53
Egypt	95	6.20	94	5.77
Malaysia	96	6.15	86	6.07
Maldives	97	6.03	100	5.45
Algeria	98	6.03	101	5.38
Saudi Arabia	99	6.00	97	5.64
Ecuador	100	5.95	98	5.64
Indonesia	101	5.76	102	5.36
Viet Nam	102	5.76	95	5.73
El Salvador	103	5.59	104	5.19
Cape Verde	104	5.58	107	4.81
Syria	105	5.58	109	4.53
Botswana	106	5.49	103	5.28
Honduras	107	5.25	114	4.18
Nicaragua	108	5.12	106	4.81
Namibia	109	5.03	105	4.90
Myanmar	110	4.90	108	4.62
Gabon	111	4.75	110	4.49
Kenya	112	4.70	112	4.27
Congo	113	4.65	115	4.11
Guatemala	114	4.55	116	4.11
Zimbabwe	115	4.50	111	4.49
Swaziland	116	4.48	113	4.27
Ghana	117	4.46	119	3.82
India	118	4.32	118	3.91
Zambia	119	4.30	121	3.67
Lesotho	120	4.24	117	3.99
Lao P.D.R.	121	4.14	122	3.66
Morocco	122	4.07	127	3.41
Cambodia	123	4.00	131	3.15
Bhutan	124	3.91	120	3.72
Nigeria	125	3.88	124	3.55
Cameroon	126	3.72	123	3.64
Yemen	127	3.69	125	3.48
Togo	128	3.65	128	3.32
Papua New Guinea	129	3.56	126	3.44
Sudan	130	3.48	129	3.19
Madagascar	131	3.38	138	2.81
Nepal	132	3.37	133	3.03
Uganda	133	3.22	134	3.01
Rwanda	134	3.17	140	2.78
Comoros	135	3.15	136	2.87
Malawi	136	3.15	132	3.11
D.R. Congo	137	3.14	135	2.94
Eritrea	138	3.13	137	2.85
Côte d'Ivoire	139	3.12	143	2.73
Bangladesh	140	3.03	130	3.16
Gambia	141	3.03	141	2.76
Tanzania	142	2.97	139	2.79
Haiti	143	2.90	142	2.74
Pakistan	144	2.89	144	2.44
Benin	145	2.76	145	2.27
Ethiopia	146	2.69	149	2.04
Senegal	147	2.48	148	2.04
Mauritania	148	2.41	146	2.21
Mozambique	149	2.36	151	1.86
Guinea-Bissau	150	2.35	147	2.13
Chad	151	2.33	150	2.00
Mali	152	2.24	152	1.76
Burkina Faso	153	1.61	153	1.25
Niger	154	1.08	154	0.82

Source: ITU.

Chart 4.12: IDI skills sub-index by geographic region (2007 and 2002)



Source: ITU.

Although less dynamic than ICT access or ICT use developments, some important relative improvements were made by Sub-Saharan Africa, the Caribbean and Central America (Chart 4.12). Since literacy and education are important preconditions for efficient ICT use, such developments will help countries to benefit from ICTs, once these become more widespread.

4.3 IDI analysis by level of development and income

One of the key policy interests in the area of information society measurement is to monitor (and close) the digital divide between countries. A thorough analysis of the global divide will therefore be presented in Chapter 5. This section will briefly highlight differences in the IDI performance between countries grouped according to their level of development (developed/developing).

Chart 4.13 illustrates the strong link between ICT development and overall level of development, with developed countries showing much higher IDI values than developing countries. While the IDI value improvement over the five-year period was much higher for developed countries, relative change was similar between the two groups: developed countries have increased their average IDI value by 36 per cent, compared to a 38 per cent average increase of developing countries.

A comparison of the sub-indices among the two groups reveals the following (see Chart 4.14):

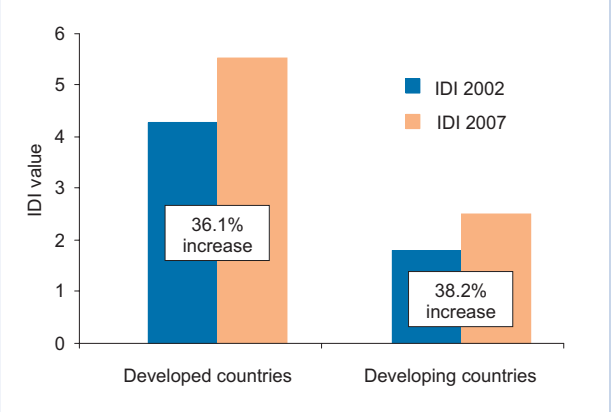
- While developed countries score much higher on ICT access, developing countries have made large relative improvements (59.4 per cent change compared to developed countries' 31.5 per cent change). This suggests that developing countries are slowly catching up on ICT access.

- The highest value gains for developed countries were made on the use sub-index, whereas developing countries made most IDI value gains on the access sub-index. This finding is consistent with the three-stage model presented earlier (Chapter 3).

- Relative gains were highest on the use sub-index for both groups, largely due to low initial values in 2002. Developing countries still have very low values on ICT use.

- In the area of skills, the differences are less striking, reflecting the nature of the underlying indicators (adult literacy and school enrolment), which have been on countries' policy agendas for decades. Developing countries have made slightly higher improvements during the five-year period than developed countries, starting from lower levels in 2002.

Chart 4.13: IDI by level of development (2002 and 2007)



Source: ITU.

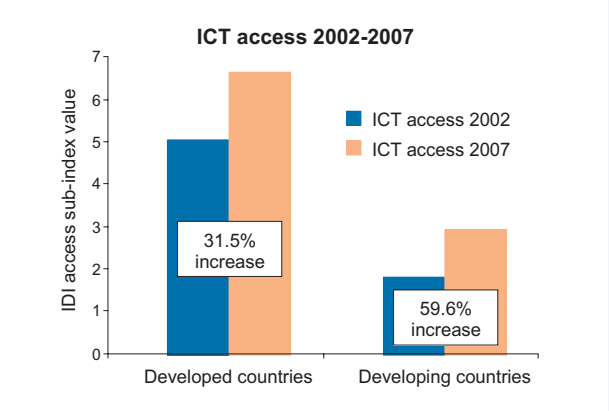
A further step in the analysis of ICT developments between developed and developing countries is to look at national income levels. Chart 4.15 shows the relationship between the IDI and per capita GNI (expressed in PPP terms). As found in previous studies[23], ICT levels are highly correlated with GNI (or GDP) per capita. The logarithmic model presented in those charts provides a good fit for the data, with a correlation coefficient of 0.91 in 2007.

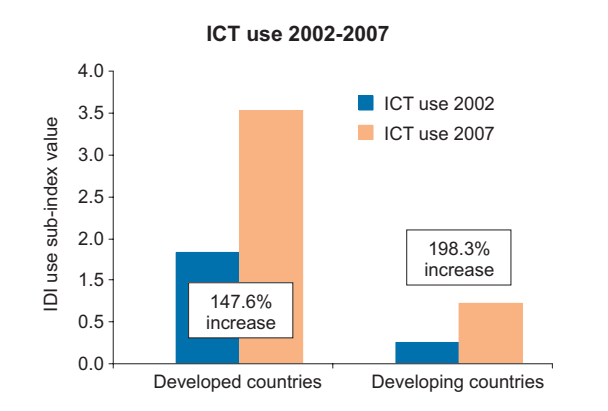
During the five-year period, the logarithmic relationship between the IDI and GNI has grown more robust (R Square value of 0.80 in 2002 compared to 0.82 in 2007) and the curve has become steeper. This suggests that more recently (in 2007), economic growth was more responsive to ICT developments than earlier. The findings also confirm earlier findings by Orbicom (2005), which compared the relationship between infodensity and GDP per capita for the years 1995 and 2003.

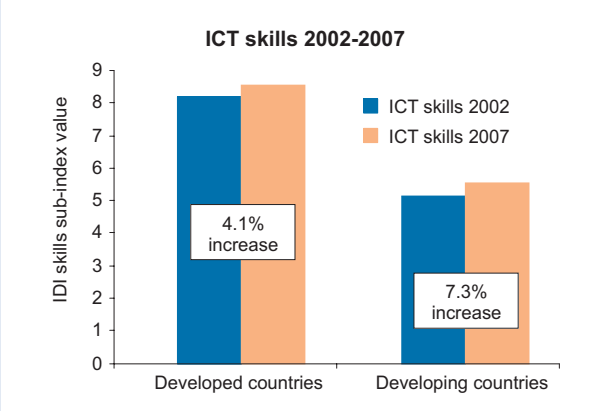
There are several countries that lie above or below the fitted line in the chart. These are economies with higher/lower-than-expected ICT levels given their national income levels. In 2007, among those that have higher than expected ICT levels are several of the top ranking IDI economies: Sweden, the Netherlands, Denmark, Iceland, and the Republic of Korea. In particular Korea, with its relatively low income level (in PPP terms), is outstanding, having much higher-than-expected ICT levels. This illustrates how a strong and targeted policy towards ICT development – as the one the Korean Government has been pursuing for many years – can drive the development of the information society in countries even with relatively low income levels.

Countries with lower-than-expected ICT levels include oil exporting countries, such as Kuwait, Brunei Darussalam and Saudi Arabia. These countries clearly have followed a different economic development strategy, focusing on their natural resources. Given the level of incomes of these countries, there is still a great potential for further growth of ICT-led development.

Chart 4.14: IDI sub-indices by level of development (2002-2007)

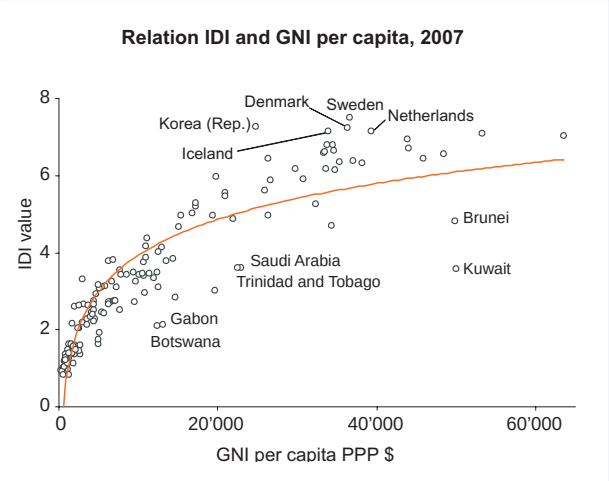


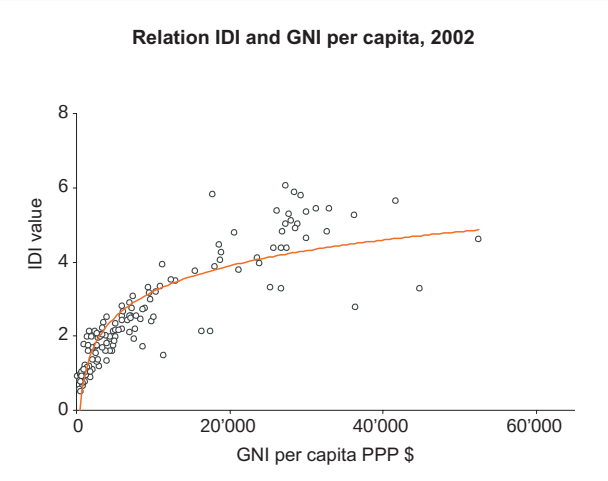




Source: ITU.

Chart 4.15: IDI and GNI per capita (2007 and 2002)





Source: ITU.

Endnotes

1 See: http://www.researchandmarkets.com/reportinfo.asp?report_id=649047.

2 Part of this text was adapted from ITU (2008c).

3 Telecoms in China. Rewired. The Economist, May 29, 2008, see: http://www.economist.com/business/displaystory.cfm?story_id=11465595.

4 See FTTH Council (2008).

5 See China Internet Network Information Center (2008).

6 See State Statistical Committee (2008)..

7 Oil comprises the major sector of Azerbaijan's economy and its demand for technologies stimulates the development of applications both in ICT and other science and technology branches, see http://www.un-az.org/undp/nhdr2003/232.html.

8 This includes the Government's policy to fully liberalize the ICT sector. In 2007, the Ministry of Communication and Information Technologies auctioned its 35.7 per cent stake in Azercell to private companies.

9 "After the oil sector, telecommunications and information technologies will be the most developed sector of the Azerbaijan economy". Ilham Aliyev, President of the Republic of Azerbaijan, see http://www.mincom.gov.az/en/main.html.

10 See Regional Commonwealth in the field of Communications (2007).

11 Based on October 2008 statistics published by the Ministry of Information and Communications. See MIC statistics website, at: http://www.mic.gov.vn/details_e.asp?Object=271032936&news_ID=13653411.

12 In 2005, in Vietnam, the under-20 year old population presented close to 40 per cent of the total population, see UNESCO Vietnam Country Profile, Table 3 at: http://www.unescobkk.org/fileadmin/user_upload/arsh/Country_Profiles/Viet_Nam/Chapter_2.pdf.

13 Limited competition was introduced in Vietnam as early as 1995, although competing operators were controlled by incumbent VNPT. While the country has licensed a total of 6 mobile cellular operators, foreign ownership is limited to 49 per cent in privatized firms.

14 See presentation made by Nguyen La Giang, on " ICT Development in Vietnam", at the 15th Asian Infor Communications Council (AIC) Conference, March 2008, at: http://www.aic.or.jp/conference/37th/pdf/ga/vietnam.pdf.

15 Ministry of Information and Communication (Vietnam) (2007). See also presentation SEACOOP and Vietnam made by Tran Ngoc Ca, Director of Secretariat of National Council for S&T Policy, April 2008, at: http://www.eurosoutheastasia-ict.org/events/vietnam/presentation/CaTran_AW_0408.pdf.

16 The GCC includes the United Arab Emirates, Bahrain, Saudi Arabia, Oman, Qatar and Kuwait.

17 Telecom sector reforms in Saudi Arabia: towards full market liberalization. Prof. Mohammed Al-Suwaiyel, Saudi Telecom Society, June 2007.

18 See ECLAC, OSILAC ICT statistical information system, www.eclac.org/tic/flash.

19 Using 1Mbp ADSL as reference for broadband, the report presents the monthly tariff as percentage of per capita income. See ECLAC (2008).

20 Cellular News, July 2008.

21 See Gamtel report on http://www.newgambia.gm/Gamtel.htm.

22 Cuba stands out with very high growth of tertiary enrolment between 2002 and 2007, reaching almost 100 per cent in 2007. Based on information from the Ministry of Higher Education (created in 1976), since the beginning of 2000 a new paradigm was launched by the Government, to create "Higher education of high quality for all and for the whole life". This gave place to what the Government calls "The new Cuban University", which is meant to be non-selective and universal. To achieve universality, programmes were launched to spread University access in the country using local infrastructure and incorporating local professionals into the universities, as well as to increase distance learning. Other programmes targeted young people and the elderly. As a result, the number of enrolled students increased 5.8 times from 2000 to 2007 and the number of university teachers increased 7.3 times. (Departamento de Estadística. Ministerio de Educación Superior. January, 2008). http://www.mes.edu.cu/index.php?option=com_content&task=view&id=99&Itemid=48.

23 See ITU, Orbicom (2005), Chapter 4.

Chapter 5

Measuring the Digital Divide

The notion of the "digital divide", the difference between the "have" and "have-nots" is something known and defined.[1] It is often associated with imbalances in access to physical infrastructure, such as computers and Internet, or even conventional communication infrastructure, such as fixed telephone lines. Digital divides can exist between developed and developing countries (also known as global divide), or within a country (known as internal country divide). It can manifest itself in different demographic characteristics of the population, such as age, gender, income and race, or different locations, such as urban and rural. In whatever form or aspect one may want to look at it, one important question to address is "how can we measure/quantify it?". Only once it is measured or known, can it be addressed effectively.

The digital divide is usually measured in terms of people's access to ICTs. Penetration levels of mobile cellular telephones, Internet and personal computers are some of the most common measures used. However, a country may excel in one area, for example mobile cellular penetration, but lag in another, such as Internet penetration. This is where a composite index serves its purpose.

5.1 Applying the IDI to measure the digital divide

Aside from knowing the different levels of ICT access, use, and skills, as illustrated by the individual ICT Development Index (IDI) values discussed in the previous chapter, as well as a country's position in the global ranking, further analysis can be done applying the IDI to determine the magnitude of the digital divide and monitor how it evolved over time.

The digital divide is known as a "relative concept". It compares the level of ICT development in a country, or group of countries, with that in another at a certain point in time. For example, the Orbicom's Infostate Index defined the digital divide as the relative difference in Infostates among countries.[2] It used a hypothetical country, "Hypothetica", or the average of all countries included in the analysis, as the benchmark against which each country was compared. Those that performed well were identified by a positive number, indicating an above-average performance. Those that performed below-average were identified by a negative number. The same methodology was employed by one of ITU's previous indices, the ICT Opportunity Index (ITU, 2007), and will be used in this chapter.

One of the benefits of having a composite measure, such as the IDI, is that it captures the magnitude of the digital divide and how it is evolving over time. Using one indicator alone, or several indicators but considered individually, does not capture the overall dimension of the global divide. In this sense, the IDI can be applied to measure differences in the digital divide between countries or groups of them, using a single number. In addition, further analysis can be done to show, for example, whether the digital divide is shrinking or widening.

The measurement of the digital divide needs to follow several methodological steps. First, countries need to be grouped based on different ICT levels, in order to monitor progress made by different country groups over time, and to compare the magnitude of the differences between them[3] (Table 5.1). Second, IDI average values for each group need to be computed. The computed values will be used as a basis for further comparison and analysis. Third, the average IDI values of each group are normalized using the 2007 overall IDI average value (benchmark value). This is necessary in order to show the magnitude of a group's IDI value relative to the overall average IDI value. At the same time, this will help gauge how the groups performed relative to the benchmark value. Finally, changes in the normalized IDI

Table 5.1: Country groups with different ICT levels

Group	Number of countries	Share in population (%)*	IDI 2007	
			Minimum	Maximum
High	33	15.1	5.29	7.50
Upper	33	11.9	3.41	5.25
Medium	44	37.4	2.05	3.34
Low	44	35.6	0.82	2.03
All countries	154	100.0	0.82	7.50

Note: * The 154 economies inlcluded in the IDI account for 97.6 per cent of the total world population in 2007.
Source: ITU.

values are computed in order to show the evolution of the digital divides. Box 5.1 explains the different steps in more detail.

The groups are described below. See Table 5.4 for countries included in each group.

- **High** (IDI values above 5.29): Economies included in this group have high level of ICT access and use and high ICT skills. The 33 economies accounted for 15 per cent of the world's population in 2007 and included twenty-one European countries, ten Asia & Pacific economies, as well as Canada, and the United States.

- **Upper** (IDI values between 3.41 and 5.25): Economies included in this category are those that have achieved an elevated level of access to and use of ICTs, and ICT skills, for a majority of their inhabitants. This group includes countries from different regions such as Mauritius from Africa, nine countries from Eastern Europe, three countries from South-Eastern Asia, two countries from the Caribbean, four countries from Latin America and seven countries from Western Asia. In total, they accounted for almost 780 million people. The economies included in both this group and in the "high" group accounted for more than 27 per cent of the total population in 2007.

- **Medium** (IDI values between 2.05 and 3.34): This group includes economies that account for more than one-third of the total population (37 per cent or 2.4 billion inhabitants). Countries like China and Indonesia are included in this group, both of which have large populations. A number of Northern African countries, four Sub-Saharan African countries as well as the rest of the Western Asian nations (i.e. those that are not in the "upper" group) are included in this group.

- **Low** (IDI values between 0.82 and 2.03): The remaining one-third of the world's inhabitants can be found in this group (36 per cent or 2.3 billion people). Except for two countries from Latin America and the Caribbean (Nicaragua and Haiti), most of the Southern-Asian countries are classified under this group along with most of the Sub-Saharan African countries. South-Eastern Asian countries such as Myanmar, Cambodia, and Lao P.D.R are also in this group. This group reflects countries with low level of ICT access, usage and skills.

5.2 Results of the digital divide analysis

The average IDI values for the four groups are presented in Table 5.2. The following observations can be made. First, the IDI value for all groups has increased between

Table 5.2: IDI averages by group

Group	IDI 2002 value	IDI 2007 value	% change
High	4.8	6.4	33.6
Upper	2.9	4.1	43.0
Medium	1.9	2.7	40.6
Low	1.0	1.3	31.6
All countries	2.48	3.40	37.1

Source: ITU.

Box 5.1: Computing the digital divide*

In order to illustrate the magnitude of digital divide and its evolution, it is important to measure it correctly. Taking the difference between absolute index values, or looking at how they increased over time is not sufficient (see step 3 below). Therefore, the following steps were taken.

Step 1: Grouping the countries according to their index values

There are different possible ways of grouping the countries. One can classify groups based on an equal number of countries according to index values and using a certain reference value. For the IDI, the overall 2007 average value was used to group the countries. The average was used to divide the 154 countries into four groups, with two groups lying above the average and two groups lying below the average. This method required the average index value for 2007 to be computed first (for 2007, the IDI average value is 3.40). The countries were grouped by locating the position of the average IDI value in the list of 2007 index scores. The average value was placed after the 66th country, which resulted in 66 countries above the average and 88 below. The 66 countries were then classified into two equal groups (high and upper). The remaining 88 countries located below the average, were also divided into two groups (medium and low).

Step 2: Computing the groups' average IDI values

After splitting the countries into the four groups (high, upper, medium, low), the next step was to compute the average IDI value of each group. The value computed was used for further analysis, such as in showing the magnitude and the evolution of the digital divide between groups, and for determining whether the divide is shrinking or widening.

Step 3: Normalizing the average IDI values

As the digital divide is a relative concept, the absolute IDI values do not show the real picture of the digital divide. As an example, countries that were already doing well in terms of ICT penetration and usage in 2002 will not show much growth if absolute values are used. On the contrary, countries that were behind in terms of ICT adoption may show huge increases because they are starting from low levels. This is illustrated in Table 5.2. Therefore, normalizing the average IDI values is important in order to gauge how well a group is doing relative to a reference value. In this case, the overall 2007 average IDI score was used as the reference value. Group averages were transformed to their corresponding normalized value using 3.40 (the average IDI 2007 value for all countries). By doing this, all the resulting values are expressed relative to the 2007 average value (see Figure 5.1).

Step 4: Computing changes in the digital divide

The normalized IDI scores were then used to illustrate the magnitude of the digital divide between the groups. The size of the digital divide was computed by subtracting the groups' 2002 normalized IDI values from the corresponding 2007 values. Changes in the digital divide were computed by subtracting the magnitude of the 2007 digital divide from the 2002 corresponding value. The direction (sign) of the computed values shows the evolution of the digital divide: a negative value indicates a closing divide between the two groups, and a positive value indicates a widening divide (see Table 5.3).

* Based on the methodology developed by Orbicom (2003).

2002 and 2007. Second, the difference between the absolute IDI values for the "high" and "low" groups increased during the period. However, this does not measure the actual development of the digital divide, thus the importance of normalizing the average values (see Box 5.1).

Third, the "upper" group made most progress, the "low" group performed the least, and the "high" group grew less than the "medium" group. This may be due to ICT services and uptake already maturing in countries included in the "high" group.

To find out whether the digital divide is growing or shrinking, changes in the digital divide values over time were computed by subtracting the 2002 normalized IDI values from the 2007 corresponding values (see Table 5.3). To illustrate the change in the digital divide between, for example, the "high" and "low" groups, the difference in the magnitude of the digital divide is -0.1 (5.1 minus 5.2). This means that the digital divide between those two groups is slightly shrinking (decreasing). The direction (sign) of the computed values (Table 5.3, column "Changes in the digital divide")

Table 5.3: Evolution of the digital divide

Between	and	Magnitude of the digital divide (Difference between nomalised IDI values)		Changes in the digital divide
		2002	2007	2002-2007
High	Low	5.2	5.1	-0.1
High	Medium	4.0	3.7	-0.2
High	Upper	2.7	2.3	-0.3
Upper	Low	2.5	2.8	0.2
Upper	Medium	1.3	1.4	0.1
Medium	Low	1.2	1.3	0.1

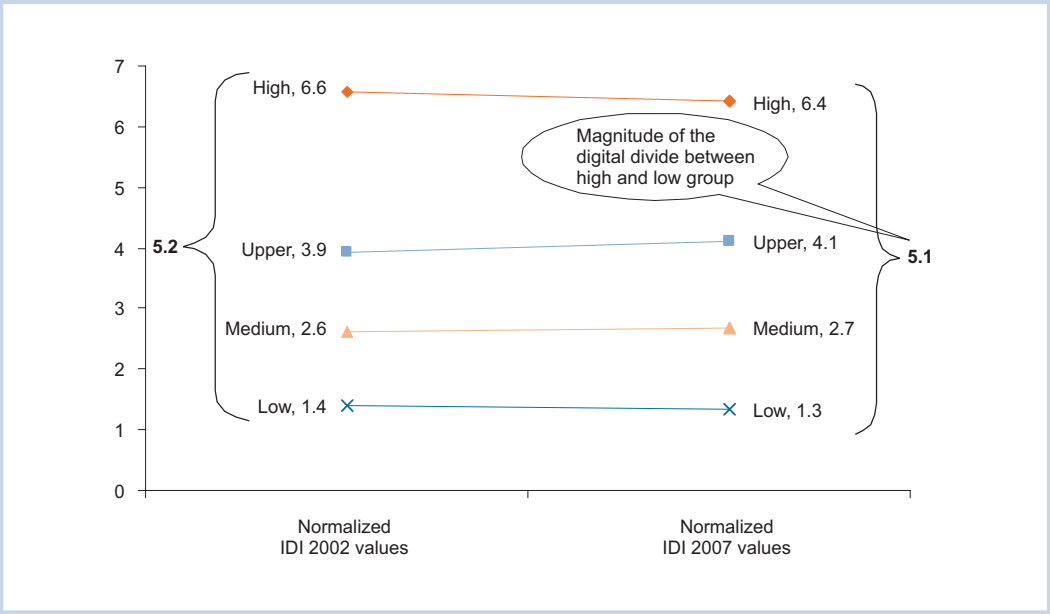
Source: ITU.

shows the evolution of the digital divide: a negative value indicates a closing divide between two groups, and a positive value indicates a widening divide.

Looking at its evolution, the main results can be summarized as follows: overall, the digital divide continues to persist, with its magnitude remaining large between the "high" and "low" group, and between the "high" and "medium" group (see Table 5.3). However, the digital divide is shrinking although by a very low margin (see Table 5.3, "Changes in digital divide" column). That is, the digital divide between the "high" and any other group has decreased slightly over the five-year period. In other words, the digital divide between those countries that have high ICT levels and those that have lower ICT levels decreased. This may be due to an increase in levels of penetration of mobile cellular phones, which is increasing in most of the developing countries (see Chapter 2).

In addition, the rates by which the digital divides are closing are not the same. The rate by which the gap between

Figure 5.1: Evolution of the digital divide between IDI groups, 2002-2007



Source: ITU.

Table 5.4: List of economies by IDI groups

HIGH	UPPER	MEDIUM	LOW
Australia	Argentina	Albania	Bangladesh
Austria	Bahrain	Algeria	Benin
Belgium	Belarus	Armenia	Bhutan
Canada	Bosnia	Azerbaijan	Burkina Faso
Denmark	Brazil	Bolivia	Cambodia
Estonia	Brunei Darussalam	Botswana	Cameroon
Finland	Bulgaria	Cape Verde	Chad
France	Chile	China	Comoros
Germany	Costa Rica	Colombia	Congo
Hong Kong, China	Croatia	Cuba	Côte d'Ivoire
Iceland	Cyprus	Dominican Rep.	D.R. Congo
Ireland	Czech Republic	Ecuador	Eritrea
Israel	Greece	Egypt	Ethiopia
Italy	Hungary	El Salvador	Gambia
Japan	Jamaica	Fiji	Ghana
Korea (Rep.)	Kuwait	Gabon	Guinea-Bissau
Lithuania	Latvia	Georgia	Haiti
Luxembourg	Lebanon	Guatemala	India
Macao, China	Malaysia	Honduras	Kenya
Malta	Mauritius	Indonesia	Lao P.D.R.
Netherlands	Panama	Iran (I.R.)	Lesotho
New Zealand	Poland	Jordan	Madagascar
Norway	Qatar	Kazakhstan	Malawi
Portugal	Romania	Kyrgyzstan	Mali
Singapore	Russia	Libya	Mauritania
Slovenia	Saudi Arabia	Maldives	Mozambique
Spain	Slovak Republic	Mexico	Myanmar
Sweden	TFYR Macedonia	Moldova	Namibia
Switzerland	Thailand	Mongolia	Nepal
Taiwan, China	Trinidad & Tobago	Morocco	Nicaragua
United Arab Emirates	Turkey	Oman	Niger
United Kingdom	Ukraine	Palestine	Nigeria
United States	Uruguay	Paraguay	Pakistan
		Peru	Papua New Guinea
		Philippines	Rwanda
		South Africa	Senegal
		Sri Lanka	Sudan
		Syria	Swaziland
		Tajikistan	Tanzania
		Tunisia	Togo
		Turkmenistan	Uganda
		Uzbekistan	Yemen
		Venezuela	Zambia
		Viet Nam	Zimbabwe

Source: ITU.

the "high" and "low" groups closes is lower than the rate between the "high" and "medium" groups or between the "high" and "upper" groups. The results also show that the digital divide between countries with "upper" ICT levels, and those with "medium" and "low" ICT level, is slightly increasing. The trend as well as the magnitude of the digital divide is illustrated in Figure 5.1.

While the grouping of countries based on their ICT levels helps in analysing the global digital divide, more country-specific or sub-index-specific analysis is necessary for understanding the underlying nature of the digital divide and its dynamism. This is discussed in other chapters of this Report.

Endnotes

[1] For example, the OECD (2001) defined the term "digital divide" as the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities. The digital divide reflects various differences among and within countries.

[2] See Orbicom (2003).

[3] In order to do such analysis, the 154 economies included in the IDI were grouped into four categories (high, upper, medium and low) based on the 2007 index values.

Chapter 6

ICT Price Basket

6.1 Overview and main objectives

Monitoring the cost of ICT services is important because it influences or even determines whether people will subscribe to a certain service and use ICTs. Although ICT infrastructure is crucial in providing the basic prerequisite for citizens to access and use ICTs, the services offered have to be affordable. Besides other factors, a successful and vibrant Information Society therefore needs to be within its people's means.

ICT prices depend on a number of factors, including the level of competition, the market size, operators' cost of providing services, as well as their profit margins. The more recent history of ICT markets has shown that tariffs tend to decrease with competition, although in a few cases (especially where services used to be (cross-) subsidized[1] by incumbent operators) prices have increased or remained unchanged.

The most flagrant impact of competition on prices has been witnessed in the mobile cellular market, where the cost of handsets and calls has been reduced dramatically over the last decade. Operators in a competitive environment will often choose to reduce prices and offer ever more innovative and better services to attract customers. Although the Average-Revenues-Per-User (ARPU) have decreased over the years, they have been compensated by an ever growing number of customers. The drop in mobile prices had a significant impact on connecting the previously unconnected and ITU estimates that by the end of 2008, there were more than 4 billion mobile subscriptions worldwide (see Chapter 2).

TRACKING ICT PRICES AND AFFORDABILITY

ITU, as well as other organizations and countries, have recognized the importance of tracking prices of ICT services and measuring ICT affordability. More and more countries, usually through the regulatory authority in charge of telecommunications and ICTs, publish telecommunication and Internet service tariffs regularly.[2]

One of the most well-known initiatives on measuring ICT prices is coordinated by the Organisation for Economic Cooperation and Development (OECD). The OECD's telecommunication and ICT price baskets date back as far as 1990. Price baskets have included information on fixed (Public Switched Telephone Network (PSTN)) tariffs for national and international calls, leased lines, Internet (dial-up and more recently broadband) access and mobile tariffs.[3] All tariff baskets have been revised over the years, reflecting changes in the use of telecommunication services within the (currently) 30 OECD Member countries. In its latest (2007) Communications Outlook, the OECD dedicated an entire chapter to "trends in pricing", publishing information on residential and business telecommunication prices, international and mobile pricing trends, as well as broadband and leased lines prices.[4]

The World Bank publishes price baskets for mobile, Internet, and fixed line services, based on ITU data, for all countries. To harmonize price comparison on fixed telecommunication services, the World Bank identified a simple methodology to calculate a price basket for residential fixed lines.[5]

ITU has been tracking the prices for telecommunication services since the late 1980s, in the area of fixed telephone lines. At the turn of the century, and with the increased used of mobile telephony and the Internet, ITU started collecting tariffs for mobile cellular and (dial-up) Internet services. More recently, tariffs for fixed broadband Internet access have been added. The ICT Price Basket presented here combines three sub-baskets – fixed telephony, mobile cellular and fixed broadband Internet – into a single basket and thus allows countries

to identify and benchmark the overall affordability of ICT services.

OBJECTIVES OF THE ICT PRICE BASKET

The main objectives of the ITU ICT Price Basket are to raise awareness of the importance of ICT prices for ICT usage and to allow policy makers to evaluate the cost of ICTs in their country and benchmark them against those of other countries. Policy discussions and analysis often tend to be focused on the availability of infrastructure, whereas the 'power of price' is often not sufficiently addressed. For this reason, it is hoped that the ICT Price Basket will provide countries with a useful additional tool for benchmarking and analysis.

Since prices are shown not only in absolute values (US$ and Purchasing Power Parities (PPP)[6] adjusted) but also as a percentage of GNI per capita, they point to the relative cost (or affordability) of ICT services within a country. At the same time, policy makers can identify where they stand globally, and in comparison to other countries. This information will put national prices into perspective and, if necessary, provide a starting point for looking into ways of lowering prices – for example, by introducing or strengthening competition, by reviewing operators' revenues and efficiency, or by reviewing specific tariff policies.

By combining fixed telephone, mobile cellular and fixed broadband Internet prices into one single value (based on which countries are ranked), the ICT Price Basket recognizes the importance of each one of these technologies and access methods (for more information on the choice of the three sub-baskets, see section 6.2 on *methodology*). An overall value and rank will quickly provide users with information on how affordable services are in their respective countries. At the same time, each price sub-basket has its own value and is therefore presented and ranked separately, allowing policy makers to identify the cost of each ICT service.

ITU plans to publish the ICT Price Basket on a yearly basis, making comparisons over time possible both in relative and absolute terms (i.e. comparisons between prices of a given service or product and comparisons of prices relative to average GNI per capita). This will provide Governments with an additional policy tool to evaluate the impact of specific ICT policies and of changes in the market, including the launch of new licenses and operators, new regulations (for example the introduction of number portability, new policies concerning Mobile Virtual Network Operators and the revision of interconnection charges), or the increase in subscriber numbers.

Many policy changes will have an immediate impact on prices, such as the revision of interconnection charges. In some cases, policies make a difference even before they come into force. In the area of competition, for example, it is not uncommon that incumbents with a monopoly status reduce prices or change other policies just by facing the forthcoming entrance of a competing operator.[7] On the other hand, other policy changes may have a longer-term effect on prices, like those affecting standards or upcoming technologies (e.g. Wimax or IMT-2000/3G).

Finally, the results of the ICT Price Basket should be seen in light of countries' broader ICT developments and trends. By publishing the ICT Price Basket as part of this Report, its results can be compared to those of the IDI. In particular, section 6.3 will examine the link between ICT prices and ICT uptake and analyse the role of the ICT Price Basket as an explanatory variable. It should be noted that there is a slight time lag between the data used for the IDI and the tariff data. While the IDI is based on 2007 data, the tariff information was collected throughout 2008.

6.2 ICT Price Basket methodology

The ICT Price Basket is contained of three price sub-baskets representing the cost of fixed line telephony, mobile cellular telephony and broadband Internet services in a given country. The choice of the three price sub-baskets used to construct the final ICT Price Basket reflects the importance of these three key services for people to participate in the Information Society. A more detailed justification for the choice of these three sub-baskets, as opposed to, for example, dial-up and mobile broadband tariffs, is provided below.

FIXED TELEPHONE PRICES

By the end of 2008, the world was home to some 1.3 billion fixed telephone lines. Although growth rates are declining, fixed telephone access remains an important access technology in its own right. In addition, the conventional fixed telephone line is used not only for dial-up Internet access, but also as a basis to upgrade to DSL technology. Since the ICT Price Basket does not include a separate dial-up sub-basket (instead it measures fixed broadband Internet access, for reasons

explained below), and since dial-up will require the user to subscribe to the fixed line network, the fixed telephone tariffs, besides indicating the price for fixed telephone services, also function as a proxy for the price of dial-up.

The **fixed telephone sub-basket** represents the cost of local fixed residential telephone service. It includes the fee of the monthly subscription charged for subscribing to the PSTN, plus the cost of 30 local calls to the same (fixed) network (15 peak and 15 off-peak calls) of three minutes each (see Annex 2 for more details on the fixed sub-basket methodology).

MOBILE CELLULAR PRICES

Mobile cellular telephony today remains uncontested in terms of subscriber numbers and popularity. The mobile phone has been able to connect millions – or rather billions – of the previously unconnected and ITU estimates that worldwide the number of mobile cellular subscriptions per 100 inhabitants has reached over 60 per cent by end 2008. No other information and communication technology and service has been able to have the same impact in terms of subscribers, particularly in the developing world, in so little time.

The **mobile cellular sub-basket** is based on the 2001 methodology of the OECD low user basket, which reflects the price of a standard basket of mobile monthly usage in US$ determined by the OECD for 25 outgoing calls per month (on-net, off-net and to a fixed line)[8], in predetermined ratios, plus 30 Short Message Service (SMS) messages.

The mobile cellular sub-basket used in the ICT Price Basket is based on prepaid tariffs. Prepaid tariffs (as opposed to postpaid tariffs) were used since they represent the dominant payment method in the majority of countries. By end 2007, about 60 per cent of all mobile subscriptions were prepaid (see Annex 2 for more details on the mobile sub-basket methodology).

FIXED BROADBAND INTERNET PRICES

Internet access matters because it opens up new communication channels and methods and provides access to close-to-unlimited amounts of information. The Internet has a great potential to enable and promote development, and to transform countries into Information Societies, allowing them to reap the benefits of ICTs. There are two main reasons for choosing fixed broadband (or high-speed) Internet access tariffs, as opposed to narrow (low-speed or dial-up) tariffs.

One reason is the importance of broadband as a development enabler. ITU has highlighted that broadband -based applications have the greatest impact on people, society and businesses.[9] A high-speed, always-on connection provides users with a completely different Internet experience, allowing them to download documents or videos and using applications that are simply unavailable to those with a dial-up connection.

The second reason is that broadband is spreading quickly. Although in a few countries broadband is offered mainly to businesses, almost all low-income countries are starting to provide commercial broadband services to private end-users. While in 2001, the number of fixed broadband subscribers represented only 15 per cent of the world's total Internet subscribers, this rate increased to almost 60 per cent by the end of 2007. In a number of developing countries, including Senegal, Morocco and Chile, broadband subscribers represent over 90 per cent of all Internet subscribers.

The IDI includes the variable 'mobile broadband subscriptions', yet, mobile broadband tariffs are not included in the ICT Price Basket, primarily since mobile broadband remains a relatively new service that is not yet available in many countries. ITU data suggest that by the end of 2007, only about 80 countries had launched IMT-2000/3G networks, theoretically allowing customers access to mobile broadband services. Given that the ICT Price Basket can only include those countries where prices for all three ICT services are available, including mobile broadband prices would have reduced the number of countries by almost half (from now 150 to around 80).[10] Given the current lack of usage data and patterns, it would be difficult not only to establish a user basket for mobile broadband but also to decide on its weight. Depending on how many people actual make use of the service, mobile broadband prices could have either the same weight as the other ICT services (fixed broadband, mobile cellular and fixed telephony) or be grouped with the fixed broadband prices. However, given the increasing number of countries launching IMT-2000/3G networks and national and international efforts to track mobile broadband uptake and usage, it is expected that mobile broadband prices will eventually be included in the ITU's ICT Price Basket.

The **fixed broadband Internet sub-basket** is calculated based on the price of the monthly subscription to an entry-

level fixed broadband plan (see Annex 2 for more details on the fixed broadband Internet sub-basket methodology).

CALCULATING THE THREE PRICE SUB-BASKETS

The sub-baskets for the fixed, mobile cellular and broadband Internet tariffs are calculated as follows:

1) in US$, using the 2008 United Nations operational rate of exchange.[11]

2) in current international dollars (PPP $), using Purchasing Power Parity (PPP) conversion factors.[12]

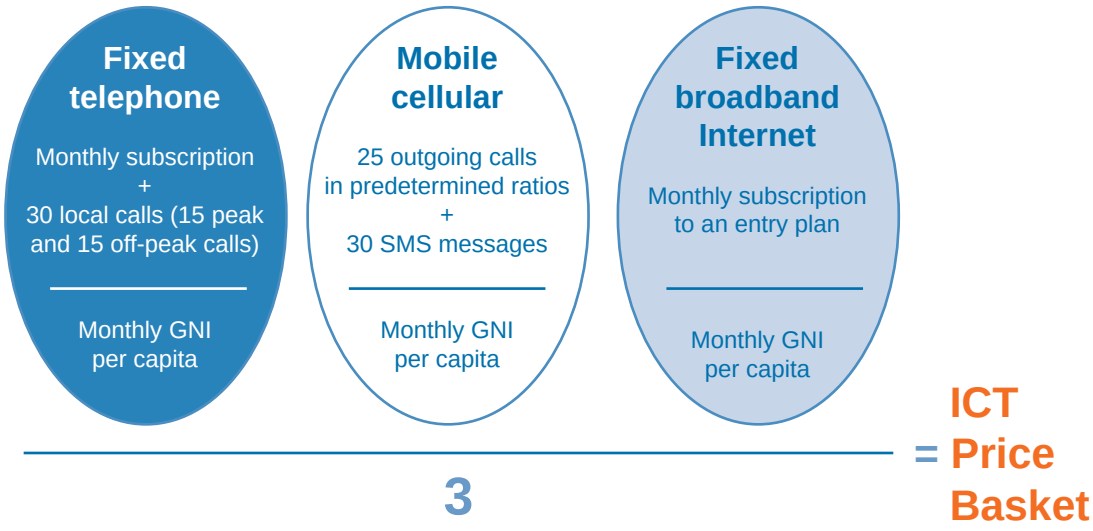
3) as a percentage of countries' 2007 monthly GNI per capita (World Bank US$ Atlas method[13]), which is the latest available year. The lower the percentage, the lower is the relative cost of the service. The value may exceed 100 per cent, indicating that the sub-basket is more expensive than the average monthly GNI per capita.

CALCULATING THE ICT PRICE BASKET

The ICT Price Basket was calculated for a total of 150 countries. The main reason for not including a specific country in the ICT Price Basket was the unavailability of one or several of the tariffs.

The final **ICT Price Basket** is the value computed as the sum of the price of each sub-basket (in US$) as a percentage of a country's monthly GNI per capita (World Bank, US$, Atlas Method), divided by 3 (Figure 6.1). For this exercise, the cost of each sub-basket as a percentage of the monthly GNI per capita is limited to a maximum value of 100, so that the final ICT Price Basket value may vary between a theoretical 'zero' (tariffs represent 'zero per cent of average monthly GNI per capita' and all three services are for free), and 100 (the price of all three sub-baskets is equal to or exceeds the monthly GNI per capita). Based on the ICT Price Basket value, countries are ranked from 1 to 150.

Figure 6.1: ICT Price Basket methodology



Note: In countries where no mobile prepaid offers are available, the monthly fixed cost (minus the free minutes included, if applicable) of a postpaid subscription is added to the basket.
For monthly fixed broadband Internet plans that limit the amount of data transferred by including caps below 1 Gigabyte, the cost for additional bytes is added.

Source: ITU.

6.3 Results and analysis

OVERALL RESULTS OF THE ICT PRICE BASKET

The ICT Price Basket ranks countries based on the relative price of fixed telephony, mobile cellular telephony and fixed broadband Internet services. Prices are relative in two ways: first, the ICT Price Basket value, on which the ranking is based, is expressed as a percentage of countries' average monthly GNI per capita. Second, the value does not indicate how much citizens need to pay for the three ICT services (as a percentage of average GNI per capita). Rather, the value presents an average cost since the sum of the three ICT prices is divided by three. The value should therefore be seen as an indication of cost that primarily serves to compare and benchmark countries to each other.

While the 2008 ICT Price Basket reveals results on the current status of ICT costs in countries, it should be noted that the ICT Price Basket will be particularly useful over time. Since ITU is planning on publishing the ICT Price Basket annually, policy makers will be able to track the absolute and relative prices of ICT services over time and benchmark and compare their development to other countries. It will further help them identify the impact of policies on ICT prices and identify bottlenecks and shortcomings in the ICT environment.

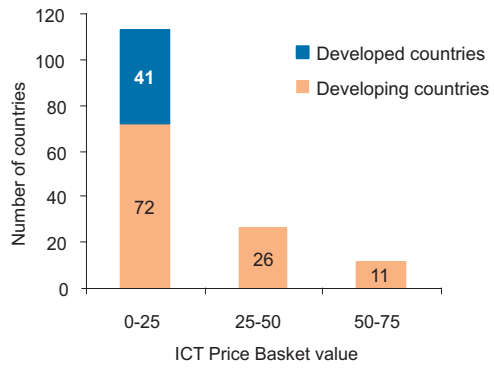
On average, the 2008 ICT Price Basket value corresponds to 15 per cent of countries' average GNI per capita. However, it varies from 1.6 per cent in developed countries to 20 per cent in developing countries. As shown in Chart 6.1, most countries are in the 0-25 per cent group. A closer look at that interval reveals that nearly all developed countries have an ICT Price Basket value that represents between 0-3 per cent of their monthly GNI per capita. On the other hand, developing countries display bigger differences, with only 17 of them in the 0-3 per cent group.

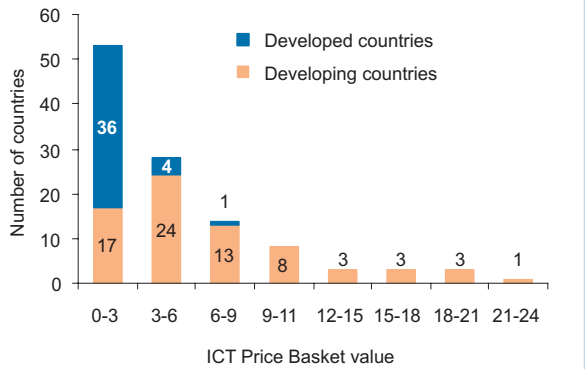
Half of the developing countries have an ICT Price Basket that corresponds to more than 10 per cent of their GNI per capita. This suggests that countries with higher income levels pay relatively little for ICT services, while low-income countries pay relatively more. In addition, as further analysed below, the high value of the ICT Price Basket in several developing countries is partly explained by very high fixed Internet broadband prices.

The results of the ICT Price Basket (Table 6.1) further suggest that the relative price of ICT services is linked to a country's ICT level. In other words, countries with high prices have lower access and usage levels. The economies ranked at the top of the ICT Price Basket include some of the most advanced economies in terms of ICT uptake and use, such as Singapore, the United States, Luxembourg, Denmark, Hong Kong (China), Sweden and Norway. These are the economies with the lowest relative price of ICTs.

All of the top 30 economies ranked in the ICT Price Basket are high-income economies.[14] This observation is also true the other way around, with poorer countries having relatively high ICT prices. More than two thirds of the 30 economies ranked at the bottom of the ICT Price Basket are developing, low-income economies.

Chart 6.1: How much are they paying? ICT Price Basket by level of development (2008)





Source: ITU.

Table 6.1: ICT Price Basket 2008

Rank	Economy	ICT Price Basket Value**	Sub-baskets			GNI per capita*, US$
			Fixed (% of GNI per capita*)	Mobile (% of GNI per capita*)	Broadband (% of GNI per capita*)	
1	Singapore	0.4	0.3	0.2	0.8	32'470
2	United States	0.4	0.5	0.4	0.4	46'040
3	Luxembourg	0.5	0.5	0.2	0.7	75'880
4	Denmark	0.5	0.6	0.1	0.7	54'910
5	Hong Kong, China	0.5	0.4	0.1	1.0	31'610
6	United Arab Emirates	0.5	0.3	0.2	1.1	23'950
7	Taiwan, China	0.5	0.2	0.7	0.7	17'250
8	Sweden	0.5	0.6	0.2	0.8	46'060
9	Norway	0.5	0.6	0.2	0.9	76'450
10	Finland	0.6	0.5	0.4	1.0	45'820
11	Macao, China	0.6	0.8	0.2	0.9	14'020
12	Switzerland	0.6	0.6	0.7	0.7	59'880
13	Iceland	0.7	0.5	0.3	1.3	54'100
14	United Kingdom	0.7	0.8	0.6	0.8	42'740
15	Canada	0.7	1.0	0.6	0.6	39'420
16	Netherlands	0.8	0.8	0.5	1.0	45'820
17	Cyprus	0.8	1.3	0.3	0.8	24'940
18	Bahrain	0.8	0.3	0.4	1.7	19'350
19	Germany	0.8	0.9	0.3	1.2	38'860
20	Kuwait	0.8	0.4	0.3	1.8	31'640
21	Ireland	0.8	1.1	0.5	1.0	48'140
22	Italy	0.8	1.0	0.6	0.9	33'540
23	Korea (Rep.)	0.8	0.4	0.9	1.2	19'690
24	Japan	0.9	0.6	1.0	1.0	37'670
25	Belgium	0.9	1.1	0.7	0.9	40'710
26	Australia	0.9	0.9	0.9	0.9	35'960
27	Greece	1.0	1.1	1.0	1.0	29'630
28	Austria	1.1	0.8	0.7	1.7	42'700
29	France	1.1	1.0	1.1	1.2	38'500
30	Malta	1.1	0.9	0.9	1.7	15'310
31	Trinidad & Tobago	1.1	1.7	0.7	1.1	14'100
32	Slovenia	1.2	1.2	0.7	1.6	20'960
33	New Zealand	1.2	1.4	1.0	1.3	28'780
34	Spain	1.3	1.3	1.4	1.2	29'450
35	Saudi Arabia	1.5	0.7	0.7	3.1	15'440
36	Serbia	1.5	1.1	1.3	2.3	4'730
37	Lithuania	1.6	1.8	1.1	1.9	9'920
38	Portugal	1.7	1.6	1.7	1.9	18'950
39	Russia	1.8	1.9	1.4	2.2	7'560
40	Latvia	1.8	1.4	0.9	3.1	9'930
41	Costa Rica	1.9	1.0	1.0	3.7	5'560
42	Malaysia	1.9	0.9	1.1	3.8	6'540
43	Estonia	2.0	1.2	1.2	3.5	13'200
44	Panama	2.1	2.0	1.1	3.3	5'510
45	Maldives	2.1	1.5	1.3	3.5	3'200
46	Croatia	2.1	1.9	2.2	2.4	10'460
47	Czech Republic	2.2	2.6	1.5	2.4	14'450
48	Slovak Republic	2.4	2.5	1.7	2.9	11'730
49	Hungary	2.5	3.1	1.7	2.6	11'570
50	Montenegro	2.5	1.0	1.6	5.0	5'180
51	Oman	2.5	3.5	0.6	3.4	11'120
52	Poland	2.7	3.4	1.5	3.3	9'840
53	Tunisia	2.9	1.1	2.7	4.8	3'200
54	Romania	3.0	2.4	2.3	4.4	6'150
55	Uruguay	3.2	2.5	2.6	4.6	6'380
56	Thailand	3.3	2.0	1.4	6.3	3'400
57	Seychelles	3.3	1.6	1.5	6.8	8'960
58	Algeria	3.3	1.5	2.7	5.7	3'620
59	Venezuela	3.4	1.2	4.1	5.1	7'320
60	Mexico	3.6	3.2	2.2	5.3	8'340
61	Bosnia	3.6	3.0	3.1	4.7	3'790
62	Argentina	3.7	1.0	2.5	7.6	6'050
63	Botswana	3.8	3.5	1.7	6.1	5'840
64	Bulgaria	3.8	2.4	4.9	4.1	4'590
65	Lebanon	3.9	2.3	4.6	4.8	5'770
66	Barbados	3.9	2.7	1.6	7.3	8'080
67	Egypt	4.1	2.3	3.6	6.3	1'580
68	Grenada	4.1	3.0	1.9	7.5	4'670
69	TFYR Macedonia	4.2	3.0	4.6	5.1	3'460
70	South Africa	4.2	4.7	2.6	5.5	5'760
71	China	4.4	1.9	1.8	9.4	2'360
72	Mauritius	4.4	1.2	1.0	11.1	5'450
73	Chile	4.5	3.9	2.0	7.6	8'350
74	India	4.7	4.4	2.1	7.7	950
75	Jamaica	5.1	3.5	2.3	9.7	3'710

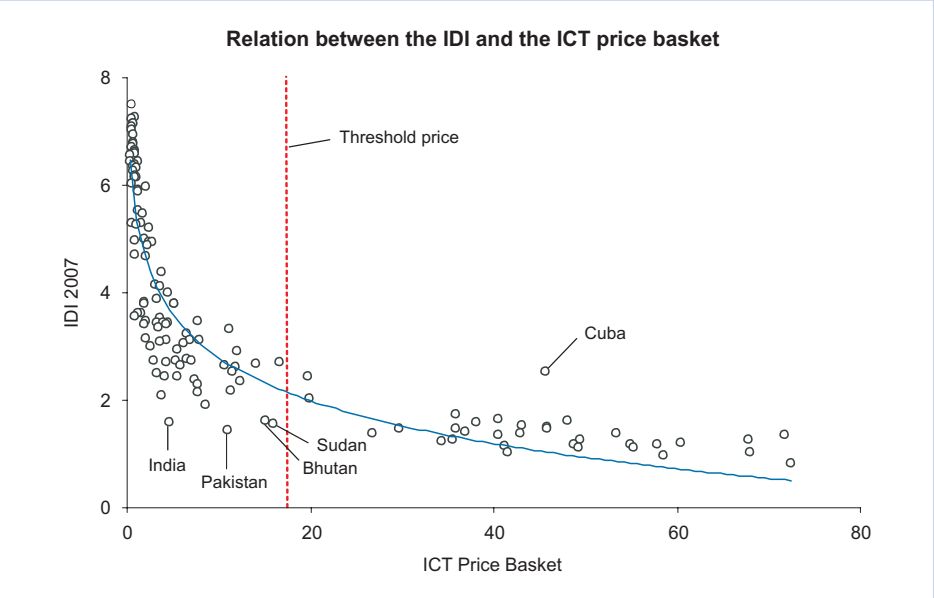
Table 6.1: ICT Price Basket 2008 (continued)

Rank	Economy	ICT Price Basket Value**	Sub-baskets			GNI per capita*, US$
			Fixed (% of GNI per capita*)	Mobile (% of GNI per capita*)	Broadband (% of GNI per capita*)	
76	Ukraine	5.2	2.0	3.8	9.8	2'550
77	Fiji	5.2	3.1	4.4	8.2	3'800
78	Iran (I.R.)	5.4	0.1	1.3	14.9	3'470
79	El Salvador	5.5	4.4	4.4	7.6	2'850
80	St. Lucia	5.7	2.5	2.6	12.0	5'530
81	Dominican Rep.	5.8	4.9	3.1	9.5	3'550
82	Jordan	6.1	3.5	1.9	13.0	2'850
83	Ecuador	6.5	0.4	3.5	15.6	3'080
84	Dominica	6.6	3.1	3.1	13.5	4'250
85	Colombia	6.6	2.8	3.5	13.4	3'250
86	Peru	6.9	5.4	2.8	12.7	3'450
87	Albania	7.1	1.6	8.3	11.5	3'290
88	Sri Lanka	7.3	3.7	1.9	16.3	1'540
89	St. Vincent and the Gren.	7.4	3.1	3.4	15.7	4'210
90	Indonesia	7.6	3.3	3.9	15.8	1'650
91	Brazil	7.7	5.9	7.5	9.6	5'910
92	Guatemala	7.7	4.3	2.2	16.7	2'440
93	Armenia	8.0	2.3	3.8	17.8	2'640
94	Micronesia	8.6	3.9	2.4	19.4	2'470
95	Namibia	8.6	5.2	4.1	16.5	3'360
96	Suriname	9.0	0.7	2.3	24.1	4'730
97	Philippines	10.7	10.5	4.2	17.3	1'620
98	Pakistan	11.0	5.0	2.7	25.5	870
99	Moldova	11.2	3.0	8.5	22.1	1'260
100	Cape Verde	11.3	4.2	9.9	19.7	2'430
101	Paraguay	11.5	5.2	4.1	25.2	1'670
102	Viet Nam	11.9	3.5	6.4	25.8	790
103	Georgia	12.0	4.1	4.8	26.9	2'120
104	Morocco	12.4	14.6	11.8	10.7	2'250
105	Belize	13.2	6.6	4.7	28.3	3'800
106	Syria	14.0	0.9	6.2	35.0	1'760
107	Bhutan	15.2	2.4	2.1	41.1	1'770
108	Sudan	16.0	5.5	6.0	36.4	960
109	Azerbaijan	16.0	1.1	7.2	39.8	2'550
110	Guyana	18.3	2.4	6.9	45.7	1'300
111	Bolivia	19.7	21.7	5.6	31.9	1'260
112	Nicaragua	19.9	6.2	16.9	36.7	980
113	Tonga	21.0	3.3	3.0	56.8	2'320
114	Senegal	26.7	25.4	12.2	42.6	820
115	Lesotho	29.6	15.0	15.2	58.7	1'000
116	Angola	30.6	9.5	5.5	76.7	2'560
117	Samoa	31.0	5.1	4.3	83.6	2'430
118	Nepal	34.3	12.1	10.3	80.4	340
119	Bangladesh	35.6	3.4	3.4	137.7	470
120	Yemen	36.0	1.2	6.7	311.4	870
121	Swaziland	36.0	2.3	5.7	873.2	2'580
122	Côte d'Ivoire	37.0	30.0	19.5	61.4	910
123	Lao P.D.R.	38.1	8.2	6.1	555.1	580
124	Guinea	40.2	10.2	10.6	2'400.0	400
125	Ghana	40.5	9.5	12.0	131.0	590
126	Mauritania	40.6	18.4	14.1	89.2	840
127	Papua New Guinea	41.2	5.7	18.0	203.7	850
128	Ethiopia	41.6	8.1	16.7	3'512.8	220
129	S. Tomé & Principe	42.0	14.6	11.4	377.2	870
130	Vanuatu	42.1	16.5	9.8	293.5	1'840
131	Nigeria	43.0	13.3	15.7	890.4	930
132	Cambodia	43.0	17.9	11.2	201.2	540
133	Cuba	45.6	13.5	23.3	1'671.8	1170
134	Cameroon	45.8	17.0	20.3	210.0	1'050
135	Gambia	45.9	15.1	22.6	1'439.3	320
136	Kenya	48.0	20.4	23.7	296.1	680
137	Comoros	48.8	20.5	25.7	793.7	680
138	Mali	49.3	23.7	24.0	139.6	500
139	Benin	49.5	15.8	32.7	220.4	570
140	Zambia	53.4	41.6	18.5	137.2	800
141	Rwanda	55.0	27.3	37.6	344.4	320
142	Tanzania	55.4	32.8	33.3	204.0	400
143	Central African Rep.	57.7	33.4	39.8	4'407.7	380
144	Malawi	57.8	16.1	57.4	4'320.0	250
145	Burkina Faso	58.6	28.7	47.1	5'193.6	430
146	Uganda	60.4	44.5	36.8	600.0	340
147	Togo	67.9	43.6	60.1	352.8	360
148	Mozambique	68.0	66.2	37.9	375.3	320
149	Madagascar	71.7	68.5	46.6	450.3	320
150	Niger	72.4	58.2	59.0	249.2Z	280

Note: * The GNI per capita is based on the World Bank's Atlas Method. ** The ICT Price Basket Value is the sum of the three sub-baskets as a percentage of GNI per capita, divided by 3.

Source: ITU.

Chart 6.2: IDI and ICT Price Basket comparison



Source: ITU.

A simple regression analysis comparing the results of the ICT Development Index to those of the ICT Price Basket suggests a strong link between ICT prices and ICT levels. The logarithmic model in Chart 6.2 provides a good fit for the data.[15]

The regression results confirm the role of ICT prices as an explanatory factor for high ICT development. As can be seen in Chart 6.2, high IDI values correspond to low ICT Price Basket values and vice versa. Indeed, all economies with an IDI value above 5 have an ICT Price Basket that represents less than 2.5 per cent of their monthly GNI per capita.

On the other hand, low IDI values – except for the outliers marked in Chart 6.2 – correspond to high ICT Price Basket values. Moreover, those countries with prices above a certain threshold (see red line) have little differences in IDI value. This suggests that prices are only a relevant factor for ICT development when they fall below a certain threshold making ICT services affordable to a significant part of the population.

Chart 6.2 also shows that there are several countries with lower IDI values than those that could be expected from the general regression (i.e. those that are below the curve). This difference is especially relevant in the case of India, Pakistan, Bhutan and Sudan. It suggests that in these countries the price of ICT services is not the main barrier to higher ICT levels. Instead, low values in the IDI access sub-index (below the world average) suggest that limited ICT infrastructures or limited access to them are the main barriers to further ICT development.

On the other hand, there are some countries with higher IDI values than those given by the regression (i.e. those that are above the curve). Among those, Cuba stands out with a remarkable difference from the trend. Cuba's IDI value is higher than that of countries with a similar ICT access and use values, due to a very high skills sub-index value (9.3 compared to 1.3 in access and 0.4 in use). Since the difference in skills is not directly related to the ICT Price Basket, it places the country as an outlier in the overall trend.

THE THREE SUB-BASKETS OF THE ICT PRICE BASKET: FIXED TELEPHONE, MOBILE CELLULAR AND FIXED BROADBAND INTERNET PRICES

The ICT Price Basket is meant to help policy makers evaluate the cost of ICTs in their country and to benchmark them against other countries. Since the Basket combines three distinct services, based on different price components (monthly cost, cost of calls) and varying usage types and levels (SMS, minutes of calls, unlimited broadband access), the average price of the sum of these ICT services must be understood as an indication of cost and not as an absolute value for the price of these three services. For example, of the three sub-baskets, broadband access remains the most expen-

sive ICT, and is on average eight times as expensive (in absolute US$) as the mobile and fixed baskets, which have similar prices.[16] Although it is difficult to compare an always-on broadband connection (which in theory provides users with unlimited access to the Internet) to the mobile and fixed telephone baskets that include a limited number of calls, all three sub-baskets represent entry plans for basic users of these services.

The combined ICT Price Basket also hides nuances in the absolute and relative prices of the three services. Therefore, for analytical and policy purposes, it is important to look at each one of the ICT services – fixed telephony, mobile cellular and fixed broadband Internet – separately. The analysis of the different components highlights that the prices for ICTs vary considerably between countries and regions, as well as between services. Prices fluctuate from as little as US$ 0.2 for the fixed basket in Iran, US$ 1.3 for the mobile basket in Bangladesh, and US$ 6.1 for the broadband basket in India, to as much as US$ 42.2, US$ 37, and over US$ 1'500 for the same services in Ireland, Brazil and Swaziland, respectively. To this end, the following section presents each sub-basket separately and highlights the main findings.

Affordability is calculated based on the price of ICT services (in US$) within a given country as a percentage of its national income level (GNI per capita). It shows that those countries with the lowest prices in terms of their absolute values are not necessarily the cheapest ones in terms of income levels. For comparability, each ICT service will be presented in terms of its US$ (current market) value, as well as in PPP terms (PPP $).

Fixed telephone sub-basket

a) Prices as a percentage of GNI per capita

As highlighted in Table 6.2, the top ten group of economies with the lowest relative fixed telephone prices is diverse in terms of income levels, development status, and region. The list includes Iran, Taiwan (China), United Arab Emirates, Singapore, Kuwait, the Republic of Korea, Ecuador, and the United States. In most of the European and many high-income economies, fixed telephone services, as measured by the sub-basket, cost one per cent or less of monthly average GNI per capita.

A comparison between the sub-basket for fixed prices on the one hand, and the overall ICT Price Basket on the other hand, highlights that a number of developing countries have relatively low fixed telephone prices as a percentage of GNI per capita. A total of 15 developing countries have a rank difference of 20 or more positions, with relatively lower fixed telephone prices. This includes Iran, which has the relatively cheapest fixed telephony prices and ranks at the top of the list. The list also includes four South American countries (Argentina, Guyana, Ecuador, and Suriname), and four countries from Western Asia (Syria, Yemen, Azerbaijan and Armenia). The countries with the greatest difference between their ICT Price Basket and fixed sub-basket rank are Syria, Yemen, Iran, Suriname, Ecuador and Swaziland.

It should be noted that the fixed telephone sub-basket does not take into account the cost of the (one-time) connection charge, which is relatively high in some developing countries (for example, Yemen and Iran). Also, some telecommunication operators, especially with a monopoly status and owned by the Government, continue to subsidize fixed telephone services so that customers receive services below market prices.

Economies where fixed telephone prices are high in terms of GNI per capita compared to their overall ICT Price Basket include Oman, Poland, Hungary, South Africa, India and Mexico. Not surprisingly, in all of these countries the percentage of mobile cellular subscriptions as a percentage of total (fixed and mobile) telephone subscriptions is above average. For example, in India and Poland, mobile cellular subscriptions account for 86 and 80 per cent respectively of total (fixed and mobile) telephone subscriptions, compared to 70 and 73 per cent in Asia and Europe (and a global average of 72 per cent).

Although these findings suggest that the link between GNI per capita and the relative cost for fixed line services is not as strong as for the overall ICT Price Basket, Chart 6.3 shows that lower prices as a percentage of monthly GNI per capita tend to prevail in high-income regions, and vice versa. Eighteen out of twenty of the countries ranked at the bottom of the fixed sub-basket (i.e. the countries with the highest relative fixed telephone prices) are from Sub-Saharan Africa, the region with the highest relative fixed telephone prices (representing 22 per cent of monthly average incomes).

b) Prices in US$ and PPP $

The fixed telephone basket ranked by absolute prices (both US$ and PPP) shows several developing economies at the top (i.e. having the lowest prices), most

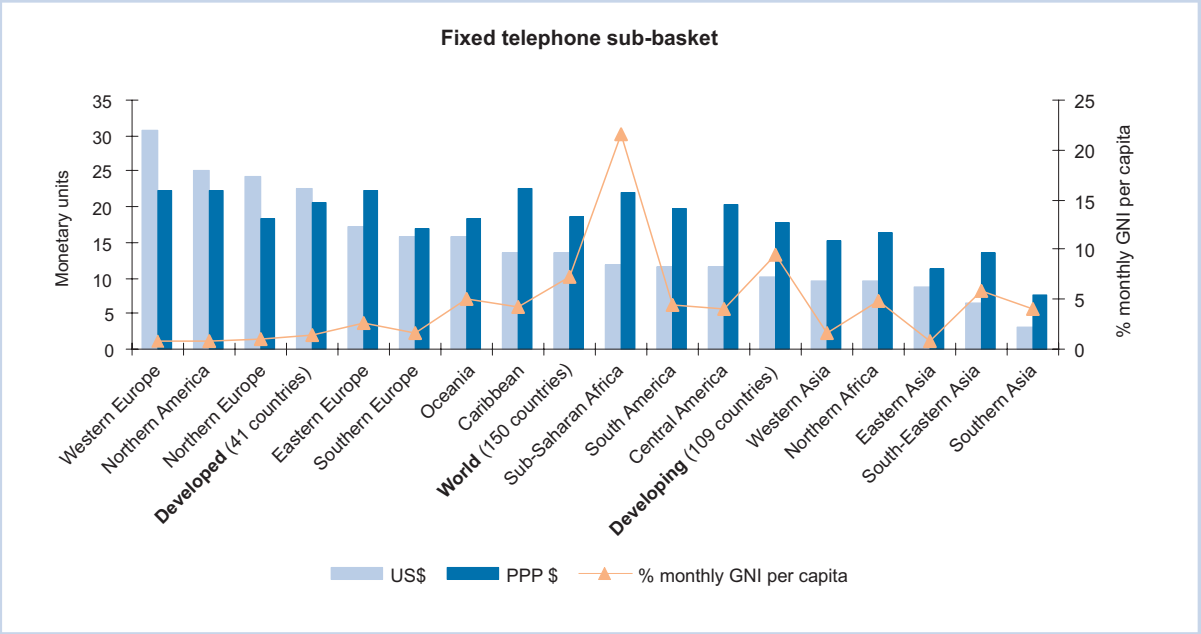
Table 6.2: Fixed telephone sub-basket 2008 (ranked by percentage of monthly GNI per capita)

Rank	Economy	Fixed sub-basket (US$)	Fixed sub-basket (PPP)	Fixed sub-basket (% of GNI per capita*)
1	Iran (I.R.)	0.2	0.6	0.1
2	Taiwan, China	3.2	5.4	0.2
3	United Arab Emirates	5.0	7.5	0.3
4	Singapore	7.1	9.4	0.3
5	Bahrain	4.7	7.1	0.3
6	Kuwait	9.3	11.7	0.4
7	Korea (Rep.)	6.4	8.3	0.4
8	Hong Kong, China	11.3	16.0	0.4
9	Ecuador	1.1	2.5	0.4
10	United States	17.2	17.2	0.4
11	Luxembourg	31.3	22.2	0.5
12	Finland	19.3	12.8	0.5
13	Iceland	24.1	16.4	0.5
14	Switzerland	29.0	18.5	0.6
15	Japan	18.3	16.2	0.6
16	Norway	37.6	22.1	0.6
17	Sweden	22.8	15.6	0.6
18	Denmark	28.5	16.3	0.6
19	Saudi Arabia	9.2	13.4	0.7
20	Suriname	2.8	4.6	0.7
21	United Kingdom	27.3	20.9	0.8
22	Macao, China	9.1	13.5	0.8
23	Austria	28.7	21.6	0.8
24	Netherlands	31.2	23.0	0.8
25	Syria	1.2	2.8	0.8
26	Malta	10.9	12.4	0.9
27	Germany	28.8	21.4	0.9
28	Australia	27.5	21.0	0.9
29	Malaysia	5.1	9.5	0.9
30	Argentina	4.8	9.5	0.9
31	Montenegro	4.1	5.9	1.0
32	France	30.9	22.3	1.0
33	Italy	27.4	20.7	1.0
34	Canada	32.8	27.2	1.0
35	Costa Rica	4.6	8.6	1.0
36	Ireland	42.2	27.9	1.1
37	Belgium	36.4	26.7	1.1
38	Greece	26.7	24.6	1.1
39	Tunisia	3.0	6.1	1.1
40	Azerbaijan	2.4	4.8	1.1
41	Venezuela	7.0	10.3	1.2
42	Yemen	0.8	2.0	1.2
43	Slovenia	20.5	20.8	1.2
44	Mauritius	5.5	9.6	1.2
45	Serbia	4.9	8.0	1.2
46	Estonia	13.7	16.4	1.2
47	Spain	30.8	27.1	1.3
48	Cyprus	26.5	41.0	1.3
49	New Zealand	34.4	29.0	1.4
50	Latvia	11.9	15.6	1.4
51	Algeria	4.6	8.1	1.5
52	Maldives	4.1	6.4	1.5
53	Albania	4.3	7.3	1.6
54	Seychelles	12.1	27.2	1.6
55	Portugal	25.7	24.1	1.6
56	Trinidad & Tobago	19.7	30.4	1.7
57	Lithuania	15.0	20.9	1.8
58	Russia	11.7	17.7	1.9
59	China	3.7	7.4	1.9
60	Croatia	16.4	19.5	1.9
61	Panama	9.1	17.5	2.0
62	Ukraine	4.2	9.2	2.0
63	Thailand	5.8	11.6	2.0
64	Swaziland	4.8	9.9	2.2
65	Lebanon	10.9	18.8	2.3
66	Egypt	3.0	8.9	2.3
67	Armenia	5.1	8.5	2.3
68	Guyana	2.5	5.4	2.4
69	Romania	12.2	15.0	2.4
70	Bhutan	3.5	9.4	2.4
71	Bulgaria	9.2	18.0	2.4
72	Uruguay	13.0	18.1	2.5
73	Slovak Republic	24.5	30.1	2.5
74	St. Lucia	11.6	20.4	2.5
74	Czech Republic	30.9	35.6	2.6

Rank	Country	Fixed sub-basket (US$)	Fixed sub-basket (PPP)	Fixed sub-basket (% of GNI per capita*)
76	Barbados	18.4	29.8	2.7
77	Colombia	7.6	12.6	2.8
78	Moldova	3.1	5.8	3.0
79	Grenada	11.6	17.3	3.0
80	Bosnia	9.5	15.8	3.0
81	TFYR Macedonia	8.7	17.9	3.0
82	Dominica	10.9	19.2	3.1
83	St. Vincent and the Gren.	10.9	18.2	3.1
84	Fiji	9.9	10.0	3.1
85	Hungary	30.2	35.9	3.1
86	Mexico	22.3	32.4	3.2
87	Indonesia	4.5	8.9	3.3
88	Tonga	6.4	9.2	3.3
89	Bangladesh	1.3	3.8	3.4
90	Poland	28.0	32.2	3.4
91	Botswana	16.9	37.2	3.5
92	Jordan	8.3	14.6	3.5
93	Jamaica	10.8	19.0	3.5
94	Oman	32.6	53.8	3.5
95	Viet Nam	2.3	7.3	3.5
96	Sri Lanka	4.8	12.2	3.7
97	Chile	27.0	34.2	3.9
98	Micronesia	8.0	10.6	3.9
99	Georgia	7.3	13.0	4.1
100	Cape Verde	8.5	8.6	4.2
101	Guatemala	8.7	15.6	4.3
102	El Salvador	10.4	19.9	4.4
103	India	3.5	9.4	4.4
104	South Africa	22.4	40.2	4.7
105	Dominican Rep.	14.4	26.1	4.9
106	Pakistan	3.6	11.0	5.0
107	Samoa	10.3	15.2	5.1
108	Namibia	14.5	24.8	5.2
109	Paraguay	7.2	13.6	5.2
110	Peru	15.4	28.4	5.4
111	Sudan	4.4	7.9	5.5
112	Papua New Guinea	4.0	7.4	5.7
113	Brazil	29.1	34.8	5.9
114	Nicaragua	5.1	13.5	6.2
115	Belize	20.9	34.2	6.6
116	Ethiopia	1.5	5.0	8.1
117	Lao P.D.R.	3.9	11.3	8.2
118	Angola	20.2	31.3	9.5
119	Ghana	4.7	8.3	9.5
120	Guinea	3.4	8.0	10.2
121	Philippines	14.2	27.3	10.5
122	Nepal	3.4	9.1	12.1
123	Nigeria	10.3	16.8	13.3
124	Cuba	13.2	NA	13.5
125	S. Tomé & Principe	10.6	20.1	14.6
126	Morocco	27.4	42.6	14.6
127	Lesotho	12.5	25.9	15.0
128	Gambia	4.0	11.0	15.1
129	Benin	7.5	14.7	15.8
130	Malawi	3.3	10.0	16.1
131	Vanuatu	25.3	44.3	16.5
132	Cameroon	14.8	25.4	16.9
133	Cambodia	8.0	24.1	17.9
134	Mauritania	12.9	26.3	18.4
135	Kenya	11.6	22.0	20.4
136	Comoros	11.6	16.7	20.5
137	Bolivia	22.7	64.6	21.6
138	Mali	9.9	17.3	23.7
139	Senegal	17.4	28.9	25.4
140	Rwanda	7.3	18.3	27.3
141	Burkina Faso	10.3	22.6	28.7
142	Côte d'Ivoire	22.8	33.6	30.0
143	Tanzania	10.9	31.2	32.8
144	Central African Rep.	10.6	17.2	33.4
145	Zambia	27.7	35.2	41.6
146	Togo	13.1	25.0	43.6
147	Uganda	12.6	30.6	44.5
148	Niger	13.6	26.0	58.2
149	Mozambique	17.7	35.9	66.2
150	Madagascar	18.3	39.9	68.5

Note: *The GNI per capita is based on the World Bank's Atlas Method.
Source: ITU.

Chart 6.3: Fixed telephone sub-basket by region and by level of development (2008)



Source: ITU.

of them being low (Yemen, Bangladesh and Ethiopia) and lower-middle income economies[17] (Iran, Ecuador, Syria, Azerbaijan and Guyana). Table 6.3 shows that few changes occur in the top ten rankings when comparing PPP and US$ prices, which proves that the top ten countries in general have relatively low fixed telephone prices, even when compared to the purchasing power of their currencies.

In developed economies, the average price of the fixed telephone basket is US$ 22.6, while that of developing economies is US$ 10.0 (see Chart 6.3). In PPP prices,

Table 6.3: Top ten economies with the least costly fixed telephone sub-basket (2008)

Economy	Region*	WB income grouping**	Fixed telephone Basket PPP $	Fixed telephone Basket US$
Iran	Southern Asia	Lower-middle	0.6	0.2
Yemen	Western Asia	Low	2.0	0.8
Ecuador	South America	Lower-middle	2.5	1.1
Syria	Western Asia	Lower-middle	2.8	1.2
Bangladesh	Southern Asia	Low	3.8	1.3
Suriname	South America	Upper-middle	4.6	2.8
Azerbaijan	Western Asia	Lower-middle	4.8	2.4
Ethiopia	Sub-Saharan Africa	Low	5.0	1.5
Guyana	South America	Lower-middle	5.4	2.5
Taiwan, China	Eastern Asia	High	5.4	3.2

Note: *See Annex 3 for a detailed list of countries per region. **Economies are divided according to 2007 GNI per capita, calculated using the World Bank Atlas method, except for Taiwan (China), where 2006 ITU GNI per capita data are used.
Source: ITU.

Table 6.4: Mobile cellular sub-basket 2008 (ranked by percentage of monthly GNI per capita)

Rank	Economy	Mobile sub-basket (US$)	Mobile sub-basket (PPP $)	Mobile sub-basket (% of GNI per capita*)
1	Hong Kong, China	2.6	3.7	0.1
2	Denmark	5.8	3.3	0.1
3	Singapore	4.0	5.3	0.1
4	Norway	9.7	5.7	0.2
5	Sweden	7.5	5.1	0.2
6	United Arab Emirates	4.1	6.2	0.2
7	Luxembourg	14.0	9.9	0.2
8	Macao, China	2.8	4.1	0.2
9	Cyprus	5.3	8.1	0.3
10	Kuwait	7.9	10.0	0.3
11	Germany	10.1	7.5	0.3
12	Iceland	14.1	9.6	0.3
13	Finland	14.1	9.4	0.4
14	United States	15.3	15.3	0.4
15	Bahrain	6.5	9.8	0.4
16	Netherlands	17.7	13.1	0.5
17	Ireland	18.7	12.3	0.5
18	United Kingdom	20.5	15.7	0.6
19	Canada	19.2	16.0	0.6
20	Oman	5.5	9.1	0.6
21	Italy	17.1	12.9	0.6
22	Belgium	21.9	16.0	0.6
23	Trinidad & Tobago	7.9	12.1	0.7
24	Saudi Arabia	8.8	12.7	0.7
25	Austria	24.3	18.4	0.7
26	Taiwan, China	9.9	17.0	0.7
27	Slovenia	12.4	12.5	0.7
28	Switzerland	35.5	22.7	0.7
29	Australia	26.5	20.2	0.9
30	Latvia	7.3	9.6	0.9
31	Malta	11.3	11.9	0.9
32	Korea (Rep.)	14.6	19.2	0.9
33	New Zealand	23.1	19.5	1.0
34	Mauritius	4.4	7.6	1.0
35	Costa Rica	4.5	8.4	1.0
36	Greece	25.1	23.1	1.0
37	Japan	32.2	28.5	1.0
38	Lithuania	8.7	12.1	1.1
39	Malaysia	5.9	10.9	1.1
40	Panama	5.1	9.7	1.1
41	France	35.7	25.8	1.1
42	Estonia	13.6	16.4	1.2
43	Serbia	4.9	8.1	1.3
44	Maldives	3.4	5.2	1.3
45	Iran (I.R.)	3.8	10.9	1.3
46	Spain	33.3	29.4	1.4
47	Russia	8.6	13.1	1.4
48	Thailand	3.9	7.8	1.4
49	Seychelles	11.1	24.9	1.5
50	Poland	12.5	14.3	1.5
51	Czech Republic	18.6	21.4	1.5
52	Montenegro	6.7	10.4	1.6
53	Barbados	11.0	17.8	1.6
54	Slovak Republic	16.1	19.8	1.7
55	Hungary	16.1	19.1	1.7
56	Portugal	26.4	24.8	1.7
57	Botswana	8.3	18.2	1.7
58	China	3.6	7.1	1.8
59	Sri Lanka	2.4	6.1	1.9
60	Jordan	4.5	7.9	1.9
61	Grenada	7.4	11.0	1.9
62	Chile	13.7	17.4	2.0
63	Bhutan	3.0	8.0	2.0
64	India	1.6	4.4	2.1
65	Croatia	18.7	22.2	2.1
66	Mexico	15.0	21.7	2.2
67	Guatemala	4.5	8.1	2.2
68	Jamaica	7.0	12.2	2.3
69	Suriname	8.9	14.4	2.3
70	Romania	11.9	14.6	2.3
71	Micronesia	4.9	6.5	2.4
72	Argentina	12.5	25.0	2.5
73	South Africa	12.3	22.1	2.6
74	St. Lucia	11.9	20.9	2.6
75	Uruguay	13.8	19.1	2.6
76	Pakistan	1.9	5.9	2.7
77	Tunisia	7.2	14.5	2.7
78	Algeria	8.2	14.6	2.7
79	Peru	8.0	14.8	2.8
80	Tonga	5.8	8.3	3.0
81	Dominican Rep.	9.1	16.5	3.1
82	Dominica	11.0	19.3	3.1
83	Bosnia	9.9	16.4	3.1
84	Bangladesh	1.3	3.8	3.4
85	St. Vincent and the Gren.	11.9	19.9	3.4
86	Ecuador	9.0	20.2	3.5
87	Colombia	9.6	15.7	3.5
88	Egypt	4.7	14.1	3.6
89	Armenia	8.4	14.0	3.8
90	Ukraine	8.2	17.8	3.8
91	Indonesia	5.3	10.4	3.9
92	Venezuela	24.7	36.2	4.1
93	Namibia	11.5	19.6	4.1
94	Paraguay	5.7	10.8	4.1
95	Philippines	5.7	11.0	4.2
96	Samoa	8.7	12.8	4.3
97	Fiji	13.9	14.0	4.4
98	El Salvador	10.5	20.2	4.4
99	TFYR Macedonia	13.2	27.0	4.6
100	Lebanon	22.2	38.2	4.6
101	Belize	14.9	24.4	4.7
102	Georgia	8.5	15.1	4.8
103	Bulgaria	18.6	36.3	4.9
104	Angola	11.8	18.3	5.5
105	Bolivia	5.9	16.8	5.6
106	Swaziland	12.1	24.9	5.6
107	Sudan	4.8	8.5	6.0
108	Lao P.D.R.	3.0	8.5	6.1
109	Syria	9.1	20.4	6.2
110	Viet Nam	4.2	13.2	6.4
111	Yemen	4.9	11.3	6.7
112	Guyana	7.4	15.8	6.9
113	Azerbaijan	15.2	30.1	7.2
114	Brazil	37.0	44.2	7.5
115	Albania	22.7	38.3	8.3
116	Moldova	8.9	16.8	8.5
117	Vanuatu	15.1	26.4	9.8
118	Cape Verde	20.0	20.2	9.9
119	Nepal	2.9	7.8	10.3
120	Guinea	3.5	8.4	10.6
121	Cambodia	5.0	15.1	11.2
122	S. Tomé & Principe	8.2	15.7	11.4
123	Morocco	22.2	34.5	11.8
124	Ghana	5.9	10.5	12.0
125	Senegal	8.4	13.9	12.2
126	Mauritania	9.9	20.1	14.1
127	Lesotho	12.6	26.2	15.1
128	Nigeria	12.1	19.7	15.6
129	Ethiopia	3.1	10.4	16.6
130	Nicaragua	13.8	36.6	16.9
131	Papua New Guinea	12.8	23.3	18.0
132	Zambia	12.3	15.7	18.5
133	Côte d'Ivoire	14.8	21.9	19.5
134	Cameroon	17.8	30.4	20.3
135	Gambia	6.0	16.5	22.6
136	Cuba	22.7	NA	23.3
137	Kenya	13.4	25.5	23.7
138	Mali	10.0	17.5	24.0
139	Comoros	14.6	21.0	25.7
140	Benin	15.5	30.4	32.7
141	Tanzania	11.1	31.6	33.3
142	Uganda	10.4	25.3	36.8
143	Rwanda	10.0	25.2	37.6
144	Mozambique	10.1	20.6	37.9
145	Central African Rep.	12.6	20.4	39.8
146	Madagascar	12.4	27.2	46.6
147	Burkina Faso	16.9	37.1	47.1
148	Malawi	12.0	35.5	57.4
149	Niger	13.8	26.4	59.0
150	Togo	18.0	34.5	60.1

Note: *The GNI per capita is based on the World Bank's Atlas Method.
Source: ITU.

the price difference between developed and developing economies is smaller, but developed economies still have higher fixed telephone prices: PPP $ 20.5 compared to PPP $ 17.9 in developing economies.

Further analysis shows that countries with the most expensive basket in terms of US$ are mainly developed countries. There are only three developing economies out of the bottom 20: Zambia (US$ 27.7), Brazil (US$ 29.1) and Oman (US$ 32.6). However, with PPP prices the situation is the reverse, only three out of the twenty most expensive countries are developed economies: Poland (PPP $ 32.3), the Czech Republic (PPP $ 35.6) and Hungary (PPP $ 35.9).

It can be thus observed that prices of fixed telephony in developing economies show significant differences, as they account for both the least and the most expensive tariffs in PPP terms.

Public policies such as subsidies and the use of state-imposed tariff controls have a direct impact on fixed telephone prices. Fixed telephony has historically been a sector of regulatory intervention for universal access and service purposes.[18] However, with the fast growth of mobile cellular telephony worldwide, there has been a shift from fixed to mobile cellular telephony as the main universal service/access technology. Between 2003 and 2007, the share of countries applying state-imposed tariff limits decreased from over 40 per cent to less than 20 per cent.[19] Results presented in this Chapter suggest there is a significant tariff difference between countries with poor telephone infrastructure that applied active regulatory policies and others that did not.

Mobile cellular sub-basket

a) Prices as a percentage of GNI per capita

Eight out of the ten countries with the lowest relative mobile cellular prices are also represented in the top-ten list in the overall ICT Price Basket (see Table 6.4). They include the list's top five: Hong Kong (China), Denmark, Singapore, Norway and Sweden. Without exception, all of the 30 economies ranked at the top of the list are developed and/or high-income economies, including most of the European, Northern American and high-income Eastern and Western Asian economies. Here, mobile cellular services, as measured by the sub-basket, cost less than one per cent of monthly average GNI per capita.

On the other hand, all of the 30 economies ranked at the bottom of the list are from the developing world, including many LDCs, such as Togo, Niger, Malawi, Burkina Faso, and the Central African Republic. A number of Southern and Eastern European countries stand out as developed countries with a relatively low ranking (i.e. relatively high mobile prices). These include Albania, Bulgaria, Macedonia, Bosnia, Romania and Croatia.

The comparison between the mobile cellular sub-basket and the ICT Price Basket shows that a number of developing countries have relatively low mobile cellular prices as a percentage of their GNI per capita. A dozen developing economies have a rank difference of 20 or more positions, with relatively lower mobile cellular prices. This includes Bhutan, Mauritius, Iran, Pakistan and Sri Lanka, as well as the two Pacific Islands (Tonga and Micronesia) and Guatemala and Suriname from Central and South America.

Economies where mobile cellular prices are high in terms of GNI per capita compared to their overall ICT Price Basket include Bulgaria, Venezuela, Lebanon, Albania, Tunisia, Brazil and Fiji.

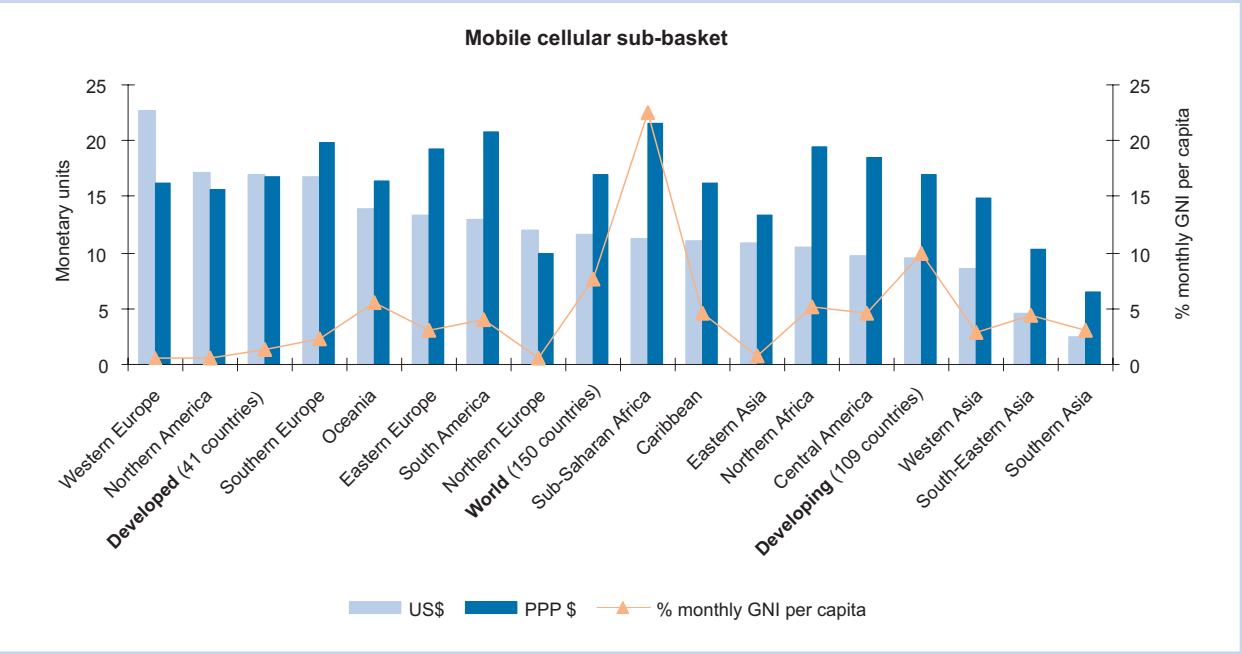
Chart 6.4 confirms the overall link between GNI per capita and the cost of mobile cellular services as a percentage of GNI per capita. In Sub-Saharan Africa – home to the largest number of LDCs – the mobile cellular sub-basket costs more than 20 per cent of average annual GNI per capita. In contrast, in the developed world, the sub-basket costs less than two per cent of average annual GNI per capita.

b) Prices in US$ and PPP $

Table 6.4 shows the ten economies with the least expensive cellular prices calculated using PPPs. Unlike the case of the fixed telephone basket (see Table 6.3), the list includes a mixture of high, low and lower-middle income economies. This is confirmed by the aggregated averages (see Chart 6.4), which show that there is little difference between mobile PPP prices of developing economies (PPP $ 17.1) and those of developed economies (PPP $ 16.8). This result is consistent with the global growth in mobile cellular telephony which, unlike any other ICT technology, has affected both the developing and the developed world.

The region with lowest mobile PPP prices is Southern Asia. All low and lower-middle countries in Table 6.5 belong to the South Asian Association for Regional

Chart 6.4: Mobile cellular sub-basket by region and by level of development (2008)



Source: ITU.

Table 6.5: Top ten economies with the least costly mobile cellular sub-basket (2008)

Economy	Region*	WB income grouping**	Mobile Basket PPP $	Mobile Basket US$
Denmark	Northern Europe	High	3.3	5.8
Hong Kong, China	Eastern Asia	High	3.7	2.6
Bangladesh	Southern Asia	Low	3.8	1.3
Macao, China	Eastern Asia	High	4.1	2.8
India	Southern Asia	Lower-middle	4.4	1.6
Sweden	Northern Europe	High	5.1	7.5
Maldives	Southern Asia	Lower-middle	5.2	3.4
Singapore	South-Eastern Asia	High	5.4	4.0
Norway	Northern Europe	High	5.7	9.7
Pakistan	Southern Asia	Low	5.9	1.6

Note: *See Annex 3 for a detailed list of countries per region. **Economies are divided according to 2007 GNI per capita, calculated using the World Bank Atlas method, except for Taiwan (China), where 2006 ITU GNI per capita data are used.
Source: ITU.

Cooperation (SAARC).[20] India is the country with the second cheapest US$ mobile tariffs and the fourth cheapest in PPP terms. Bangladesh and Pakistan, the other big SAARC in terms of population, rank also among the top ten in both US$ and PPP prices.

Several Northern European countries are among the top ten list of lowest mobile PPP prices. The aggregate value for the region (PPP $ 9.9) is very low, only above the one for Southern Asia (PPP $ 6.5). Other high-income economies among the top ten list of lowest

mobile prices (both in PPP and US$ terms) are the two Special Administrative Regions of China: Macao and Hong Kong.[21]

On the other hand, Sub-Saharan Africa (PPP $ 21.5) and South America (PPP $ 20.9) are the two regions with the most expensive mobile cellular sub-basket.

Fixed broadband Internet sub-basket

a) Prices as a percentage of GNI per capita

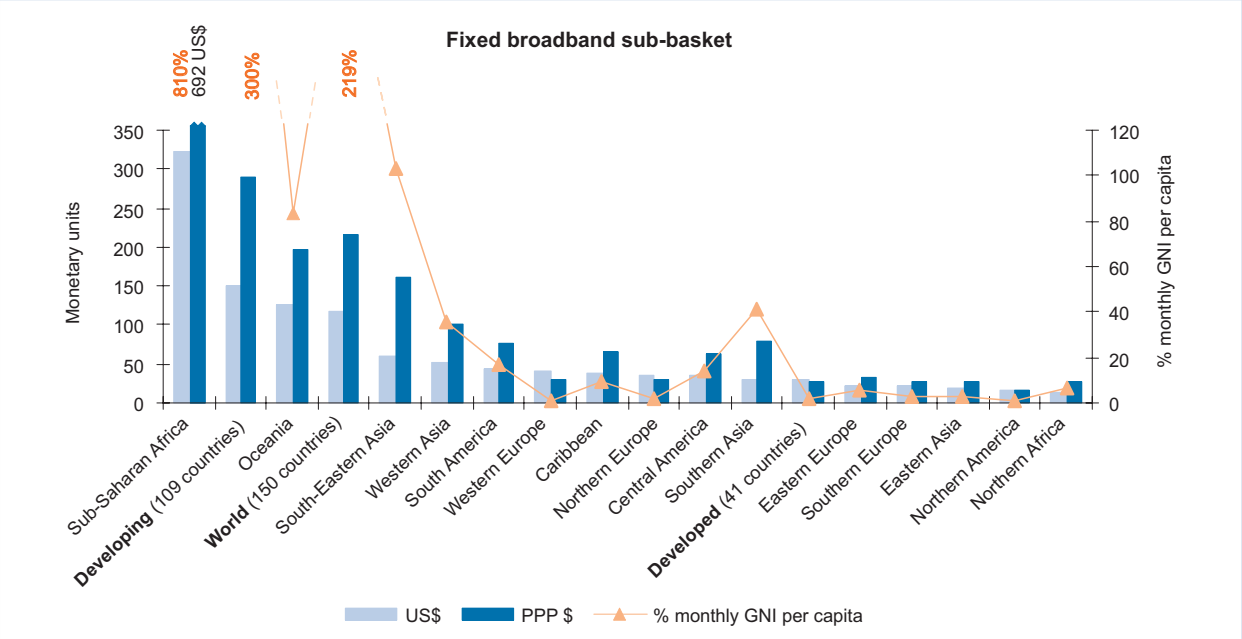
The lowest relative broadband prices are available in the United States and Canada, followed by Switzerland, Denmark and Luxembourg. Almost all of the 50 economies ranked at the top of the list are developed and/or high-income economies, including the Northern American, most European and the high-income Eastern and Western Asian economies (see Table 6.6). The only developing non-high-income countries in the top-50 list are Panama, the Maldives and Costa Rica.

Among the remaining 100 economies in the broadband sub-basket, only Bulgaria, Romania, Bosnia, Montenegro, TFYR Macedonia and Albania are classified as developed economies. These findings suggest that there is a link between GNI per capita and the cost of fixed broadband Internet services. This link is much stronger than in the case of fixed and mobile services.

In 30 countries, the price of the broadband sub-basket exceeds the monthly GNI per capita, highlighting the exorbitant price for high-speed Internet access. All of these countries are LDCs, with very low broadband penetration. In the Central African Republic, Malawi, Ethiopia, Burkina Faso, Guinea, Cuba and The Gambia, an entry level broadband package exceeds the average monthly GNI per capita by over 1'000 per cent, suggesting that broadband is limited to businesses and selected organizations, rather than households.[22]

Chart 6.5 shows that there are major regional differences in the relative prices for broadband. The regions with the relatively most expensive fixed broadband services include the developing countries in general and Sub-Saharan Africa particularly. The difference in the cost for broadband as a percentage of GNI per capita between developed and developing countries (two per cent in developed versus close to 300 per cent in developing economies) is stronger than in the other two price sub-baskets. This 'price divide' is also consistent with the existing broadband divide that separates the developed from the developing world.

Chart 6.5: Fixed broadband Internet sub-basket by region[23] and by level of development (2008)



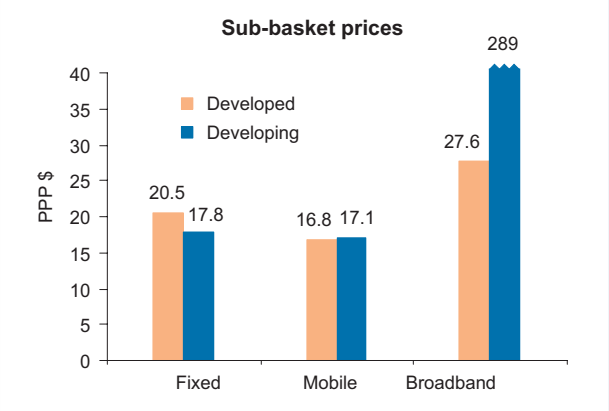
Source: ITU.

Table 6.6: Fixed broadband Internet sub-basket 2008 (ranked by percentage of monthly GNI per capita)

Rank	Economy	Broad-band sub-basket (US$)	Broad-band sub-basket (PPP $)	Broad-band sub-basket (% of GNI per capita*)
1	United States	15.0	15.0	0.4
2	Canada	19.8	16.5	0.6
3	Switzerland	32.2	20.6	0.6
4	Denmark	30.4	17.4	0.7
5	Luxembourg	44.3	31.4	0.7
6	Taiwan, China	10.3	17.6	0.7
7	Cyprus	16.5	25.5	0.8
8	Singapore	21.9	29.0	0.8
9	United Kingdom	29.4	22.5	0.8
10	Sweden	32.3	22.0	0.8
11	Macao, China	10.0	14.8	0.9
12	Norway	57.0	33.5	0.9
13	Belgium	30.5	22.3	0.9
14	Australia	27.5	21.0	0.9
15	Italy	25.8	19.5	0.9
16	Ireland	38.1	25.2	1.0
17	Hong Kong, China	25.4	36.0	1.0
18	Finland	38.0	25.2	1.0
19	Netherlands	38.1	28.2	1.0
20	Japan	31.6	28.0	1.0
21	Greece	25.2	23.2	1.0
22	United Arab Emirates	21.5	32.4	1.1
23	Trinidad & Tobago	12.7	19.6	1.1
24	Spain	28.8	25.4	1.2
25	Germany	38.1	28.2	1.2
26	France	38.0	27.4	1.2
27	Korea (Rep.)	20.3	26.6	1.2
28	Iceland	57.0	38.7	1.3
29	New Zealand	30.7	25.9	1.3
30	Slovenia	27.5	27.8	1.6
31	Bahrain	26.7	40.2	1.7
32	Malta	21.1	22.1	1.7
33	Austria	60.9	46.0	1.7
34	Kuwait	46.3	58.0	1.8
35	Portugal	30.2	28.4	1.9
36	Lithuania	15.9	22.2	1.9
37	Russia	13.9	21.1	2.2
38	Serbia	9.0	14.7	2.3
39	Croatia	20.9	24.8	2.4
40	Czech Republic	28.9	33.3	2.4
41	Hungary	24.8	29.5	2.6
42	Slovak Republic	28.5	35.0	2.9
43	Saudi Arabia	39.7	57.7	3.1
44	Latvia	26.0	34.0	3.1
45	Panama	15.0	28.8	3.3
46	Poland	27.0	31.0	3.3
47	Oman	31.3	51.6	3.4
48	Estonia	38.5	46.3	3.5
49	Maldives	9.4	14.6	3.5
50	Costa Rica	17.0	31.6	3.7
51	Malaysia	20.5	37.7	3.8
52	Bulgaria	15.6	30.6	4.1
53	Romania	22.7	27.9	4.4
54	Uruguay	24.3	33.7	4.6
55	Bosnia	14.8	24.7	4.7
56	Tunisia	12.7	25.7	4.8
57	Lebanon	23.0	39.7	4.8
58	Montenegro	21.3	33.0	4.9
59	TFYR Macedonia	14.7	30.2	5.1
60	Venezuela	31.3	45.8	5.1
61	Mexico	37.0	53.6	5.3
62	South Africa	26.3	47.1	5.5
63	Algeria	17.3	30.8	5.7
64	Botswana	29.6	65.3	6.1
65	Egypt	8.3	24.9	6.3
66	Thailand	18.0	36.1	6.3
67	Seychelles	50.7	114.1	6.8
68	Barbados	49.4	80.0	7.3
69	Grenada	29.3	43.5	7.5
70	El Salvador	18.0	34.5	7.6
71	Argentina	38.4	76.7	7.6
72	Chile	53.0	67.2	7.6
73	India	6.1	16.4	7.7
74	Fiji	26.1	26.4	8.2
75	China	18.5	36.8	9.4
76	Dominican Rep.	28.0	50.8	9.5
77	Brazil	47.3	56.5	9.6
78	Jamaica	30.0	52.4	9.7
79	Ukraine	20.8	45.2	9.8
80	Morocco	20.0	31.1	10.7
81	Mauritius	50.6	88.2	11.1
82	Albania	31.4	53.1	11.5
83	St. Lucia	55.2	96.7	12.0
84	Peru	36.4	67.3	12.7
85	Jordan	30.9	54.7	13.0
86	Colombia	36.3	59.9	13.4
87	Dominica	47.8	84.2	13.5
88	Iran (I.R.)	43.0	123.2	14.9
89	Ecuador	39.9	89.1	15.5
90	St. Vincent and the Gren.	55.2	92.4	15.7
91	Indonesia	21.7	42.5	15.8
92	Sri Lanka	21.0	53.4	16.3
93	Namibia	46.1	78.8	16.5
94	Guatemala	34.0	61.1	16.7
95	Philippines	23.4	45.0	17.3
96	Armenia	39.2	65.5	17.8
97	Micronesia	40.0	52.8	19.4
98	Cape Verde	39.8	40.1	19.6
99	Moldova	23.2	43.7	22.1
100	Suriname	95.0	153.0	24.1
101	Paraguay	35.0	65.7	25.1
102	Pakistan	18.5	56.5	25.5
103	Viet Nam	17.0	53.2	25.8
104	Georgia	47.6	84.5	26.9
105	Belize	89.5	146.5	28.3
106	Bolivia	33.5	95.3	31.9
107	Syria	51.3	114.3	35.0
108	Sudan	29.1	51.8	36.4
109	Nicaragua	30.0	79.6	36.7
110	Azerbaijan	84.5	167.3	39.8
111	Bhutan	60.7	161.6	41.1
112	Senegal	29.1	48.4	42.6
113	Guyana	49.5	105.2	45.7
114	Tonga	109.8	157.3	56.8
115	Lesotho	48.9	101.5	58.7
116	Côte d'Ivoire	46.5	68.8	61.4
117	Angola	163.6	253.6	76.7
118	Nepal	22.8	60.6	80.4
119	Samoa	169.3	249.6	83.6
120	Mauritania	62.4	127.1	89.2
121	Ghana	64.4	114.7	131.0
122	Zambia	91.5	116.1	137.2
123	Bangladesh	53.9	155.1	137.7
124	Mali	58.2	101.6	139.6
125	Cambodia	90.6	271.8	201.2
126	Papua New Guinea	144.3	263.0	203.7
127	Tanzania	68.0	194.1	204.0
128	Cameroon	183.8	314.4	210.0
129	Benin	104.7	204.9	220.4
130	Niger	58.2	111.4	249.2
131	Vanuatu	450.0	787.2	293.5
132	Kenya	167.8	318.6	296.1
133	Yemen	225.7	525.1	311.4
134	Rwanda	91.8	231.0	344.4
135	Togo	105.8	202.6	352.8
136	Mozambique	100.1	203.8	375.3
137	S. Tomé & Principe	273.5	521.7	377.2
138	Madagascar	120.1	262.4	450.2
139	Lao P.D.R.	268.3	772.0	555.1
140	Uganda	170.0	412.9	600.0
141	Comoros	449.7	646.4	793.7
142	Swaziland	1'877.5	3'854.1	873.2
143	Nigeria	690.1	1'122.9	890.4
144	Gambia	383.8	1'051.8	1439.3
145	Cuba	1'630.0	NA	1671.8
146	Guinea	800.0	1'897.3	2400.0
147	Ethiopia	644.0	2'198.0	3512.8
148	Malawi	900.0	2'674.2	4320.0
149	Central African Rep.	1'395.8	2'266.4	4407.7
150	Burkina Faso	1'861.0	4'098.5	5193.6

Note: *The GNI per capita is based on the World Bank's Atlas Method.
Source: ITU.

Chart 6.6: Difference between prices in developing and developed countries (2008)



Source: ITU.

b) PPP and US$ prices

Fixed broadband Internet prices display quite singular patterns compared to fixed and mobile cellular telephony prices. The difference between developed and developing economies is bigger than in all other cases (see Chart 6.6).

In particular, the high Internet broadband price of Sub-Saharan countries is striking (average PPP $ 692, US$ 322). It practically implies the unavailability of that service in the region. Moreover, the price difference between Sub-Saharan countries and other regions shows that the region is lagging behind. Some of Oceania's islands (Papua New Guinea, Samoa, Tonga and Vanuatu) are also in the same situation.

As can be seen in Table 6.7, seven out of ten economies with the least expensive fixed broadband Internet PPP prices are high-income economies. The inclusion of Maldives and India in the list and the fact that both are also among the top ten economies with least expensive mobile PPP prices shows their good performance concerning mobile and Internet pricing. Results in US$ confirm this affirmation.

The United States and Canada also have relatively cheap broadband PPP prices. Indeed, the Northern American average broadband Internet price (PPP $ 15.7) is the lowest among all regions. Eastern Asia (PPP $ 26.6) is the second least expensive region in terms of PPP, with Macao (China) and Taiwan (China), amid the top ten economies with least expensive broadband prices.

Finally, consistent with the regional averages, out of the bottom 20 countries (i.e. with most expensive broadband PPP prices) 14 are from the Sub-Saharan region and three are islands from Oceania.

Table 6.7: Top ten economies with the least costly fixed broadband Internet sub-basket (2008)

Economy	Region*	WB income grouping**	Fixed broadband basket PPP $	Fixed broadband basket US$
Maldives	Southern Asia	Lower-middle	14.6	9.4
Serbia	Southern Europe	Upper-middle	14.7	9.0
Macao, China	Eastern Asia	High	14.8	10.0
United States	Northern America	High	15.0	15.0
India	Southern Asia	Lower-middle	16.4	6.1
Canada	Northern America	High	16.5	19.8
Denmark	Northern Europe	High	17.4	30.4
Taiwan, China	Eastern Asia	High	17.6	10.3
Italy	Southern Europe	High	19.5	25.8
Trinidad & Tobago	Caribbean	High	19.6	12.7

Note: *See Annex 3 for a detailed list of countries per region. **Economies are divided according to 2007 GNI per capita, calculated using the World Bank Atlas method, except for Taiwan (China), where 2006 ITU GNI per capita data are used.
Source: ITU.

Endnotes

[1] For example, in many countries, the price for local calls were kept to a minimum to allow as many users as possible to make affordable local calls, through (cross-)subsidies, which allowed operators to recover revenues lost on low-priced local calls in other areas, for example, international calls. Increasing competition in the ICT market put pressure on the higher profit segment to reduce prices and obliged incumbent operators to abandon cross-subsidies and to make prices cost-oriented (often increasing the price for local calls).

[2] See for example, the Mexican regulatory authority, COFETEL, at: http://www.cft.gob.mx/wb/Cofetel_2008/Cofe_tarifas and Togo's ARTP, Observatoire 2007, at http://www.artp.tg/Rap_ac_2006.pdf.

[3] See OECD Telecommunications Basket definitions in Teligen (2000) as well as OECD broadband price criteria, at: http://www.oecd.org/document/1/0,3343,en_2649_34225_39575489_1_1_1_1,00.html.

[4] See OECD (2007).

[5] See World Bank ICT at a Glance definitions and sources, at: http://go.worldbank.org/Y3A1OOIJ20.

[6] The use of PPP exchange factors helps screening price and exchange rate distortions, thus providing a measure of the cost of a given service taking into account the purchasing power equivalences between countries. PPP data used in the ICT Price Basket were provided by the World Bank. For more information on PPP methodology and data, see http://go.worldbank.org/UI22NH9ME0 and the World Bank (2008a).

[7] See, for example, the World Bank (1995), Chapter 5, point 5.11. For a more recent example, see the World Bank (2008b), Chapter 2, section "Access Costs (Prices)"on the effect on tariffs by the threat of competition in Vanuatu.

[8] On-net refers to a call made to the same mobile network, while off-net and fixed line refer to calls made to other (competing) mobile networks and to a fixed telephone line, respectively.

[9] See, for example, ITU (2006c) and ITU 2008c).

[10] ITU's mobile broadband data refer to subscribers with access to mobile cellular networks with access to data communications (e.g. the Internet) at broadband speeds (here defined as greater than or equal to 256 kbit/s in one or both directions)* such as W-CDMA, HSDPA, CDMA2000 1xEV-DO, CDMA 2000 1xEV-DV. Based on this definition, it is not clear if subscribers are actually using mobile broadband services, i.e. if they are active or rather potential users. Although there are some ad-hoc surveys on the use of mobile broadband networks and applications, only a limited number of countries, including France and Portugal, currently track how many people are active users of mobile broadband. See, for example, the French Regulatory Authority, which states that "the number of active users of 3G services (voice, video phone, mobile television, data transfer, etc.) reached 7.6 million at the end of the second quarter 2008, corresponding to 14 per cent of mobile operator customers. In one year, this number rose by close to three million (+61.3 per cent)." See ARCEP (2008) and also ANACOM (2008).

[11] The average United Nations operational rate of exchange from January 2008 to September 2008 is used (the month when prices were gathered).

[12] The international dollar (PPP $) is a common world currency obtained by applying PPP conversion factors (based on the US$ as the reference currency) to local currencies.

[13] The World Bank's Atlas method is used for the Bank's official estimates of the size of economies in terms of GNI converted to current U.S. dollars. GNI takes into account all production in the domestic economy (i.e., GDP) plus the net flows of factor income (such as rents, profits, and labor income) from abroad. The Atlas method smoothes exchange rate fluctuations by using a three year moving average, price-adjusted conversion factor. See: http://go.worldbank.org/B5PYF93QF0.

[14] The term "high-income" here is defined as per the World Bank's definition of income level, see: http://go.worldbank.org/D7SN0B8YU0. The only exception is Taiwan (China), which is not included in the World Bank's list of economies but which has a GNI per capita comparable to those economies ranked as high-income by the World Bank.

[15] Correlation value of 0.915 and R square value of 0.836.

[16] Japan, Greece, Switzerland, Spain, the US, Taiwan (China), Bulgaria and Morocco, where the broadband basket is actually cheaper than the mobile basket, are the only exceptions.

[17] According to the income grouping of the World Bank. 2007 country groupings can be found in http://go.worldbank.org/D7SN0B8YU0.

[18] According to the ICT Regulation Toolkit (ITU / InfoDev), the terms Universal Service (US) and Universal Access (UA) include the notions of availability, accessibility and affordability. In developing countries, affordability may imply targets such as having "a tariff option that allows households in the lowest income decile a minimum or modest use" among other Universal Service Obligations. This is the case, for example, of Ecuador, where (depending on social criteria) fixed telephone tariffs vary. See Information for Development (2008) for more details on Universal Access Policies worldwide.

[19] ITU World Regulatory Database, see http://www.ictregulationtoolkit.org/en/Section.3143.html.

[20] Bangladesh, India, Maldives and Pakistan. See http://www.saarc-sec.org for more details on SAARC members and activities.

[21] Both Macao (China) and Hong Kong (China) have a very high population density, which may be an explanatory factor for mobile cellular development and therefore also for mobile telephony prices.

[22] Except for Cuba, in these countries commercially advertised, fixed broadband Internet speeds are only available through leased lines, WDSL and SDSL. In the case of Cuba, fixed broadband Internet is only available to businesses.

[23] Cuba is excluded of the Caribbean region in the comparison, due to the fact that there is no PPP data for the country and that fixed broadband Internet is only available for businesses. Therefore it would be misleading to compare Cuba's broadband Internet connection price in US$ with those of other countries in the Caribbean.

Chapter 7

Conclusions

This Report presented an analysis of recent developments of the information society globally, regionally, and by countries. It has shown that by the end of 2008, the world had reached unprecedented ICT levels: over 4 billion mobile cellular subscriptions, 1.3 billion fixed telephone lines and close to a quarter of the world's population using the Internet. Despite overall high growth rates, record numbers, and all-high penetration rates, major differences in ICT levels between regions and between the developed and developing economies remain.

This is particularly true in the area of broadband. While high-speed access to the Internet is available in almost all countries, fixed broadband penetration levels account for just over two per cent in the developing world compared to almost 20 per cent in the developed world. At the same time, fixed broadband networks are increasingly being complemented by mobile broadband networks. Given the limited availability of wired access in many of the world's developing countries and rural areas, and the rapid spread of IMT-2000/3G mobile cellular networks, mobile broadband is opening up exciting and new possibilities. Despite low penetration rates of mobile broadband in the developing world (less than one per cent by the end of 2007), it has a clear potential to help more and more people communicate, and increasingly at high speed.

The Report has presented a new tool for benchmarking the information society, the ITU ICT Development Index (IDI). A comparison of IDI results for 2002 and 2007 illustrates that, with the exception of the Republic of Korea, the top ICT performers are all from Europe, in particular European Nordic countries, with little change from 2002. All of the countries included in the top 30 of the IDI 2007 are from the developed world, and some high-income developing economies.

Generally speaking, all countries have improved their ICT levels during the five-year period, but huge differences remain in the progress that was made. While Western Europe and Eastern Asia have made significant gains on the IDI, Eastern Europe is the region that has improved most its ICT levels between 2002 and 2007, with the most dynamic growth in the IDI of all regions worldwide.

In the area of ICT use (captured by the number of Internet users, fixed and mobile broadband subscriptions), Northern and Western European countries have grown most between 2002 and 2007, surpassing North America. This is largely due to impressive fixed broadband uptake in some European countries, compared to, for example, the United States and Canada.

Developed countries have much higher levels of ICT use and intensity of use, but developing countries have made larger improvements on ICT access over the five-year period and are therefore likely to catch up slowly with developed countries on ICT access. ICT use, on the other hand, is still very low in developing countries and for the majority of people broadband is either not available or its cost is prohibitive. The Report shows that there is a strong link between the level of ICT and the level of income (in PPP $ terms), and the relationship is growing stronger over time.

Following the conceptual framework on which the IDI is based, the results also illustrate the sequential nature of ICT developments, where ICT access is followed by ICT use. In 2002, countries with relatively high IDI values already had relatively high access scores. By 2007, many of those had increased their ICT use values. On the other hand, those with overall low IDI values in 2002 mainly increased their ICT access values by 2007 (and not their ICT use values).

Compared to ICT use, ICT skills (here defined by literacy and education levels) are more equally distributed across countries with different levels of development. In the absence of widespread ICT use, the impact of ICT will not (yet) be felt as strongly in those countries. At the same time, with the likely increase in ICT use, countries with relatively high skill levels (for example, those in Eastern Europe and some Central Asian economies) are likely to benefit swiftly from ICT use and its impact on social and economic development.

While access to, and use of, ICTs is increasing (as reflected by absolute IDI values), results of the digital divide analysis reveal that the global digital divide is as prevalent as before with minor changes over the five-year period. In other words, despite increased access to ICTs in many parts of the worlds, the magnitude of the digital divide is almost the same as five years earlier. An analysis of groups of countries with different levels of ICT (or IDI values) showed that the digital divide has slightly decreased between countries with high levels of ICT and those with lower ICT levels. This may partly be due to an increase in levels of penetration of mobile cellular phones, which is increasing in most of the developing countries. On the other hand, the digital divide has increased somewhat between countries with "upper" ICT levels and those with "medium" or "low" ICT levels. This suggests that as countries' information societies become more mature, ICT levels flatten out, whereas less mature, but reasonably advanced, information societies grow strongly, thereby leaving behind those at the lower end of the scale.

The Report also presented the results of the ITU ICT Price Basket, which is published for the first time. The main conclusions of the ICT Price Basket analysis are that the prices for ICT services vary greatly between countries, not only in absolute terms (i.e. US$) but also when they are adjusted to purchasing power parity (PPP), and when they are presented as a percentage of GNI per capita. Results illustrate that high-income, developed countries tend to have lower relative prices for ICT services (as a percentage of GNI per capita), whereas low-income, developing economies tend to have higher prices. Nevertheless, there are some important exceptions of countries where ICT prices are below-average compared to their income levels. These include countries that subsidize services (such as fixed telephony) provided by Government-owned operators, but also others that have succeeded in attracting investors and creating a competitive environment in the fixed broadband or mobile cellular market.

A simple regression analysis comparing the results of the IDI to the results of the ICT Price Basket suggests a strong link between ICT prices and ICT levels. The Report highlights that economies with relatively low prices have relatively high IDI levels; economies with relatively high prices rank relatively low in the IDI. This confirms the importance for policy makers to address the cost of ICT services. Future editions of this Report will allow countries to monitor price developments over time.

The Report also presented the absolute and relative prices for each sub-basket: fixed telephony, mobile cellular telephony and fixed broadband Internet. The main conclusions are that while prices for fixed telephone and mobile cellular services as a percentage of incomes remain low in large parts of the developing world, fixed broadband Internet prices, in both absolute and relative terms, are clearly outside the reach of the majority of people in the developing world.

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Explanatory notes

Figures in italics correspond to ITU estimates or values referring to previous years.

Three dots (…) indicate that data are not available.

A hyphen (-) indicates that the amount is nil or negligible (e.g. costs of 3 min. local calls below US$ 0.005).

Annex 1: ICT Development Index (IDI) methodology

The following outlines the methodology used in computing the IDI and provides more details on its different steps including the indicator selection, indicator definition, imputation of missing values, normalisation, weights applied to the indicators and sub-indices and results of the sensitivity analysis.

1. Principal Components Analysis (PCA)

The main objective of running multivariate analysis, such as Principal Components Analysis (PCA), was to analyse carefully the underlying nature of the data used in the index. PCA is a multivariate analysis tool for reducing multidimensional data sets to lower dimensions for analysis. It is done by calculating combinations of the underlying data that contain most of the information. PCA was applied to explore whether the different dimensions are statistically well-balanced and to reveal how different indicators are associated and change in relation to each other. PCA helped in determining the most important indicators to be included in each of the sub-indices by identifying those that are statistically "similar".

This type of analysis is important for reducing the number of variables (and achieving the goal of having a rather simple index) while retaining as much of the original information as possible. PCA was performed for ICT access, use and skills indicators using the Statistical Package for the Social Sciences (SPSS). Those characteristics of the data set (variables) that contributed most to its variance were retained, by keeping principal components, which usually contain the most important aspects of the data.

There were twenty indicators considered in the process of constructing the IDI. Strengths and weaknesses of the indicators were examined to ensure they correspond to the conceptual framework of the IDI.

Before running the statistical analyses, the countries to be included in the index were defined based on data availability. The data set was prepared and cleaned, to avoid including missing data (see also section 3).

Before running the PCA, Bartlett's test of sphericity was performed to find out whether the indicators initially chosen are correlated. Results (Annex Table 1.1) confirmed that some of the indicators are indeed correlated, hence the need of performing PCA. PCA involves the examination of the correlation matrix and the extraction of the principal components. The results/outputs derived from PCA include three main elements: eigenvalues, the percent (%) of variance explained in each component and the rotated component loadings. Eigenvalues represent the relative importance of the components – components with high eigenvalues and which explain the maximum variance are retained.

In the case of the access indicators, four components that explained 99% of the variability in the dataset were retained (explained by the following indicators: fixed telephone lines, mobile cellular subscribers, bandwidth per user, percent of households with computers and percent of households with Internet). For the use sub-group, three indicators (fixed broadband, mobile broadband and internet users) were retained. For the skills sub-group, there were also three indicators retained (adult literacy, secondary and tertiary gross enrolment (see Annex Table 1.2).

2. Definition of the indicators included in the IDI

ICT INFRASTRUCTURE AND ACCESS INDICATORS

Indicators included in this group provide an indication for the available ICT infrastructure and individuals' access to basic ICTs. Data for all of these indicators are collected by ITU.

1. Fixed telephone lines per 100 inhabitants

Fixed telephone lines refer to telephone lines connecting a subscriber's terminal equipment to the public switched telephone network (PSTN) and which have a dedicated port on a telephone exchange. This term is synonymous with the terms "main station" and "Direct Exchange Line" (DEL) that are commonly used in telecommunication documents. It may not be the same as an access line or a subscriber. The number of ISDN channels and fixed wireless subscribers are included.

2. Mobile cellular telephone subscriptions per 100 inhabitants

Mobile cellular telephone subscriptions refer to the number of subscriptions to a public mobile telephone service

Annex Table 1.1: Results of Principal Components Analysis

	Eigenvalues	Share of variance explained (%)	Cumulative share of variance explained (%)
ICT access indicators			
Component 1	3.49	69.78	69.78
Component 2	0.96	19.23	89.02
Component 3	0.36	7.20	96.21
Component 4	0.15	2.92	99.13
Component 5	0.04	0.87	100.00
Bartlett's test:	Chi-Sq (728.258)	(p-value = 0.000)	
ICT use indicators			
Component 1	2.46	81.97	81.97
Component 2	0.40	13.42	95.40
Component 3	0.14	4.60	100.00
Bartlett's test:	Chi-Sq (300.801)	(p-value = 0.000)	
ICT skills indicators			
Component 1	2.47	82.37	82.37
Component 2	0.36	11.98	94.36
Component 3	0.17	5.64	100.00
Bartlett's test:	Chi-Sq (286.393)	(p-value = 0.000)	

Source: ITU.

using cellular technology, which provides access to the Public Switched Telephone Network (PSTN). This includes analogue and digital cellular systems, including IMT-2000 (Third Generation, 3G). Post-paid and pre-paid subscriptions are included. Prepaid subscriptions include those that have been used within a reasonable period of time (e.g. 3 months). ITU advices countries to exclude inactive users of subscriptions, however, some countries still include them.

In the past, the indicator was called mobile cellular *subscribers* (not *subscriptions*). However, the indicator includes both prepaid and postpaid subscriptions and one subscriber (person) may have multiple subscriptions. For example, at the end of 2008, there were 4 billion subscriptions worldwide. This figure will continue to grow rapidly and may reach or even surpass the world population. Therefore, it seems reasonable to distinguish between the number of mobile subscriptions and the number of individuals using a mobile phone. While the latter indicator would be more useful in the index, only very few countries currently collect this information through household surveys. As data are becoming available[1], the number of mobile users should eventually replace the number of mobile subscriptions.

3. International Internet Bandwidth (bit/s) per Internet user

International Internet bandwidth refers to the capacity that backbone operators provide to carry Internet traffic. It is measured in bits per second (per Internet users).

4. Proportion of households with a computer

A *computer* refers to a desktop or a laptop computer. It does not include equipment with some embedded computing abilities such as mobile cellular phones, personal digital assistants or TV sets.

There are certain data limits to this indicator, since many developing countries are not yet collecting ICT household statistics. For those countries, estimates were calculated (see below on missing data). As data will become more available, the quality of the indicator will improve.

5. Proportion of households with Internet access at home

The *Internet* is a world-wide public computer network. It provides access to a number of communication services

including the World Wide Web and carries e-mail, news, entertainment and data files, irrespective of the device used (not assumed to be only via a computer – it may also be by mobile phone, games machine, digital TV etc.). Access can be via a fixed or mobile network.

There are certain data limits to this indicator, since many developing countries are not yet collecting ICT household statistics. For those countries, estimates were calculated (see below on missing data). As data will become more available, the quality of the indicator will improve.

ICT USE INDICATORS

1. Internet users per 100 inhabitants

While more and more countries capture the number of Internet users through household surveys, data are estimated for many countries, usually based on the number of Internet subscribers and the prevalence and popularity of public or shared Internet access.

For most developed and larger developing countries, Internet user data are based on user surveys conducted usually by national statistical agencies. The data are either provided directly from the NSOs to the ITU, or ITU does the necessary research to obtain them. For countries where Internet user surveys are not available, it is common to estimate the number of users based on a multiple of the numbers of actual paying Internet subscribers. As a result, the actual number of users is usually less accurately measured in developing economies where fewer surveys exist. In the future, an increasing number of household surveys and measures of the numbers of public access facilities will help improve the data availability.

2. Fixed broadband Internet subscribers per 100 inhabitants

Fixed broadband Internet subscriptions refer to subscriptions to paid high-speed access to the public Internet (a TCP/IP connection). High-speed access is defined as being at least 256 kbit/s, in one or both directions. Fixed broadband Internet includes cable modem, DSL, fibre and other fixed broadband technology (such as satellite broadband Internet, Ethernet LANs, fixed-wireless access, Wireless Local Area Network, WiMAX etc.) Subscribers with access to data communications (including the Internet) via mobile cellular networks are excluded.

3. Mobile broadband subscriptions per 100 inhabitants

Mobile broadband subscriptions refer to subscriptions to mobile cellular networks with access to data communications (e.g. the Internet) at broadband speeds (here defined as greater than or equal to 256 kbit/s in one or both directions) such as W-CDMA, HSDPA, CDMA2000 1xEV-DO, CDMA 2000 1xEV-DV etc, irrespective of the device used to access the Internet (handheld computer, laptop or mobile cellular telephone etc). These services are typically referred to as 3G or 3.5G and include:

- Wideband CDMA (W-CDMA), an IMT-2000/3G mobile network technology, based on CDMA that presently delivers packet-switched data transmission speeds up to 384 kbit/s and up to 2 Mbit/s when fully implemented. It is known as Universal Mobile Telecommunications System (UMTS) in Europe.

- High-speed Downlink Packet Access (HSDPA), an upgrade to W-CDMA to allow downlink data transmission at speeds of typically 8-10 Mbit/s. It is complemented by High-Speed Uplink Packet Access (HSUPA), which offers uplink speeds of around 5 Mbit/s.

- CDMA2000 1xEV-DO (Evolution, Data Optimised), an IMT-2000 3G mobile network technology, based on CDMA that delivers packet-switched data transmission speeds of up to 4.9 Mbit/s.

The first commercial IMT-2000/3G networks only started to be launched in 2002/2003 and ITU started to collect this indicator in 2006. The main problem is that only very few (and mainly developed) countries have started collecting data for mobile broadband subscriptions and that definitions often vary between countries. The OECD is currently finalizing a definition for mobile broadband. For countries where data on this indicator are not available, ITU is using data from Wireless Intelligence[2] for '3G' subscriptions with access to data at speeds of 256 kbit/s in one or both directions (including CDMA 2000 1x EV-DO & W-CDMA). Wireless Intelligence collects these data directly from operators. It should be noted that these data do not refer to active subscriptions and they do not indicate how many people are actually using IMT-2000/3G networks to access the Internet. Indeed, some subscriptions to these networks might not even be aware of the possibility to access the Internet, or they may not make use of this functionality.

While ITU is using the Wireless Intelligence data for countries that do not provide data to ITU, countries are invited and encouraged to verify and change the data, if they are collecting it from operators. ITU expects more and more countries to provide national data over time.

ICT SKILLS INDICATORS

Data on adult literacy rates and gross school enrolment are collected by UNESCO Institute for Statistics (UIS).

1. Adult literacy rate

According to the UIS, the "*Adult literacy rate* is defined as the percentage of population aged 15 years and over who can both read and write with understanding a short simple statement on his/her everyday life. Adult illiteracy is defined as the percentage of the population aged 15 years and over who cannot both read and write with understanding a short simple statement on his/her everyday life."[3]

2. Gross enrolment ratio (secondary and tertiary level)

According the UIS, "The *gross enrolment ratio* is the total enrolment in a specific level of education, regardless of age, expressed as a percentage of the eligible official school-age population corresponding to the same level of education in a given school-year."

3. Imputation of missing data

A critical step in the construction of the index is to create a complete data set, without missing values. There are several imputation techniques that can be applied to estimate missing data.[4] Each of the imputation techniques, like any other method employed in the process, has their own strengths and weaknesses. The most important consideration is to ensure that the data imputed will reflect or estimate a country's actual level of ICT access, usage and skills.

Given that ICT access and usage is correlated with national income, hot deck imputation was chosen as the method for estimating the missing data. Hot deck imputation uses data from countries with "similar" characteristics. GDP per capita and geographic location were used as the main criteria in identifying countries with similar characteristics. For example, missing data for country A were estimated for a certain indicator by first identifying the countries that have similar levels of GDP per capita and that are from the same region. Then the indicator that has a known relationship to the indicator to be estimated was considered. For instance, Internet user data of country A was estimated by using Internet user data of country B from the same region, with similar level of GDP per capita and similar level of Internet subscription. The same logic was applied to estimate missing data for all indicators included in the Index.

4. Normalization of data

Normalization of the data is necessary before any aggregation can be made to ensure that the dataset uses the same unit of measurement. For the indicators selected for the construction of the IDI, it is important to transform the values to same unit of measurement since some of them were expressed as a percentage (of the population or households where maximum value is 100), while other indicators (although expressed as a percentage) can have values exceeding 100, such as mobile cellular subscriptions or international Internet bandwidth.

There are certain particularities that need to be taken into consideration when selecting the normalization method for the IDI. For example, in order to identify the digital divide, it is important to measure the relative performance of countries (i.e. divide among countries). Second, the normalization procedure should produce index results that allow countries to track progress of their evolution towards an information society over time.

A further important criterion for the selection of the normalization method was to choose one that can be replicated by countries. As mentioned in chapter 3 of this Report, there has been a strong interest by some countries to apply the index methodology at the national or regional level. Therefore, certain methods cannot be applied, for example those that rely on the values of other countries, since those (i.e. the entire database) might not be available to users.

For the IDI, the *distance to a reference measure* was used as the normalization method. The reference measure is the ideal value that could be reached for each variable (similar to a goalpost). In all of the indicators chosen, this will be 100, except for four indicators:

- International Internet bandwidth per Internet user, which in 2007 ranges from 10 (bits/s/user) to more

than 1 million. To diminish the effect of the large number of outliers at the high end of the value scale, the data were first transformed to a logarithmic (log) scale. The ideal value was then computed by adding two standard deviations to the mean of the rescaled values, resulting in a log value of 5.

- Mobile cellular subscriptions, which in 2007 range from 0.56 to 176 (per 100 inhabitants). The ideal value was computed using the same methodology used for the bandwidth data, by adding two standard deviations to the mean. The resulting reference value was 150 subscriptions per 100 inhabitants.

- Fixed telephone lines per 100 inhabitants range between 0.01 and 65 in 2007. The same methodology was used to compute the reference value, resulting in a rounded value of 60 per 100 inhabitants.

- Fixed broadband subscribers per 100 inhabitants. This is a fairly recent indicator and values range from zero to over 40 per 100 inhabitants. In line with main fixed telephone lines, the ideal value was defined at 60 per 100 inhabitants.

After the data had been normalized, they were rescaled to identical ranges, from 1-10. This was necessary in order to compare the values of the indicators and the sub-indices.

5. Weighting and aggregation

In choosing the weights, the results of the Principal Components Analysis (PCA) were taken into consideration. As explained above, PCA identifies the relative importance of the indicators selected in each subgroup. It assigns a relative weight to each indicator.

The results derived from the PCA are shown in Annex Table 1.2 below, particularly the component loadings (derived using varimax rotation). The weights were computed by performing the following steps[5]:

- The component loadings were squared and divided by the share of variance explained by the component.
- The results were then multiplied by the ratio of the variance explained by the component and total variance.[7]
- The derived weights were rescaled to sum up to 100 (to increase comparability).

The three steps were performed for the access, use and skills sub-indices.

Annex Table 1.2: Component loadings and weights for indicators used to compute IDI

	Component loadings	Indicator weights (%)
ICT access indicators		
Fixed telephone line penetration	0.531	7.51
Mobile cellular penetration	0.884	20.84
International Internet bandwidth per Internet user	0.996	26.43
Proportion of households with computer	0.915	22.30
Proportion of households with Internet	0.927	22.91
ICT use indicators		
Internet user per 100 inhabitants	0.842	32.06
Fixed broadband subscribers per 100 inhabitants	0.809	29.61
Mobile broad subscriptions per 100 inhabitants	0.921	38.33
ICT skills indicators		
Adult literacy rate	0.890	28.18
Secondary gross enrolment ratio	0.792	36.20
Tertiary gross enrolment ratio	0.897	35.62

Source: ITU.

The respective weights derived from the PCA helped in identifying the relative importance of each indicator. Although not directly applied to the indicators, they provided guidance on assigning the weights. Since no major differences were found among weights in each subgroup, and in order to keep the methodology as simple as possible, it was decided to assign the same weight to indicators in the same subgroup including the fixed telephone line penetration indicator (with the smallest weight) and the International Internet bandwidth per Internet user indicator (with the highest weight). Fixed telephone line is still an important infrastructure indicator for many countries, and it is considered a prerequisite for fixed (DSL) Internet access while international Internet bandwidth is an indicator that may be of less importance to some countries with mainly domestic Internet traffic. This was explained in Chapter 3.

6. Calculating the IDI

Sub-indices were computed by summing up the weighted values of the indicators included in the respective subgroup.

- ICT access is measured by fixed telephone lines per 100 inhabitants, mobile cellular subscriptions per 100 inhabitants, international Internet bandwidth per Internet user, the proportion of households with computer and the proportion of households with Internet access at home. The indicators included in this sub-index were given equal weights (one-fifth weight each).

- ICT use is measured by Internet users per 100 inhabitants, fixed broadband Internet subscribers per 100 inhabitants and mobile broadband per 100 inhabitants. The indicators included in this sub-index were given equal weights (one-third weight each).

- ICT skills is measured by adult literacy rate, secondary gross enrolment ratio, and tertiary gross enrolment ratio. The indicators included in this sub-index were given equal weights (one-third weight each).

The values of the sub-indices were calculated first by normalizing the indicators included in each sub-index in order to have the same unit of measurement. The reference values applied in the normalization were discussed above. The sub-index value was calculated by taking the simple average (using equal weights) of the normalized indicator values.

For the final index computation, the ICT access and ICT use sub-indices were given 40 per cent weight each, and the skills sub-index (because it is based on proxy indicators) 20 per cent weight. The final index value was then computed by summing up the weighted sub-indices. Annex Box 1.1 illustrates the process of computing the IDI for Sweden (which tops the IDI 2007).

7. Sensitivity analysis

Sensitivity analysis was carried out to investigate the robustness of the index results, in terms of the relative position in the overall ranking, using different combinations of methods and techniques to compute the index.

Potential sources of variation or uncertainty can be attributed to different processes employed in the computation of the index including the selection of individual indicators, the imputation of missing values, the normalization of the data, weighting and aggregation.

Each of the processes or combination of processes affects the IDI value. To examine the robustness of the IDI results – rather than the actual values – a number of tests were carried out. The tests computed the possible index values and country rankings for different combinations of the processes mentioned above. Results show that while the computed index values change, the overall message remains the same. The index was found to be extremely robust to different methodologies – with the exception of some countries, particularly countries in the "high" group.

The relative position of countries included in the "high" group can change somewhat depending on the methodology used. Therefore, conclusions based on the ranking of these countries should be made with caution. On the contrary, the relative position of countries included in the "middle" and "low" groups is in no way affected by the methods or techniques applied. Countries in these groups ranked similar in all index computations (using different methodologies). This confirms the results conveyed by the IDI.

Annex Box 1.1: Example of how to calculate the IDI value

	SWEDEN			
	Indicators	**Ideal value***		**2007**
	ICT access			
a	Fixed telephone lines per 100 inhabitants	60		60.4
b	Mobile cellular telephone subscriptions per 100 inhabitants	150		113.73
c	International Internet bandwidth per Internet user**	100'000		62'483.73
d	Proportion of households with a computer	100		83
e	Proportion of households with Internet access at home	100		79
	ICT use			
f	Internet users per 100 inhabitants	100		80
g	Fixed broadband Internet subscribers per 100 inhabitants	60		36.0
h	Mobile broadband subscriptions per 100 inhabitants	100		24.8
	ICT skills			
i	Adult literary rate	100		99.0
j	Secondary gross enrolment ratio	100		103.2
k	Tertiary gross enrolment ratio	100		76.4
	Normalized values			
	ICT access	**Formula**	**Weight**	
z1	Fixed telephone lines per 100 inhabitants	a/60	0.20	1.00
z2	Mobile cellular telephone subscriptions per 100 inhabitants	b/150	0.20	0.76
z3	International Internet bandwidth per Internet user	log(c)/5	0.20	0.96
z4	Proportion of households with a computer	d/100	0.20	0.83
z5	Proportion of households with Internet access at home	e/100	0.20	0.79
	ICT use			
z6	Internet users per 100 inhabitants	f/100	0.33	0.80
z7	Fixed broadband Internet subscribers per 100 inhabitants	g/60	0.33	0.60
z8	Mobile broadband subscriptions per 100 inhabitants	h/100	0.33	0.25
	ICT skills			
z9	Adult literary rate	i/100	0.33	0.99
z10	Secondary gross enrolment ratio	j/100	0.33	1.00
z11	Tertiary gross enrolment ratio	k/100	0.33	0.76
	Sub-indices			
	ICT access sub-index (L)	**y1+y2+y3+y4+y5**	**0.40**	**0.87**
y1	Fixed telephone lines per 100 inhabitants	z1*.20		0.20
y2	Mobile cellular telephone subscriptions per 100 inhabitants	z2*.20		0.15
y3	International Internet bandwidth per Internet user	z3*.20		0.19
y4	Proportion of households with a computer	z4*.20		0.17
y5	Proportion of households with Internet access at home	z5*.20		0.16
	ICT use sub-index (M)	**y6+y7+y8**	**0.40**	**0.55**
y6	Internet users per 100 inhabitants	z6*.33		0.26
y7	Fixed broadband Internet subscribers per 100 inhabitants	z7*.33		0.20
y8	Mobile broadband subscriptions per 100 inhabitants	z8*.33		0.08
	ICT skills sub-index (N)	**y9+y10+y11**	**0.20**	**0.92**
y9	Adult literary rate	z9*.33		0.33
y10	Secondary gross enrolment ratio	z10*.33		0.33
y11	Tertiary gross enrolment ratio	z11*.33		0.25
IDI	**ICT Development Index**	**((L*.40)+(M*.40)+(N*.20))*10**		**7.50**

Note: *The ideal value was computed by adding two standard deviations to the mean value of the indicator.
**To diminish the effect of the large number of outliers at the high end of the value scale, the data were first transformed to a logarithmic (log) scale. The ideal value of 100'000 bit/s per Internet user is equivalent to 5 if transformed to a log scale.

Source: ITU.

Endnotes

1 This is a Partnership core indicator to be collected via household surveys. See Partnership on Measuring ICT for Development (2005 and 2009).

2 Wireless Intelligence is a research group which is part of the GSM Association.

3 UIS "Education Indicators: Technical Guidelines", see http://www.uis.unesco.org/ev.php?ID=5202_201&ID2=DO_TOPIC.

4 See OECD and European Commission (2008).

5 For further details on the methodology, see OECD and European Commission (2008).

6 The square of component loadings represents the proportion of the total unit variance of the indicator which is explained by the component (see OECD and European Commission, 2008, p. 90)

7 These results are then associated as the participation (weights) of each variable in the total components taken into account.

Annex 2: ICT Price Basket methodology

The following describes in more detail the methodology used to gather the data included in the ICT Price Basket, and to compute each of the sub-baskets. It also presents some descriptive statistics concerning the distribution of prices in developed and developing economies, and an illustration of the ICT Price Basket calculation using Singapore (which tops the price ranking) as an example (see Annex Box 2.2).

1. Fixed telephone sub-basket

The fixed telephone sub-basket aims to capture the average monthly cost of a basic local fixed residential telephone service. Following the methodology of the World Bank's "Price Basket for residential fixed line", it includes the monthly subscription fee plus the cost of 30 three-minute local calls to the same (fixed) network (15 peak and 15 off-peak calls). However, unlike the World Bank's basket, it does not take into consideration the one-time connection charge. This choice has been made in order to improve the comparability with the other sub-baskets, and therefore include only recurring monthly charges.

The cost of a 3-minute local call refers to the cost of a 3-minute call within the same exchange area (local call) using the subscriber's equipment (i.e., not from a public telephone). It thus refers to the amount the subscriber must pay for a 3-minute call and not the average price for each 3-minute interval. For example, some operators charge a connection fee for every call, or a different price for the first minute of a call. In this case, the actual amount for the (first) three minutes is calculated.

Many operators indicate whether advertised prices include taxes or not. If they are not included, and if the tax rate is advertised, taxes are added to the price sub-basket, to improve the comparability of tariffs between countries. The sub-basket does not take into consideration the price of a telephone set. Data were collected in 2008, directly from operators' websites. 2007 data from the ITU's World Telecommunication/ICT Indicators database were used for those countries where 2008 data were not available.

2. Mobile cellular sub-basket

The mobile cellular sub-basket represents the monthly cost of a basic mobile cellular subscription. The monthly usage is determined following the OECD/Teligen methodology.[1] It consists of 25 outgoing calls per month (on-net, off-net and to a fixed line),[2] in predetermined ratios, plus 30 Short Message Service (SMS) messages. The predetermined ratios used to calculate the OECD mobile low user basket are shown in Annex Box 2.1.

While prepaid tariffs tend to be more expensive (per minute) than postpaid tariffs, they were chosen because they are often the only payment method available to low-income users who might not have a regular income and will thus not qualify for a postpaid subscription based service.

Rather than representing the cheapest option available, the mobile cellular sub-basket therefore represents a basic, representative package available to all customers. Where possible, the prices of the major operator (in terms of subscriber market share) were taken, obtained from operators' websites or by direct correspondence with operators.

Since the price of calls often depends on the time of day or week it is made, peak, off-peak, and weekend periods are taken into consideration. The cost of local SMS is the charge to the consumer for sending a single short messaging service (SMS) within the local exchange area. Many operators indicate if advertised prices include taxes or not. If they are not included, and if the tax rate is advertised, taxes are added to the sub-basket, to improve the comparability of tariffs between countries.

Annex Box 2.1: Formula for the low user mobile basket

$$M_{lowe\_user} = 5.32 * Net_{peak} + 4.9 * Net_{off\text{-}peak} + 3.78 * Net_{weekend} + 6.38 * Fix_{peak} + 5.88 * Fix_{off\text{-}peak} + 4.54 * Fix_{weekend} + 2.39 * Off\text{-}Net_{peak} + 1.7 * Off\text{-}Net_{weekend} + 30 * \text{SMS}$$

Source: ITU, based on OECD (2002).

The connection price, which applies in some countries (usually representing the price of the SIM card) is not taken into consideration and since prepaid services do not include any monthly charges, these do not apply, either.

3. Fixed broadband Internet sub-basket

The price gathered for the broadband tariff gives a broad representation of typical fixed broadband offers available in an economy. Broadband is considered any dedicated connection to the Internet at speeds equal to, or greater than, 256 kbit/s, in one or both directions. Where several offers were available, preference was given to a 256 kbit/s connection. The tariff represents the cheapest broadband entry plan (although special offers – limited in time or to specific geographic areas – were not taken into consideration) but does not necessarily represent the fastest or most cost-effective connection since often the price for a higher-speed plan is relatively cheaper (in terms of the caps).

Tariffs were collected from Internet Service Providers' (ISP) websites or through direct correspondence with ISPs. Since for many countries it is not clear which ISP has the dominant market share, preference was given to tariffs offered by the (former) incumbent telecommunication operator. In some cases, especially when tariffs were not clearly advertised, available only in the local language, and when ISPs did not respond to queries, alternative ISPs were chosen. All prices were gathered during 2008 and translated into US$.

Broadband offers are residential ones, unless ISPs offer only business packages. Since DSL technologies are increasingly used to replace leased lines in businesses, the costs shown for some developing countries may be very high, as they represent replacements for leased lines rather than residential broadband offers. Preference was given to 'unlimited' offers, when available. If providers set a limit to the amount of data that can be transferred within a month to less than one Gigabyte, then the price per additional Gigabyte was used (and added to the monthly tariff) to calculate the cost of 1 Gigabyte of data per month. Prices correspond to DSL services (since this is the most popular access method worldwide).

The sub-basket does not include installation charges, modem prices, nor telephone line rentals that are often required for ADSL services. Fixed telephone line rentals are already included in the fixed telephone sub-basket. Hardware and installation charges are disregarded, because their inclusion would involve taking into account other prices than those concerning strictly ICT services.

4. Statistics

Annex Table 2.1 shows the results of statistically analysing the distribution of the ICT Price Basket in developed and developing countries. As stated in Chapter 6, prices in developing countries are more widely spread both in absolute terms (higher standard deviation) and relative to their mean (higher co-efficient of variation).

Annex Table 2.1: Descriptive statistics of the ICT Price Basket

	Developed	Developing	All
Mean	1.6	20.1	15.1
Standard deviation	1.3	20.6	19.4
Co-efficient of variation	0.8	1.0	1.3

Source: ITU.

Annex Box 2.2: Example of how to calculate the ICT Price Basket

SINGAPORE 2008 Tariffs		% GNI	US$	PPP $
Fixed telephony				
(a)	Monthly subscription (residential)		6.40	8.46
(b)	Cost 3-minute local call (peak)		0.03	0.04
(c)	Cost 3-minute local call (off-peak)		0.02	0.02
Mobile cellular telephony				
(d)	On-net per minute local call (peak)		0.12	0.15
(e)	On-net per minute local call (off-peak)		0.06	0.08
(f)	On-net per minute local call (weekend/evening)		0.06	0.08
(g)	Off-net per minute local call (peak)		0.12	0.15
(h)	Off-net per minute local call (off-peak)		0.06	0.08
(i)	Off-net per minute local call (weekend/evening)		0.06	0.08
(j)	To fixed per minute local call (peak)		0.12	0.15
(k)	To fixed per minute local call (off-peak)		0.06	0.08
(l)	To fixed per minute local call (weekend/evening)		0.06	0.08
(m)	Local SMS		0.04	0.05
Fixed broadband Internet*				
(n)	Monthly fee (residential)		21.9	29.0
GNI per capita**				
(o)	Monthly GNI per capita		2'706	
Sub-baskets				
Fixed sub-basket				
(p)	(a) + 15 * (b) +15 * (c)		7.12	9.43
(q)	US$ (p) / (o)	0.26		
Mobile sub-basket				
(r)	5.32 * (d) + 4.9 * (e) + 3.78 * (f) + 2.39 * (g) + 2.21 * (h) + + 1.7 * (i) + 6.38 * (j) + 5.88 * (k) + 4.54 * (l) + 30 * (m)		4.01	5.31
(s)	US$ (r) / (o)	0.15		
Fixed Broadband Internet sub-basket				
(t)	(n)		21.89	28.97
(u)	US$ (t) / (o)	0.81		
ICT Price Basket***				
	[(q) + (s) + (u)] / 3	**0.41**		

Note: * If data transmission is limited to less than 1GB per month, the price per additional GB is used to compute the monthly fee of 1 GB of data per month.
** World Bank Atlas Method, 2007.
*** If the value of any of the sub-baskets (i.e. (q), (s) or (u)) is above 100%, it is capped at a maximum value of 100%.

Source: ITU.

Endnotes

[1] For more details on the OECD/Teligen methodology, see OECD (2002).

[2] On-net refers to a call made to the same mobile network, while off-net and fixed line refer to calls made to other (competing) mobile networks and to a fixed telephone line, respectively.

Annex 3: List of economies included in the IDI and the ICT Price Basket by region

Caribbean	Central America	Central Asia	Eastern Asia
Barbados	Belize	Kazakhstan	China
Cuba	Costa Rica	Kyrgyzstan	Hong Kong, China
Dominica	El Salvador	Tajikistan	Japan
Dominican Rep.	Guatemala	Turkmenistan	Korea (Rep.)
Grenada	Honduras	Uzbekistan	Macao, China
Haiti	Mexico		Mongolia
Jamaica	Nicaragua		Taiwan, China
St. Lucia	Panama		
St. Vincent and the Grenadines			
Trinidad & Tobago			

Eastern Europe	Northern Africa	Northern America	Northern Europe
Belarus	Algeria	Canada	Denmark
Bulgaria	Egypt	United States	Estonia
Czech Republic	Libya		Finland
Hungary	Morocco		Iceland
Moldova	Tunisia		Ireland
Poland			Latvia
Romania			Lithuania
Russia			Norway
Slovak Republic			Sweden
Ukraine			United Kingdom

Oceania	South America	South-Eastern Asia	Southern Asia
Australia	Argentina	Brunei Darussalam	Bangladesh
Fiji	Bolivia	Cambodia	Bhutan
Micronesia	Brazil	Indonesia	India
New Zealand	Chile	Lao P.D.R.	Iran (I.R.)
Papua New Guinea	Colombia	Malaysia	Maldives
Samoa	Ecuador	Myanmar	Nepal
Tonga	Guyana	Philippines	Pakistan
Vanuatu	Paraguay	Singapore	Sri Lanka
	Peru	Thailand	
	Suriname	Viet Nam	
	Uruguay		
	Venezuela		

Southern Europe	Sub-Saharan Africa	Western Asia	Western Europe
Albania	Angola	Armenia	Austria
Bosnia	Benin	Azerbaijan	Belgium
Croatia	Botswana	Bahrain	France
Greece	Burkina Faso	Cyprus	Germany
Italy	Cameroon	Georgia	Luxembourg
Malta	Cape Verde	Israel	Netherlands
Montenegro	Central African Rep.	Jordan	Switzerland
Portugal	Chad	Kuwait	
Serbia	Comoros	Lebanon	
Slovenia	Congo	Oman	
Spain	Côte d'Ivoire	Palestine	
TFYR Macedonia	D.R. Congo	Qatar	
	Eritrea	Saudi Arabia	
	Ethiopia	Syria	
	Gabon	Turkey	
	Gambia	United Arab Emirates	
	Ghana	Yemen	
	Guinea		
	Guinea-Bissau		
	Kenya		
	Lesotho		
	Madagascar		
	Malawi		
	Mali		
	Mauritania		
	Mauritius		
	Mozambique		
	Namibia		
	Niger		
	Nigeria		
	Rwanda		
	S. Tomé & Principe		
	Senegal		
	Seychelles		
	South Africa		
	Sudan		
	Swaziland		
	Tanzania		
	Togo		
	Uganda		
	Zambia		
	Zimbabwe		

Annex 4: Statistical tables of indicators used to compute the IDI

Access indicators

		Fixed telephone lines per 100 inhab.		Mobile cellular subscriptions per 100 inhab.		International Internet bandwidth per Internet user(bit/s)		Proportion of households with computer		Proportion of households with Internet	
		2002	2007	2002	2007	2002	2007	2002	2007	2002	2007
1	Albania	7.2	*9.0*	27.7	72.1	1'000	1'164	2.0	9.5	1.0	7.8
2	Algeria	6.2	9.1	1.4	81.4	313	857	*2.1*	*8.3*	*0.3*	*6.8*
3	Argentina	20.5	24.0	17.5	102.2	1'336	8'943	27.0	*36.4*	14.0	*27.5*
4	Armenia	17.8	*20.9*	2.3	62.5	133	*2'712*	1.2	*41.2*	1.0	*6.1*
5	Australia	53.3	47.1	64.9	102.5	928	8'035	61.0	73.0	46.0	64.0
6	Austria	47.8	40.8	82.9	18.6	11'996	30'116	49.2	71.0	33.0	60.0
7	Azerbaijan	11.2	14.8	9.6	53.4	7	6'475	*3.7*	10.1	0.2	9.3
8	Bahrain	25.2	*25.9*	55.9	148.3	1'588	7'660	35.0	*50.7*	19.0	*34.1*
9	Bangladesh	0.5	0.8	0.8	21.7	211	1'284	*0.8*	*1.9*	*0.1*	*1.3*
10	Belarus	29.9	37.9	4.7	71.8	89	427	3.0	*24.9*	*1.0*	*12.1*
11	Belgium	47.6	44.6	78.2	102.7	17'662	37'831	40.9	67.0	43.0	60.0
12	Benin	0.8	1.2	2.9	21.0	42	1'033	*1.2*	*8.0*	*0.6*	*3.6*
13	Bhutan	1.0	3.4	-	17.2	200	1'125	5.0	*13.7*	-	*6.1*
14	Bolivia	6.8	7.1	11.8	34.2	169	398	*7.1*	*18.0*	1.8	5.9
15	Bosnia	23.0	27.1	19.1	62.3	340	1'896	5.2	*35.6*	2.7	*25.8*
16	Botswana	8.4	7.3	18.8	61.2	233	810	0.8	4.5	0.1	0.1
17	Brazil	21.7	20.5	19.5	63.1	570	2'955	14.2	*20.8*	10.3	*15.4*
18	Brunei Darussalam	23.3	*19.6*	44.0	89.5	1'948	*2'954*	*45.9*	*66.6*	*38.9*	*61.7*
19	Bulgaria	36.4	30.1	32.9	129.6	110	15'878	*5.1*	23.3	*3.4*	19.0
20	Burkina Faso	0.5	*0.7*	0.9	10.9	320	*2'170*	2.0	*3.0*	*0.3*	*1.8*
21	Cambodia	0.3	0.3	2.9	17.9	400	3'571	*0.5*	*4.1*	*0.1*	*2.4*
22	Cameroon	0.7	1.0	4.5	24.5	150	371	*0.5*	10.1	-	5.2
23	Canada	65.9	55.5	37.9	61.7	4'628	22'250	64.0	*79.1*	54.5	*72.1*
24	Cape Verde	14.9	*13.5*	9.1	27.9	188	*649*	4.6	*11.6*	*2.3*	*11.4*
25	Chad	0.1	*0.1*	0.4	8.5	34	*61*	*0.3*	*2.0*	*0.1*	*0.1*
26	Chile	22.0	20.7	39.6	83.7	659	13'135	20.5	36.4	11.0	22.1
27	China	16.6	27.5	16.0	41.2	159	1'735	10.2	*39.1*	5.0	*16.4*
28	Colombia	17.8	17.2	10.6	73.5	349	3'528	10.0	*27.4*	5.6	*3.7*
29	Comoros	1.4	*2.6*	-	4.8	80	*317*	0.8	*4.3*	-	*1.0*
30	Congo	0.6	*0.6*	6.1	34.2	26	*10*	*1.5*	*5.0*	-	*1.4*
31	Costa Rica	25.3	32.2	12.3	33.8	623	2'440	20.0	*31.6*	7.3	11.8
32	Côte d'Ivoire	1.9	*1.4*	5.9	36.6	220	*689*	*2.9*	*6.2*	*0.6*	*3.6*
33	Croatia	40.5	40.5	51.9	110.5	228	7'553	18.8	*34.7*	*16.7*	*29.5*
34	Cuba	6.0	9.3	0.2	1.8	481	162	*0.5*	2.3	-	1.8
35	Cyprus	53.0	44.9	51.8	115.6	739	4'218	36.0	53.0	24.0	39.0
36	Czech Republic	35.9	23.6	84.0	124.9	9'108	14'649	27.8	43.0	13.5	35.0
37	D.R. Congo	-	-	1.1	10.5	100	43	*0.2*	*0.3*	-	*0.2*
38	Denmark	68.8	51.9	83.2	114.5	31'721	42'752	72.2	83.0	56.0	78.0
39	Dominican Rep.	10.7	9.3	20.0	56.5	83	894	5.5	12.5	2.8	5.7
40	Ecuador	11.1	13.5	12.3	75.6	377	2'458	*17.5*	18.0	*2.0*	6.8
41	Egypt	11.1	14.9	6.4	39.8	339	1'023	3.0	16.1	*1.4*	*9.1*
42	El Salvador	10.2	15.8	13.6	89.5	199	157	*5.2*	*8.6*	*2.3*	*3.6*
43	Eritrea	0.9	0.8	-	1.7	222	100	0.2	*0.3*	-	*0.2*
44	Estonia	35.2	37.1	65.3	148.4	985	18'722	21.8	57.0	13.9	53.0
45	Ethiopia	0.5	1.1	0.1	1.5	200	842	0.1	0.2	0.1	0.1
46	Fiji	11.8	14.5	10.9	63.2	160	1'379	*8.9*	*18.2*	*1.3*	*11.5*
47	Finland	52.4	33.0	86.8	115.2	5'140	21'847	54.5	74.0	44.0	69.0
48	France	57.1	56.5	64.6	89.8	11'076	46'086	36.6	62.0	23.0	49.0
49	Gabon	2.4	2.0	21.2	87.9	320	2'439	*0.8*	*4.3*	*0.6*	*3.6*
50	Gambia	2.7	4.5	7.2	46.8	82	618	*0.3*	*4.0*	-	*2.0*
51	Georgia	13.9	12.7	10.9	59.2	245	9'103	-	*12.6*	-	*2.4*
52	Germany	65.1	65.1	71.7	117.6	6'448	35'487	61.0	79.0	46.0	71.0
53	Ghana	1.3	1.6	1.9	32.4	71	565	*0.3*	5.1	0.2	1.8
54	Greece	57.0	53.9	84.3	110.3	1'476	13'805	25.3	40.0	12.0	25.0
55	Guatemala	7.2	*11.0*	13.5	76.0	1'625	1'429	*5.9*	*13.6*	0.6	1.8
56	Guinea-Bissau	0.8	0.3	-	17.5	5	*45*	*0.3*	*3.6*	-	*1.0*
57	Haiti	1.6	1.1	1.7	26.1	746	155	*0.3*	*4.0*	-	*1.8*
58	Honduras	4.8	11.6	4.9	58.9	101	4'081	4.2	*10.1*	-	3.3
59	Hong Kong, China	56.3	57.2	94.0	149.2	3'863	23'571	62.1	74.2	52.5	70.1
60	Hungary	36.1	32.4	67.7	110.0	1'477	9'203	26.0	54.0	8.0	38.0
61	Iceland	65.6	62.0	90.9	108.9	301	8'121	83.0	89.0	*77.0*	84.0
62	India	3.9	3.4	1.2	20.0	113	441	*0.3*	*3.7*	0.2	*3.0*
63	Indonesia	3.6	7.7	5.5	35.3	127	923	2.5	*8.1*	1.0	*6.9*
64	Iran (I.R.)	19.1	33.5	3.4	41.8	174	473	*5.5*	*13.0*	*2.8*	*8.6*
65	Ireland	50.2	49.1	76.3	115.9	13'254	27'122	*41.1*	65.0	32.8	57.0
66	Israel	47.4	*44.4*	99.3	128.5	1'260	7'190	53.8	*61.6*	24.4	*44.7*
67	Italy	46.9	*49.0*	93.6	153.1	4'173	27'339	39.9	53.0	34.0	43.0
68	Jamaica	16.6	13.5	47.6	98.6	3'333	*34'000*	13.0	*17.3*	7.7	12.7
69	Japan	47.7	40.0	63.6	83.9	511	5'415	71.7	85.0	48.8	62.1
70	Jordan	12.8	9.9	23.2	80.5	293	831	16.4	*25.1*	5.0	*10.5*
71	Kazakhstan	14.0	21.0	6.9	79.9	192	1'052	*3.4*	*15.6*	*0.5*	*13.9*
72	Kenya	1.0	0.7	3.7	30.2	65	112	1.0	5.5	0.7	2.2
73	Korea (Rep.)	54.5	46.4	68.4	90.2	613	1'353	78.6	80.0	70.2	94.0
74	Kuwait	19.8	*18.6*	50.3	97.3	308	2'577	*29.0*	*34.1*	*24.0*	*29.1*
75	Kyrgyzstan	7.8	9.1	1.0	40.8	59	796	*2.8*	*8.6*	*0.6*	*3.6*
76	Lao P.D.R.	1.1	1.6	1.0	25.2	100	1'880	-	*6.7*	-	*1.8*
77	Latvia	29.9	28.3	39.2	97.4	825	6'428	15.0	49.0	*8.5*	51.0

		Fixed telephone lines per 100 inhab.		Mobile cellular subscriptions per 100 inhab.		International Internet bandwidth per Internet user(bit/s)		Proportion of households with computer		Proportion of households with Internet	
		2002	2007	2002	2007	2002	2007	2002	2007	2002	2007
78	Lebanon	19.6	*17.8*	22.3	30.7	150	289	*18.8*	*40.0*	13.9	*38.0*
79	Lesotho	1.6	*2.9*	7.7	22.7	49	*171*	*1.0*	*68*	-	*0.9*
80	Libya	13.1	*15.7*	1.3	73.1	48	1'064	*2.9*	*6.3*	*0.8*	*4.3*
81	Lithuania	27.0	23.6	47.5	145.2	526	9'461	12.0	46.0	4.1	40.3
82	Luxembourg	55.6	53.2	105.8	129.5	8'212	9'617'645	52.6	80.0	40.0	75.0
83	Macao, China	39.0	37.0	61.2	165.1	1'878	18'718	*66.0*	*85.5*	*56.0*	*77.8*
84	Madagascar	0.4	0.7	1.0	11.3	109	1'240	*6.9*	*12.8*	-	*1.0*
85	Malawi	0.6	1.3	0.7	7.6	98	480	*0.1*	*4.0*	-	*1.4*
86	Malaysia	19.5	16.4	37.8	87.9	168	1'791	24.0	*35.9*	10.5	*20.0*
87	Maldives	9.4	10.8	13.7	102.6	467	37'576	*19.6*	*28.9*	3.0	*9.0*
88	Mali	0.5	0.7	0.4	20.5	240	2'130	*1.0*	*1.0*	-	*0.5*
89	Malta	52.3	56.6	69.9	91.4	1'359	12'817	42.9	63.0	31.3	54.0
90	Mauritania	1.1	1.3	8.8	41.6	950	4'889	*1.0*	*2.0*	*1.0*	*1.0*
91	Mauritius	27.1	28.6	28.8	73.6	272	840	*16.2*	*27.8*	*11.1*	*19.1*
92	Mexico	14.6	18.5	25.2	62.5	426	784	15.2	22.1	7.5	12.0
93	Moldova	16.9	28.5	8.0	49.6	227	5'061	0.8	*23.0*	-	*16.0*
94	Mongolia	5.0	*6.1*	8.5	34.4	340	*938*	3.0	*12.5*	*1.9*	*7.7*
95	Morocco	3.7	7.7	20.6	64.2	443	3'808	*8.9*	17.2	*0.4*	7.0
96	Mozambique	0.5	*0.3*	1.4	15.4	230	*360*	0.2	3.8	-	0.9
97	Myanmar	0.7	*1.5*	0.1	0.6	23'723	*2'350*	0.4	*1.8*	-	1.8
98	Namibia	6.2	6.7	7.7	38.6	170	554	*9.0*	11.2	*2.0*	3.3
99	Nepal	1.3	2.5	0.1	11.6	247	350	*0.4*	2.8	-	*1.0*
100	Netherlands	50.0	44.7	75.3	117.5	17'064	92'832	69.0	86.0	58.0	83.0
101	New Zealand	45.3	41.8	62.8	101.7	984	6'569	52.0	*75.7*	43.0	65.9
102	Nicaragua	3.3	*5.0*	4.6	37.9	67	4'697	2.2	*7.8*	*0.6*	*3.6*
103	Niger	0.2	*0.2*	0.5	6.3	133	*2'826*	-	*1.0*	-	0.2
104	Nigeria	0.6	1.1	1.3	27.3	171	69	*0.5*	5.1	*0.3*	*3.6*
105	Norway	50.9	42.4	83.2	110.5	6'866	31'726	70.0	82.0	58.0	78.0
106	Oman	9.1	10.3	18.6	96.3	211	1'088	*23.4*	*29.5*	*13.1*	*17.0*
107	Pakistan	2.5	2.9	1.1	38.4	103	404	*0.8*	*8.1*	-	*1.1*
108	Palestine	9.0	9.3	9.5	27.5	190	3'376	*23.5*	32.5	*5.7*	*15.9*
109	Panama	12.6	14.8	17.2	90.1	2'382	71'616	*9.8*	16.9	*5.8*	*8.9*
110	Papua New Guinea	1.1	1.0	0.3	4.7	80	*104*	*1.5*	3.0	*1.0*	*2.0*
111	Paraguay	4.8	6.4	29.0	76.6	1'000	1'886	5.4	*10.4*	1.7	*4.0*
112	Peru	6.2	9.6	8.6	55.3	565	9'877	4.3	*13.8*	*0.8*	5.6
113	Philippines	4.2	4.5	19.6	58.9	254	1'887	*5.3*	*18.3*	4.9	*12.3*
114	Poland	30.7	27.1	36.0	108.7	779	6'251	23.1	54.0	11.0	41.0
115	Portugal	42.1	39.5	83.9	126.6	2'048	11'960	27.0	48.3	15.1	39.6
116	Qatar	25.7	28.2	38.9	150.4	2'214	6'624	*29.0*	*34.2*	*18.8*	*33.8*
117	Romania	19.2	19.9	23.3	106.7	1'350	12'335	6.0	34.0	*3.9*	22.0
118	Russia	24.4	31.0	12.1	114.6	886	2'712	7.0	*16.2*	3.5	*9.5*
119	Rwanda	0.3	0.2	1.0	6.5	411	780	0.1	*0.3*	0.1	*0.1*
120	Saudi Arabia	15.1	16.2	22.1	114.7	243	1'932	*18.8*	*43.2*	*8.5*	*35.6*
121	Senegal	2.1	2.2	5.1	29.3	752	2'079	*1.7*	*7.8*	*0.5*	*1.0*
122	Singapore	46.3	42.0	79.6	133.5	2'857	34'655	68.4	79.0	59.4	74.0
123	Slovak Republic	26.0	21.4	54.1	112.6	3'775	9'932	24.6	55.0	*12.6*	46.0
124	Slovenia	41.1	42.8	84.8	96.4	1'943	12'784	55.0	66.0	37.0	58.0
125	South Africa	10.4	9.6	29.4	87.1	182	852	*9.9*	14.8	*1.9*	4.8
126	Spain	42.4	45.9	80.6	109.4	5'594	21'456	36.1	60.4	17.4	45.0
127	Sri Lanka	4.4	14.2	4.6	41.4	463	3'072	*1.3*	*7.8*	-	*4.1*
128	Sudan	2.0	0.9	0.6	21.3	150	3'800	0.8	4.3	0.4	*1.0*
129	Swaziland	3.4	*4.8*	6.6	33.3	51	*282*	6.1	12.8	*5.0*	*6.0*
130	Sweden	62.5	60.4	89.0	113.7	14'962	62'484	75.0	83.0	66.0	79.0
131	Switzerland	74.7	65.9	79.6	109.7	14'726	38'541	65.4	*78.1*	61.9	77.5
132	Syria	11.9	17.3	2.2	31.3	44	304	20.0	35.0	20.0	30.0
133	Taiwan, China	59.2	62.3	108.3	106.1	1'380	12'632	56.8	67.1	45.9	61.6
134	Tajikistan	3.8	5.1	0.2	34.9	523	*516*	-	*1.0*	-	*0.1*
135	Tanzania	0.5	0.4	1.7	20.6	200	*250*	1.7	*2.3*	0.3	*0.6*
136	TFYR Macedonia	27.7	22.7	18.1	95.5	143	61	*23.8*	*25.0*	*5.4*	*15.5*
137	Thailand	10.5	11.0	16.3	123.8	211	1'645	*8.4*	*27.2*	4.0	*7.3*
138	Togo	0.9	1.5	3.0	18.1	60	84	0.8	*3.5*	*0.5*	*1.0*
139	Trinidad & Tobago	24.6	23.1	20.3	113.2	696	4'229	17.0	43.6	*15.5*	*18.1*
140	Tunisia	11.7	12.3	5.9	75.9	301	1'800	4.5	9.6	1.4	*2.9*
141	Turkey	26.9	24.3	33.2	82.8	145	8'390	8.0	28.5	5.0	18.9
142	Turkmenistan	8.1	9.2	0.2	*7.0*	571	*3'414*	-	*1.0*	-	*0.5*
143	Uganda	0.2	0.5	1.5	13.6	77	306	*0.3*	*5.1*	0.1	-
144	Ukraine	22.6	27.8	7.7	119.6	349	956	*3.0*	16.2	*0.3*	*6.8*
145	United Arab Emirates	29.1	31.6	64.6	176.5	1'067	5'380	33.0	*43.3*	30.0	*40.4*
146	United Kingdom	58.8	55.4	83.3	118.5	9'662	55'281	57.9	75.0	50.0	67.0
147	United States	65.3	53.4	48.9	83.5	2'208	15'341	59.0	*70.2*	52.0	61.7
148	Uruguay	27.9	28.9	15.1	90.0	987	3'102	17.6	*27.0*	13.6	*13.5*
149	Uzbekistan	6.6	6.7	0.7	21.5	65	199	*0.1*	2.4	-	*0.8*
150	Venezuela	11.2	18.4	25.8	86.1	555	3'016	5.1	*11.9*	2.0	*3.0*
151	Viet Nam	4.9	32.7	2.4	27.2	95	704	2.6	*10.1*	*0.6*	*5.0*
152	Yemen	2.8	*4.7*	2.6	15.6	60	1'969	*0.2*	*2.6*	*0.2*	*2.0*
153	Zambia	0.8	0.8	1.3	22.1	98	74	*0.8*	*4.3*	*0.3*	*1.8*
154	Zimbabwe	2.3	2.6	2.7	9.2	60	42	*1.7*	*7.8*	*0.3*	1.8

Note: For definition, see Annex 1.
Source: ITU.

Use indicators

		Internet users per 100 inhab.		Fixed broadband subscribers per 100 inhab.		Mobile broadband subscriptions per 100 inhab.	
		2002	2007	2002	2007	2002	2007
1	Albania	0.34	18.5	-	0.3	-	-
2	Algeria	1.56	10.3	-	0.9	-	-
3	Argentina	10.9	25.9	0.4	6.6	-	-
4	Armenia	2.0	6.2	-	*0.3*	-	-
5	Australia	*58.0*	*69.0*	1.3	23.3	-	32.8
6	Austria	*37.0*	*67.0*	5.6	19.4	-	29.5
7	Azerbaijan	3.6	10.9	-	0.1	-	-
8	Bahrain	17.6	33.2	0.7	9.1	-	10.2
9	Bangladesh	0.2	0.3	-	-	-	-
10	Belarus	9.0	29.0	-	*0.9*	-	0.1
11	Belgium	*45.9*	*67.0*	7.9	26.0	-	2.7
12	Benin	0.6	1.7	-	-	-	-
13	Bhutan	0.5	4.6	-	-	-	-
14	Bolivia	3.1	10.5	-	0.4	-	-
15	Bosnia	2.6	26.8	-	2.2	-	-
16	Botswana	3.4	5.3	-	0.2	-	-
17	Brazil	*9.2*	*35.2*	0.4	3.5	-	1.2
18	Brunei Darussalam	15.3	48.2	0.8	2.9	-	30.0
19	Bulgaria	*9.1*	*31.0*	-	8.2	-	2.4
20	Burkina Faso	0.2	0.7	-	*0.1*	-	-
21	Cambodia	0.2	0.5	-	0.1	-	-
22	Cameroon	0.4	3.0	-	-	-	-
23	Canada	*61.6*	*73.0*	11.2	27.6	-	1.5
24	Cape Verde	3.4	7.0	-	*0.4*	-	-
25	Chad	0.2	0.8	-	-	-	-
26	Chile	19.1	31.0	1.2	7.9	-	0.4
27	China	4.6	*16.0*	0.3	5.0	-	-
28	Colombia	4.6	26.2	0.1	2.6	-	-
29	Comoros	0.4	2.6	-	-	-	-
30	Congo	0.1	2.6	-	-	-	-
31	Costa Rica	19.9	33.6	-	3.0	-	-
32	Côte d'Ivoire	0.5	2.3	-	*0.4*	-	-
33	Croatia	17.5	43.6	-	8.5	-	5.9
34	Cuba	1.4	11.6	-	-	-	-
35	Cyprus	*28.3*	*38.0*	0.7	11.7	-	11.3
36	Czech Republic	*23.8*	*49.0*	0.2	12.9	-	1.7
37	D.R. Congo	0.1	0.4	-	-	-	-
38	Denmark	*64.0*	*81.0*	8.4	36.0	-	12.2
39	Dominican Rep.	7.3	17.2	-	1.6	-	-
40	Ecuador	4.3	13.2	0.1	2.4	-	0.7
41	Egypt	2.7	14.0	-	0.6	-	0.2
42	El Salvador	4.6	11.1	-	1.3	-	-
43	Eritrea	0.2	2.5	-	-	-	-
44	Estonia	*41.8*	*64.0*	3.4	20.8	-	3.3
45	Ethiopia	0.1	0.4	-	-	-	-
46	Fiji	6.1	10.9	-	1.4	-	0.2
47	Finland	*62.0*	*79.0*	5.3	30.6	-	15.4
48	France	*30.2*	*64.0*	2.8	25.2	-	13.7
49	Gabon	1.9	6.2	-	0.2	-	-
50	Gambia	1.8	5.9	-	-	-	-
51	Georgia	1.6	8.2	-	1.1	-	2.3
52	Germany	*49.0*	*72.0*	3.9	23.7	-	10.5
53	Ghana	0.8	3.8	-	0.1	-	-
54	Greece	*15.0*	*33.0*	-	9.1	-	10.1
55	Guatemala	3.4	13.1	-	*0.6*	-	0.3
56	Guinea-Bissau	1.0	2.6	-	-	-	-
57	Haiti	1.0	10.4	-	-	-	-
58	Honduras	2.5	6.0	-	-	-	-
59	Hong Kong, China	*48.2*	*64.8*	15.3	26.3	-	30.5
60	Hungary	*16.6*	*52.0*	1.1	14.2	-	1.4
61	Iceland	*78.8*	*90.0*	8.5	32.5	-	-
62	India	1.6	6.9	-	0.3	-	-
63	Indonesia	2.1	5.6	-	0.1	-	1.4
64	Iran (I.R.)	4.7	32.3	-	*0.1*	-	-
65	Ireland	*25.9*	*57.0*	0.3	18.7	-	38.9
66	Israel	17.7	28.9	3.7	22.1	-	26.0
67	Italy	*28.0*	*38.0*	1.5	18.4	-	41.3
68	Jamaica	23.0	55.3	0.3	3.4	-	0.2
69	Japan	46.4	68.9	7.4	22.1	0.1	56.8
70	Jordan	5.8	19.0	0.1	1.5	-	-
71	Kazakhstan	1.7	12.3	-	1.8	-	-
72	Kenya	1.2	8.0	-	0.1	-	1.0
73	Korea (Rep.)	*59.4*	*76.3*	22.0	30.5	0.4	48.6
74	Kuwait	10.2	31.6	0.4	*2.5*	-	0.6
75	Kyrgyzstan	3.0	14.1	-	0.1	-	-
76	Lao P.D.R.	0.2	1.7	-	0.1	-	-
77	Latvia	*21.9*	*55.0*	0.4	6.4	-	2.4

		Internet users per 100 inhab.		Fixed broadband subscribers per 100 inhab.		Mobile broadband subscriptions per 100 inhab.	
		2002	2007	2002	2007	2002	2007
78	Lebanon	11.5	31.5	1.0	4.9	-	-
79	Lesotho	1.2	3.5	-	*0.1*	-	-
80	Libya	2.3	4.7	-	*0.2*	-	0.2
81	Lithuania	*18.0*	*49.0*	0.6	15.0	-	4.5
82	Luxembourg	*40.0*	*78.0*	1.3	27.5	-	43.2
83	Macao, China	25.5	49.5	3.8	23.0	-	9.6
84	Madagascar	0.3	0.6	-	-	-	-
85	Malawi	0.2	1.0	-	-	-	-
86	Malaysia	32.7	55.7	0.1	3.8	-	5.9
87	Maldives	4.9	10.8	0.1	3.6	-	0.1
88	Mali	0.2	0.8	-	-	-	-
89	Malta	*28.8*	*45.0*	4.5	20.4	-	4.1
90	Mauritania	0.4	1.4	-	*0.2*	-	-
91	Mauritius	10.3	27.0	-	4.9	-	6.2
92	Mexico	*13.3*	*22.4*	0.2	4.3	-	0.3
93	Moldova	3.5	18.5	-	1.2	-	-
94	Mongolia	2.0	12.0	-	0.3	-	*1.0*
95	Morocco	2.3	21.1	-	1.5	-	0.1
96	Mozambique	0.3	0.9	-	*0.4*	-	-
97	Myanmar	-	0.1	-	-	-	-
98	Namibia	2.6	4.9	-	-	-	-
99	Nepal	0.3	1.4	-	-	-	-
100	Netherlands	*61.0*	*84.0*	7.3	33.5	-	13.4
101	New Zealand	*60.0*	*70.0*	1.1	20.4	-	28.0
102	Nicaragua	1.7	3.1	-	*0.6*	-	-
103	Niger	0.1	0.4	-	-	-	-
104	Nigeria	0.3	6.8	-	-	-	0.1
105	Norway	*72.6*	*85.0*	4.5	30.6	-	21.7
106	Oman	7.2	13.1	-	0.8	-	-
107	Pakistan	2.7	10.7	-	-	-	-
108	Palestine	3.1	9.5	-	1.5	-	-
109	Panama	8.5	22.3	0.4	4.3	-	-
110	Papua New Guinea	1.4	1.8	-	-	-	-
111	Paraguay	1.7	8.7	-	0.8	-	-
112	Peru	9.0	27.4	0.1	2.0	-	-
113	Philippines	4.5	6.0	-	0.6	-	0.7
114	Poland	*21.0*	*44.0*	0.3	9.0	-	6.3
115	Portugal	*19.0*	*40.0*	2.5	14.4	-	29.3
116	Qatar	10.2	41.8	-	8.4	-	2.9
117	Romania	*6.6*	*24.0*	0.1	9.1	-	4.9
118	Russia	4.1	21.1	-	2.8	-	-
119	Rwanda	0.3	2.1	-	-	-	-
120	Saudi Arabia	6.2	25.8	0.2	2.5	-	2.4
121	Senegal	1.0	6.6	-	0.3	-	-
122	Singapore	*49.6*	*68.0*	6.5	20.2	-	43.3
123	Slovak Republic	*40.0*	*56.0*	0.1	8.8	-	3.6
124	Slovenia	*28.2*	*53.0*	2.9	17.2	-	13.8
125	South Africa	6.7	8.2	-	0.8	-	2.7
126	Spain	*20.0*	*52.0*	3.0	18.2	-	22.7
127	Sri Lanka	1.0	4.0	-	0.3	-	0.8
128	Sudan	0.5	9.1	-	0.1	-	0.2
129	Swaziland	1.9	3.7	-	-	-	-
130	Sweden	*71.0*	*80.0*	9.4	36.0	-	24.8
131	Switzerland	*62.0*	*77.0*	6.3	31.8	-	19.3
132	Syria	2.1	17.4	-	-	-	-
133	Taiwan, China	47.6	64.5	9.3	20.9	-	28.5
134	Tajikistan	0.1	7.2	-	-	-	0.1
135	Tanzania	0.2	1.0	-	-	-	0.2
136	TFYR Macedonia	*17.4*	*27.3*	-	4.9	-	7.0
137	Thailand	7.7	21.0	-	1.4	-	-
138	Togo	3.5	5.2	-	-	-	-
139	Trinidad & Tobago	10.7	16.0	-	2.7	-	8.0
140	Tunisia	5.2	16.7	-	1.1	-	-
141	Turkey	*11.1*	*16.2*	-	6.1	-	-
142	Turkmenistan	0.3	1.4	-	-	-	-
143	Uganda	0.4	3.6	-	-	-	-
144	Ukraine	1.9	21.6	-	1.7	-	0.6
145	United Arab Emirates	27.1	51.6	0.4	8.7	-	46.6
146	United Kingdom	*56.0*	*72.0*	2.3	25.7	-	20.6
147	United States	*59.6*	*72.5*	6.9	24.0	-	17.4
148	Uruguay	11.2	29.0	-	4.9	-	-
149	Uzbekistan	1.1	4.4	-	-	-	-
150	Venezuela	4.9	20.7	0.3	3.1	-	5.4
151	Viet Nam	1.9	20.5	-	1.5	-	-
152	Yemen	0.5	1.4	-	-	-	-
153	Zambia	0.5	4.2	-	*0.1*	-	-
154	Zimbabwe	3.9	10.1	-	0.1	-	-

Note: For definition, see Annex 1.
Source: ITU.

Skills indicators

		Gross enrolment ratio				Adult literacy rate	
		Secondary		Tertiary			
		2002	2007	2002	2007	2002	2007
1	Albania	73.0	*79.8*	15.8	*32.2*	85.9	88.9
2	Algeria	75.0	*83.2*	17.8	24.0	68.9	73.9
3	Argentina	99.1	*84.4*	61.1	*61.9*	97.0	97.4
4	Armenia	84.6	*89.5*	26.5	35.5	98.6	98.9
5	Australia	153.3	*150.3*	76.5	*72.8*	99.0	99.0
6	Austria	99.1	*101.9*	47.4	*51.0*	99.0	99.0
7	Azerbaijan	80.1	*83.0*	15.8	14.9	*99.0*	*99.0*
8	Bahrain	98.3	*102.1*	*33.6*	*31.1*	88.5	90.9
9	Bangladesh	47.8	*40.6*	6.0	*7.1*	41.1	43.5
10	Belarus	88.8	95.4	58.2	68.5	99.0	99.0
11	Belgium	157.1	*109.7*	59.8	*63.3*	99.0	99.0
12	Benin	23.3	*32.5*	5.0	*5.0*	39.8	45.4
13	Bhutan	49.5	*48.8*	*3.5*	*6.2*	*58.8*	*62.5*
14	Bolivia	86.3	*82.5*	38.3	*40.6*	86.6	89.2
15	Bosnia	*83.8*	85.5	*29.8*	*29.8*	*99.0*	*99.0*
16	Botswana	75.6	*76.5*	4.2	*5.7*	78.9	82.8
17	Brazil	109.4	*105.5*	20.1	*29.3*	87.7	89.5
18	Brunei Darussalam	90.0	97.4	13.7	15.4	91.5	93.7
19	Bulgaria	96.0	*105.3*	39.9	*47.7*	98.6	98.9
20	Burkina Faso	10.5	15.5	1.4	2.5	25.7	30.4
21	Cambodia	22.7	42.0	2.5	5.4	69.4	72.7
22	Cameroon	*30.9*	25.2	4.9	*7.8*	73.5	78.9
23	Canada	108.5	*121.9*	60.2	*65.7*	99.0	99.0
24	Cape Verde	65.1	79.4	3.6	8.9	75.7	79.3
25	Chad	13.2	*15.2*	0.8	*1.2*	45.8	53.8
26	Chile	85.6	*91.2*	41.0	*46.6*	96.1	96.7
27	China	67.1	*75.5*	12.7	*21.6*	86.4	89.3
28	Colombia	70.7	85.1	24.0	31.8	92.2	93.4
29	Comoros	28.1	*35.1*	*1.8*	*2.3*	56.2	57.1
30	Congo	37.0	*48.4*	3.7	*3.8*	82.8	87.5
31	Costa Rica	66.4	87.4	19.0	*25.3*	95.8	96.5
32	Côte d'Ivoire	24.6	*31.4*	*6.7*	*6.7*	50.7	55.5
33	Croatia	87.1	*91.1*	35.8	45.1	98.5	98.9
34	Cuba	86.5	92.7	27.8	*87.9*	96.9	97.5
35	Cyprus	96.9	*96.6*	25.1	*33.6*	97.5	98.2
36	Czech Republic	95.9	*96.2*	35.0	*52.0*	99.0	99.0
37	D.R. Congo	*42.9*	*42.9*	*3.7*	*3.7*	*41.5*	*47.5*
38	Denmark	126.8	*119.5*	63.5	*79.1*	99.0	99.0
39	Dominican Rep.	69.0	79.1	*34.0*	*36.1*	84.4	86.1
40	Ecuador	59.7	67.5	*17.6*	*17.6*	92.1	93.5
41	Egypt	87.2	*87.8*	*29.2*	37.9	56.9	60.7
42	El Salvador	58.9	64.7	17.5	*21.1*	79.7	82.0
43	Eritrea	26.8	*31.1*	1.2	*0.5*	57.7	62.3
44	Estonia	96.3	*99.9*	62.0	*65.0*	99.0	99.0
45	Ethiopia	18.1	30.5	1.6	2.8	41.5	47.5
46	Fiji	81.4	82.4	15.5	15.4	93.5	95.0
47	Finland	126.1	*111.6*	84.8	*94.6*	99.0	99.0
48	France	108.6	*113.9*	53.3	*56.3*	99.0	99.0
49	Gabon	54.7	*57.2*	*6.6*	*6.6*	*73.5*	*78.9*
50	Gambia	42.8	*44.9*	*1.2*	*1.2*	38.9	44.9
51	Georgia	82.0	90.2	40.9	37.3	*99.0*	*99.0*
52	Germany	99.8	*101.9*	*46.2*	*46.2*	99.0	99.0
53	Ghana	37.5	49.3	3.3	5.8	73.8	78.9
54	Greece	*94.3*	*103.1*	66.4	*99.6*	99.0	99.0
55	Guatemala	44.0	55.6	9.5	*7.7*	69.9	73.0
56	Guinea-Bissau	17.8	*18.0*	*5.3*	*5.3*	41.0	47.4
57	Haiti	*29.4*	*29.4*	*1.2*	*1.2*	51.9	56.5
58	Honduras	*32.0*	61.4	17.3	*17.2*	76.2	79.0
59	Hong Kong, China	81.5	86.2	*30.6*	33.8	93.8	95.0
60	Hungary	101.5	*95.5*	44.8	*72.1*	99.0	99.0
61	Iceland	111.6	*109.9*	54.1	*75.5*	99.0	99.0
62	India	48.1	*54.6*	10.4	*12.7*	58.8	62.5
63	Indonesia	58.0	*65.7*	15.0	*16.9*	87.9	90.4
64	Iran (I.R.)	77.7	72.7	19.4	31.4	78.1	82.5
65	Ireland	107.7	*111.6*	53.6	*59.4*	99.0	99.0
66	Israel	93.9	*92.3*	57.2	*57.1*	95.3	96.5
67	Italy	98.0	*100.3*	55.2	*68.8*	99.0	99.0
68	Jamaica	84.3	*87.1*	19.1	*18.4*	87.6	89.3
69	Japan	102.6	*101.4*	50.5	*59.4*	99.0	99.0
70	Jordan	89.6	*88.7*	33.0	*38.2*	90.9	93.2
71	Kazakhstan	93.0	92.8	38.8	51.2	99.0	99.0
72	Kenya	41.2	*50.3*	2.8	*2.6*	84.3	88.2
73	Korea (Rep.)	90.1	*97.5*	83.3	92.6	*99.0*	*99.0*
74	Kuwait	86.4	*88.7*	21.8	*16.4*	82.9	85.1
75	Kyrgyzstan	84.5	86.4	42.9	42.8	99.0	99.0
76	Lao P.D.R.	39.3	*43.5*	4.3	*10.5*	66.4	70.5
77	Latvia	93.7	*98.6*	67.3	*72.3*	99.0	99.0

		Gross enrolment ratio				Adult literacy rate	
		Secondary		Tertiary			
		2002	2007	2002	2007	2002	2007
78	Lebanon	77.0	81.1	41.2	51.6	86.9	89.2
79	Lesotho	33.0	*37.0*	2.3	*3.9*	84.4	86.6
80	Libya	108.3	*93.5*	54.2	*62.5*	81.7	85.4
81	Lithuania	101.9	*98.8*	61.7	*76.3*	99.0	99.0
82	Luxembourg	96.9	*96.3*	11.6	*10.2*	99.0	99.0
83	Macao, China	87.1	99.3	64.6	57.0	94.3	95.2
84	Madagascar	*14.3*	26.2	2.0	3.2	68.1	72.2
85	Malawi	31.0	28.3	*0.4*	*0.4*	61.8	65.9
86	Malaysia	65.7	*69.1*	28.0	*24.9*	88.4	90.7
87	Maldives	66.4	*83.1*	0.2	0.2	97.2	97.8
88	Mali	*23.4*	31.6	2.3	4.4	27.2	31.1
89	Malta	91.7	*99.5*	24.3	*45.9*	92.6	93.9
90	Mauritania	21.9	*25.0*	3.1	*4.0*	41.2	43.6
91	Mauritius	81.3	87.8	11.5	*17.4*	85.3	87.1
92	Mexico	77.2	*87.2*	21.7	*26.9*	91.7	93.0
93	Moldova	83.4	83.3	32.2	41.2	99.0	99.0
94	Mongolia	76.0	91.7	34.0	47.7	98.5	98.8
95	Morocco	41.5	55.9	10.3	11.3	50.7	55.1
96	Mozambique	8.4	*15.5*	*0.9*	*2.3*	46.5	53.0
97	Myanmar	41.4	*49.0*	11.9	*11.7*	85.3	86.7
98	Namibia	58.1	59.0	5.7	*5.4*	83.3	86.6
99	Nepal	42.0	*43.2*	5.0	*8.6*	44.0	49.6
100	Netherlands	121.1	*118.2*	55.7	*60.7*	99.0	99.0
101	New Zealand	116.6	*119.6*	69.2	*77.3*	99.0	99.0
102	Nicaragua	59.6	*65.8*	17.8	*19.3*	67.1	68.8
103	Niger	6.8	*11.2*	*0.9*	*1.1*	17.1	20.0
104	Nigeria	*30.3*	*32.4*	*9.6*	*11.1*	66.8	73.1
105	Norway	112.1	*112.8*	73.6	*76.6*	99.0	99.0
106	Oman	83.2	89.8	14.2	25.5	74.4	80.4
107	Pakistan	*25.8*	32.5	2.5	5.1	44.9	49.1
108	Palestine	86.4	92.4	30.0	46.2	92.4	92.8
109	Panama	70.6	70.2	42.7	*47.1*	92.3	93.4
110	Papua New Guinea	*22.7*	*22.7*	*15.4*	*15.4*	65.3	68.7
111	Paraguay	67.2	*66.5*	26.0	*26.7*	93.7	94.8
112	Peru	90.3	*94.5*	32.0	*36.2*	90.5	92.2
113	Philippines	81.6	*83.1*	30.4	*28.9*	95.4	96.4
114	Poland	103.2	*99.6*	58.4	*67.1*	99.0	99.0
115	Portugal	109.5	*97.5*	53.4	*54.0*	99.0	99.0
116	Qatar	85.0	103.5	18.1	15.9	82.1	84.3
117	Romania	84.9	*85.9*	31.8	*60.4*	98.3	98.7
118	Russia	*92.0*	*84.0*	*65.1*	*73.4*	*99.0*	*99.0*
119	Rwanda	*12.3*	18.1	1.9	*2.5*	69.2	74.7
120	Saudi Arabia	*69.2*	*69.2*	22.3	*29.2*	77.9	81.9
121	Senegal	17.0	*23.8*	*5.0*	*6.6*	39.3	44.0
122	Singapore	*74.1*	*74.1*	*43.8*	*43.8*	92.9	94.4
123	Slovak Republic	89.6	*95.8*	32.3	*50.5*	99.0	99.0
124	Slovenia	107.2	*95.5*	66.7	*86.7*	99.0	99.0
125	South Africa	89.6	*95.8*	14.6	*15.5*	86.0	87.8
126	Spain	113.3	*118.7*	62.2	*68.5*	99.0	99.0
127	Sri Lanka	86.0	*88.5*	*5.3*	*5.3*	92.1	93.2
128	Sudan	29.8	*33.4*	*6.2*	*6.2*	59.9	65.1
129	Swaziland	42.8	*46.8*	4.4	*3.9*	80.9	84.0
130	Sweden	144.3	*103.2*	75.6	*76.5*	99.0	99.0
131	Switzerland	92.6	*92.7*	40.6	*46.2*	99.0	99.0
132	Syria	44.2	72.1	*15.7*	*15.7*	76.1	79.7
133	Taiwan, China	*75.5*	*75.5*	*21.6*	*21.6*	*96.1*	*96.1*
134	Tajikistan	78.7	83.6	14.0	19.8	99.0	99.0
135	Tanzania	*5.8*	*5.8*	0.8	1.5	77.1	81.9
136	TFYR Macedonia	83.8	*84.0*	27.0	*33.5*	96.1	97.0
137	Thailand	68.4	83.5	41.0	49.5	95.8	96.6
138	Togo	*36.5*	*40.4*	*3.6*	*3.6*	59.6	65.8
139	Trinidad & Tobago	74.6	*76.3*	8.4	*11.6*	98.5	98.9
140	Tunisia	77.9	*84.9*	22.8	*32.0*	73.2	77.9
141	Turkey	81.1	*78.6*	24.4	*38.6*	86.0	88.4
142	Turkmenistan	90.5	*99.9*	*21.7*	*21.7*	*99.0*	*99.0*
143	Uganda	18.6	*18.3*	3.0	*5.3*	68.9	73.2
144	Ukraine	99.2	94.2	56.9	76.4	99.0	99.0
145	United Arab Emirates	76.7	92.4	23.0	22.9	77.3	79.7
146	United Kingdom	102.8	*98.0*	62.9	*59.3*	99.0	99.0
147	United States	93.0	*93.9*	80.5	*81.3*	99.0	99.0
148	Uruguay	106.5	*101.0*	38.5	*47.4*	97.7	98.1
149	Uzbekistan	90.5	102.4	13.8	9.8	99.0	99.0
150	Venezuela	67.9	79.4	37.8	*58.0*	93.1	94.5
151	Viet Nam	*69.7*	*69.7*	*9.5*	*9.5*	92.9	93.7
152	Yemen	*45.4*	*45.6*	*10.2*	*9.4*	49.0	55.7
153	Zambia	28.0	43.1	*2.3*	*2.3*	79.9	83.5
154	Zimbabwe	40.7	*40.0*	4.1	*2.4*	90.0	92.8

Note: For definition, see Annex 1.
Source: ITU.

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