International Telecommunication Union

United Nations Conference on Trade and Development

WORLD INFORMATION SOCIETY 2007 REPORT

Beyond WSIS

world summit on the information society
Geneva 2003 - Tunis 2005

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This document is the **ITU/UNCTAD 2007 World Information Society Report: Beyond WSIS**. This is the second in a series of reports, launched in May 2006, which are intended to track progress towards bridging the digital divide and implementing the outcomes of the World Summit on the Information Society (WSIS), a UN Summit held in two phases in Geneva in December 2003 and in Tunis in November 2005 (see www.itu.int/wsis).

The full text of the report and selected data tables are available, free of charge, online on the ITU website at: www.itu.int/wisr and on the UNCTAD website at: www.unctad.org/wisr. Printed copies of the report, including the full statistical annex, are available from the ITU sales office, and can be ordered using the online order form from at: www.itu.int/publications.

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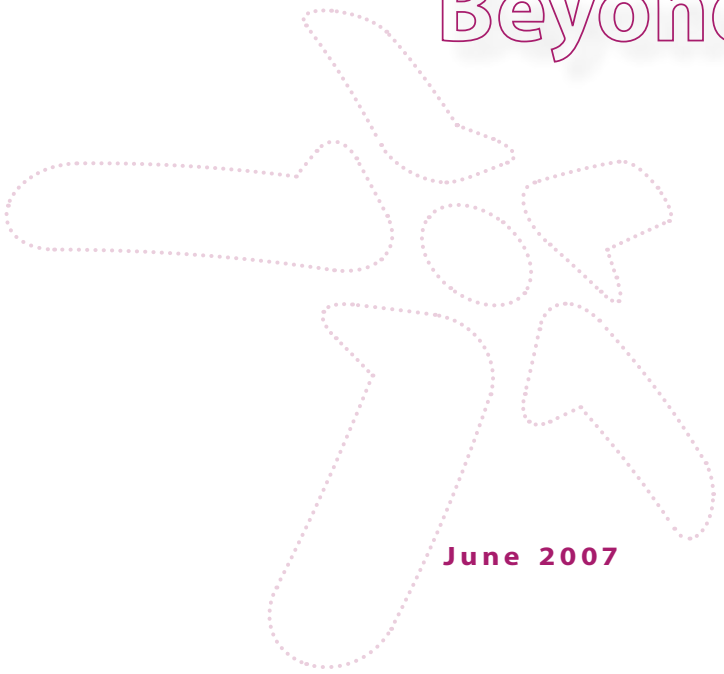

June 2007

UNITED NATIONS
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Foreword

ITU and UNCTAD are proud to publish this 2007 edition of the World Information Society Report, benchmarking the continuing growth of the Information Society around the world.

This Report is important for a number of reasons. Firstly, the World Summit on the Information Society (WSIS) recognized the need for monitoring and evaluation of WSIS follow-up to determine whether the Summit succeeded in what it set out to do. This Report tracks progress in digital opportunity for 181 economies since the start of the WSIS process, which was held in two phases: in Geneva in December 2003 and in Tunis in November 2005.

Secondly, this Report shows that there has been a steady expansion in digital opportunity, both in terms of more widespread access to basic Information and Communication Technologies (ICTs) and the growth in high-speed access to ICTs, on both fixed line and mobile networks. Ever greater numbers of people around the world are enjoying access to the benefits ICTs can bring. Already, the number of people using ICTs around the world has doubled since the WSIS was first proposed in 1998. By the start of 2008, there will be around three billion mobile phones and more than one billion fixed lines around the world. This suggests that we have already surpassed the WSIS target that states that more than half of the world's inhabitants should have access to ICTs within their reach. However, the Report also suggests that disparities and inequality in access are evolving: the digital divide is taking on new forms in terms of the differences in the speed and quality of access to ICTs.

Lastly, this Report is important because, as a joint publication between ITU and the United Nations Conference on Trade and Development (UNCTAD), it is a fine example of the principles of multi-stakeholder collaboration that the Summit endorsed. The report has been created by the "Digital Opportunity Platform", an open multi-stakeholder platform with contributions from governments, academics and civil society, as well as inter-governmental organisations. For it is only by drawing upon the resources of a range of different stakeholders that we can build an inclusive, people-centred and development-oriented Information Society, that can accommodate the needs of all participants.

For these reasons, ITU and UNCTAD are proud to publish this second edition of the World Information Society Report and we look forward to a continued and successful collaboration in monitoring WSIS follow-up in the implementation of the WSIS goals by 2015.

Geneva, 16 May 2007

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This Report monitors progress in WSIS implementation using the Digital Opportunity Index, which has been developed by the Digital Opportunity Platform, whose members include ITU, the United Nations Conference on Trade and Development (UNCTAD), the Korea Agency for Digital Opportunity and Promotion (KADO), the Ministry of Information and Communication of the Republic of Korea, LIRNEAsia and LINKAfrica. The authors are particularly grateful to Dr. C. M. Cho of the Korea Agency for Digital Opportunity and Promotion (KADO) for his vision and insights into early iterations of the Digital Opportunity Index (DOI) and to Doreen Bogdan, Vanessa Gray, Roopa Joshi, Arthur Levin, Mario Maniewicz, Beatrice Pluchon, Susan Schorr and Nancy Sundberg (ITU) for their insightful comments. The authors also wish to thank Marie-Elise Dumans, Dimo Calovski, Dong Wu and Mohamed Adida of UNCTAD for their invaluable comments. The Digital Opportunity Platform is an open multi-stakeholder partnership that welcomes new partners (www.itu.int/digitalopportunity).

Most of the data contained in this Report is taken from the ITU World Telecommunication Indicators Database maintained by the ITU. The database is available on CD-ROM or over the Internet as a subscription service. All of ITU's indicators, reports and databases are available for purchase at www.itu.int/indicators. More information on ITU's Reports can be obtained from www.itu.int/publications, and UNCTAD's reports from www.unctad.org.

The main text of the report, the executive summary and Data Tables 1-3 are available, free of charge, online at www.itu.int/wisr; and at www.unctad.org/wisr. Printed copies, including the detailed statistical annex (Data Tables 4-12), are available for purchase from the ITU Publication Sales Office at: www.itu.int/publications, Fax: +41 22 730 51 94, email: sales@itu.int, with discounts for ITU Members and Sector Members, purchaser from Least Developed Countries (LDCs) and university libraries. The full report is also available from ITU's electronic bookshop.

The views expressed in this Report are those of the authors and do not necessarily reflect the opinions of ITU and UNCTAD or of their membership.

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(Note: Does not include Data Tables 4-12, which are available in the priced version of the report.)

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* Chapter 7 is based on an extract from ITU's publication "Measuring the Information Society 2007", which was published in February 2007. Please note that the ICT Opportunity Index is an ITU index that was developed concurrently with the Digital Opportunity Platform.

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List of Acronyms

ADSL	Asymmetric Digital Subscriber Line
AIDS	Acquired Immune Deficiency Syndrome
APEC	Asia-Pacific Economic Cooperation
API	Asia-Pacific Initiative
APWG	Anti-Phishing Working Group
ASP	Application Services Provider
ATI	Tunisian Internet Agency
AVU	Africa's Virtual University
BCC	Business Cooperation Contracts (Vietnam)
CAUCE	Coalition Against Unsolicited Commercial Email
CD	Compact Disc
CDMA	Code Division Multiple Access
CERT	Computer Emergency Response Team
CIIP	Critical Information Infrastructure Protection
CNSA	Contact Network of Spam Authorities (EU)
CPP	Calling Party Pays
CoE	Council of Europe
CSP	Content Application Services Provider (Malaysia)
CSTD	United Nations Commission on Science and Technology for Development
DOI	Digital Opportunity Index
DOP	Digital Opportunity Platform
DSF	Digital Solidarity Fund
DSL	Digital Subscriber Line
DT	Tunisian Dinar
EASSy	East Africa Submarine System
ECA	UN Economic Commission for Africa
ECLAC	United Nations Economic Commission for Latin America and the Caribbean
ECOSOC	United Nations Economic and Social Council
EEnet	Estonian Educational and Research Network
eLAC2007	Regional ICT Action Plan for Latin America and the Caribbean
ENISA	European Network and Information Security Agency
ePol-NET	Global ePolicy Resource Network
ERDF	European Rural Development Fund
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
EU	European Union
EUROSTAT	European Union Statistical Office
FAO	Food and Agricultural Organization
FBO	Facilities-Based Operator
FCC	Federal Communications Commission (USA)

FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GNI	Gross National Income
GSM	Global System for Mobile (communications)
HIV	Human Immunodeficiency Virus
HSDPA	High-Speed Downlink Packet Access
ICT(s)	Information and Communication Technology/ies
ICT-OI	ICT Opportunity Index
IDA	Infocomm Development Agency (Singapore)
IDRC	International Development Research Centre (Canada)
IGF	Internet Governance Forum
ILO	International Labour Organization
INSEAD	European Institute of Business Administration
INT	National Telecommunications Agency (Tunisia)
IP	Internet Protocol
IPTV	Internet Protocol Television
ISP	Internet Services Provider
IT	Information Technology
IT839	Korea's Information Technology Development Plan
ITCI-DC	Internet Training Centres Initiative for Developing Countries
ITU	International Telecommunication Union
LDC	Least Developed Country
KADO	Korea Agency for Digital Opportunity Promotion
Kbit/s	kilo bits per second
KII	Korea Information Infrastructure Initiative
MAAWG	Messaging Anti-Abuse Working Group
Mbit/s	Mega bits per second
MCIT	Ministry of Communication and Information Technology (Egypt)
MIC	Ministry of Information and Communication (Republic of Korea)
MMS	Multi-Media Services
MMU	Multi-Media University (Malaysia)
MNC	Multi-National Corporation
NFP	Network Facilities Provider
NGN	Next-Generation Network
NGO	Non-Governmental Organization
NICI	National Information and Communication Infrastructure
NIST	National Institute of Standards and Technology (USA)
NSO	National Statistics Office
NSP	Network Services Provider
NTP	National Telecommunications Policy (Nigeria)
OAS	Organization of American States
OECD	Organisation for Economic Cooperation and Development
OFCOM	Office of Communications (United Kingdom)
OPTA	Onafhenkelijke Post en Telecommunicatie Authoriteit (Netherlands)
PAC	Public Access Centres (of the Union Myanmar)

PASP	Program Acessa São Paulo (Brazil)
PC	Personal Computer
PGC	Partnership for Global Cybersecurity
PIAP	Public Internet Access Point (Estonia)
PPI	Private Participation in Infrastructure programme (World Bank)
PRGS	Poverty Reduction and Growth Strategy
PSTN	Public Switched Telephone Network
R&D	Research & Development
RITA	Rwandan Information Technology Authority
RPP	Receiving Party Pays
RTDF	Rural Telecommunication Development Fund
SBO	Service-Based Operator
SIT	Superintendent's Office of Telecommunications (Guatemala)
SME	Small- and Medium-sized Enterprise
SMS	Short Messaging Service
Spim	Spam over Instant Messaging
Spit	Spam over Internet Telephony
TB	Tuberculosis
TOT	Telephone Organization of Thailand
TUF	Frequency Usufruct Titles (Guatemala)
TV	Television
UNCTAD	United Nations Conference on Trade and Development
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCWA	United Nations Economic and Social Commission for Western Asia
UNICEF	United Nations Children's Fund
UIS	UNESCO Institute for Statistics
URL	Uniform Resource Locator
USAID	United States Agency for International Development
USD	United States Dollar
USO	Universal Service Obligation
VoIP	Voice over Internet Protocol
VSAT	Very Small Aperture Terminal
WARP	Warning, Advice and Reporting Point (UK)
W-CDMA	Wideband Code Division Multiplexing Access
WEF	World Economic Forum
WEOG	Western Europe and Other Group
WHO	World Health Organization
Wi-Fi	Wireless Fidelity
WiMax	Worldwide Interoperability for Microwave Access
WMO	World Meteorological Organization
WSIS	World Summit on the Information Society
WTO	World Trade Organization
3G	Third-generation (mobile service)

chapter one
Introduction

1.1 The WSIS Commitment

The World Summit on the Information Society (WSIS) was a United Nations Summit held in two phases in Geneva (December 2003) and Tunis (November 2005).[1] It was convened in response to rising awareness of the pervasive power of Information and Communication Technologies (ICTs) and growing concerns that developing countries should not be left behind in the new Information Society. The WSIS resulted in a remarkable commitment:

"We are … fully aware that the benefits of the information technology revolution are today unevenly distributed between the developed and developing countries and within societies. We are fully committed to turning this digital divide into a digital opportunity for all, particularly for those who risk being left behind and being further marginalized" (WSIS Geneva Declaration of Principles, Para 10).[2]

This commitment by world leaders, to turn the digital divide into a digital opportunity for all, will be severely tested over the next decade or so, as dozens of new ICT services and applications are rolled out at an ever-accelerating pace. Is it really possible to ensure that the latest ICTs do not reinforce existing divisions between information-rich countries and the information-poor? Can we ensure that existing inequalities do not take on new and far-reaching dimensions in the dawning knowledge society?

This is an extremely important issue, which is far from simply a question of who has access to the most high-tech gadgets. At the World Summit, leaders from every country recognized the fundamental role that ICTs can play in promoting economic growth, social development and cohesion, as well as a sense of cultural identity. ICTs can help create new jobs, while transforming firms and streamlining work practices. The ability to use ICTs is a key skill that increasingly determines the employability and standard of living of many citizens. Access to ICTs now drives access to information and knowledge, which, in turn, can decide access to wealth and affluence. A society in which a significant part of the population feels excluded from the benefits that ICT access brings is a society that is fundamentally insecure, at peril of social disintegration.

This series of reports – the World Information Society Reports, published by ITU, UNCTAD and other members of the Digital Opportunity Platform (see Box 1.1) – was launched in 2006[3], following the Tunis Phase of the Summit. These Reports track progress in implementing the outcomes of the WSIS and assess the extent to which the digital divide is being turned into digital opportunity for all.

1.2 Measuring the Information Society

One of the challenges for the international community identified by the WSIS was the development of a methodology for measuring the Information Society. The Geneva Plan of Action called for:

"A realistic international performance evaluation and benchmarking (both qualitative and quantitative), through comparable statistical indicators and research results…" (Para 28).

It also called for the development of:

"A composite ICT Development (Digital Opportunity) Index. It could be published annually, or every two years, in an ICT Development Report. The index could show the statistics while the report would present analytical work on policies and their implementation, depending on national circumstances, including gender analysis" (Para 28a).

Between 2003 and 2005, much work was carried out, notably within the UN system, in response to this challenge. In November 2005, during the Tunis Phase of the Summit, governments and other stakeholders recognized a number of elements in an "agreed methodology" (Tunis Agenda, Para 112):

- Appropriate indicators and benchmarking for tracking the digital divide (Para 113 of the Tunis Agenda; see Chapters two and three of this Report);
- The launch of the Partnership on Measuring ICT for Development (Para 114; see Box 1.2);
- The launch of two composite indices—the ICT Opportunity Index (ICT-OI) and the Digital Opportunity Index (DOI)—based on the common set of core indicators proposed by the Partnership (Para 115).

Box 1.1: The Digital Opportunity Platform and its work

A multi-stakeholder partnership for measuring and bridging the digital divide.

The Digital Opportunity Platform (DOP, www.itu.int/digitalopportunity) is an ITU-led multi-stakeholder partnership for bridging the digital divide. First initiated as the "Digital Bridges" programme in 2004, the Platform unites stakeholders from various backgrounds, including UNCTAD, UNESCWA, London Business School (LBS), LIRNEAsia and LinkAfrica, with its founding partners of ITU, the Ministry of Information and Communication of the Republic of Korea (MIC) and the Korea Agency for Digital Opportunity and Promotion (KADO).

The DOP has mobilized the experience and capabilities of its stakeholders in many different activities, including policy research, data collection, information exchange, capacity-building and other support for policy processes. Inspired by the WSIS, the Partnership has committed to make a real contribution to the creation of a people-centered, inclusive and development-oriented information society driven by ICTs.

The core focus of the Platform is on the analysis and measurement of the evolving Information Society, as called for by the WSIS Geneva Plan of Action (Para 28). Overcoming the digital divide requires research, analysis and measurement – no sustainable solution is possible without a clear understanding of the problems underlying the divide. The DOP provides all stakeholders with a powerful and easy-to-use tool—the Digital Opportunity Index (DOI, www.itu.int/doi)—one of the two indices endorsed by WSIS in the Tunis Agenda for the Information Society (Para 115). Measurement of the digital divide based on reliable benchmark evidence informs policy-making and maximizes the benefits of ICTs, especially for developing countries. The policy toolkit being developed under DOP will further the knowledge of the divide and allow tailored recommendations to be made for specific countries or regions, based on facts about what worked and what did not in certain contexts. In this sense, the insights of the different stakeholders involved are invaluable in developing customized and appropriate policy support.

The DOP holds an annual Forum – the Digital Opportunity Forum (www.itu.int/dof) – uniting ICT policy-makers, researchers and experts from governments, regulatory agencies and academic institutions from different countries, as well as international and regional organizations. The Forum is an incubator for ideas and innovation on sustainable development using ICTs and it provides a wealth of resources freely available on the internet. Other conferences organized under the DOP in 2006 to frame further constructive work on specific themes include the joint ITU/London Business School conference on Digital Transformations in the Information Society, held in June 2006. [4]

Through its growing network of partners, the DOP is an active partner in WSIS implementation and will continue translating pledges into tangible, results-oriented activities, contributing to turning the digital divide into digital opportunity for all.

Source: For more information, see www.itu.int/digitalopportunity.

- The need to take into account national circumstances (Para 116), avoid duplication (Para 117), further develop national statistical capacity (Para 118) and commit to bridging the digital divide (Para 119);
- The launch of the Stocktaking database and Golden Book of WSIS-related activities which should continue to be maintained by ITU (Para 120; see Chapter six).

This Report corresponds to the annual Report requested in Para 28a. In response to the need identified by the Summit, it evaluates and benchmarks international digital opportunity in terms of access to the benefits of the Information Society. It considers digital opportunity broadly and matches evidence of startling growth with a consideration of the potential downside and threats to the Information Society.

1.3 Towards a single composite index of ICT development

1.3.1 WSIS-endorsed composite indices

In its work on statistics for measuring the Information Society, ITU has been involved with both the composite indices endorsed by the Tunis Phase (Tunis Agenda, Para 115):

- The Digital Opportunity Index (DOI)[5] was developed by a multi-stakeholder partnership, the Digital Opportunity Platform (highlighted in Box 1.1), whose members include ITU, UNCTAD, MIC Korea, KADO, UNESCWA, LBS, LIRNEAsia and LINKAfrica. It is based on

Box 1.2: The Partnership on Measuring ICT for Development

The Word Summit on the Information Society (WSIS) affirmed the need for more comprehensive and reliable statistical information to measure the information society and called for the development of "appropriate indicators and benchmarking … [to] clarify the magnitude of the digital divide…" (WSIS Geneva Plan of Action, Para 28b). The Partnership on Measuring ICT for Development was launched during UNCTAD XI in June 2004 by the ITU, UNCTAD and a number of other stakeholders. It currently represents the most comprehensive effort to develop, collect and disseminate globally relevant indicators to measure the Information Society.

As an international, multi-stakeholder initiative, the Partnership provides an open framework for coordinating ongoing and future activities, and for developing a coherent and structured approach to advancing the development of ICT indicators globally, in particular in developing countries. It includes ITU, OECD, EUROSTAT, UNCTAD, UNESCO Institute for Statistics (UIS), four UN Regional Commissions (ECA, ECLAC, ESCAP and ESCWA), the UN ICT Task Force/GAID and the World Bank. Some National Statistical Offices (NSOs) from developed countries contribute to the Partnership's activities by providing expertise and advice to NSOs from developing countries. The Partnership is also actively involved in the transfer of knowledge in areas such as definitions, methodologies and household and business surveys. Its core objectives are:

1) To achieve a common set of core ICT indicators, to be harmonized and agreed upon internationally. A first core list, which was agreed upon in February 2005, includes a total of 42 indicators and reflects key actors in the information society – individuals, households, and enterprises. A number of indicators on "ICTs in Education" are expected to be adopted soon. The Partnership plans to extend the list over time to cover more sectors (health, government, etc), and eventually 'impact' indicators.

2) To assist in building statistical capacity in developing countries. A key objective of the Partnership is to enhance the capacities of NSOs in developing countries and to build competence to develop statistical compilation programmes. Based on a stocktaking-exercise to identify capacity building needs in developing countries, the Partnership has held regional workshops on ICT indicators in Asia-Pacific, Latin America, Western Asia and Africa, to exchange national experiences and discuss methodologies, definitions, surveys, etc. Technical assistance is based on countries' commitment to using recommended indicators from the Partnership's core list.
3) To develop a global database on ICT indicators and to make data available over the Internet.

The Partnership has published a number of publications on the availability of ICT data, as well as methodological material that helps guide developing countries in their data collection efforts. A global Partnership report and meeting are planned for the second half of 2007.

Box Table 1.1: Partnership on Measuring ICT for Development's core list of ICT indicators, April 2007

ICT infrastructure and access	Data have been collected by ITU (from official country contacts, primarily regulatory agencies and Ministries) for many years and are largely available for the majority of countries. Indicators include fixed telephone lines, mobile cellular subscribers, Internet and broadband subscribers, international Internet bandwidth, and tariff indicators.
Access to, and use of, ICTs by households and individuals	Data have been collected (from National Statistical Offices) by ITU since 2005 but availability of data is scarce. While the large majority of countries have information on basic ICT equipment in households (TV and fixed lines), data on more recent technologies are lacking. Major regional differences exist. Indicators include households with a radio, a TV, a fixed telephone line, a mobile cellular telephone and a PC. Indicators on location, type, and purpose of Internet use are also included.
Use of ICT by businesses	Data are collected by UNCTAD and include indicators on businesses and employees using PCs, the Internet and e-commerce activities.
ICT sector and trade in ICT goods	Data have been collected by UNCTAD since 2004 and include indicators on ICT goods imports and exports, as well as the ICT sector's value-added.

Source: Further information about the Partnership on Measuring the Information Society is available at: www.itu.int/ITU-D/ict/partnership/ and http://measuring-ict.unctad.org.

Table 1.1: The Digital Opportunity Index (DOI) and the ICT Opportunity Index (ICT-OI)

Comparison of the indicators included in the two composite indices endorsed by the Tunis Phase of the WSIS.

Digital Opportunity Index (DOI)	*ICT Opportunity Index (ICT-OI)*
Opportunity	**Info density: Networks**
1. Percentage of population covered by mobile telephony	1. Main telephone lines per 100 inhabitants
2. Internet access tariffs as a percentage of per capita income	2. Mobile cellular subscribers per 100 inhabitants
3. Mobile cellular tariffs as a percentage of per capita income	3. International Internet bandwidth (kbit/s per inhabitant)
Infrastructure	**Info density: Skills**
4. Proportion of households with a fixed-line telephone	4. Adult literacy rates
5. Proportion of households with a computer	5. Gross enrolment rates (primary, secondary and tertiary)
6. Proportion of households with Internet access at home	**Info use: Uptake**
7. Mobile cellular subscribers per 100 inhabitants	6. Internet users per 100 inhabitants
8. Mobile Internet subscribers per 100 inhabitants	7. Proportion of households with a TV
Utilization	8. Computers per 100 inhabitants
9. Proportion of individuals that have used the Internet	**Info use: Intensity**
10. Ratio of fixed broadband subscribers to total Internet subscribers	9. Total broadband Internet subscribers per 100 inhabitants
11. Ratio of mobile broadband subscribers to total mobile subscribers	10. International outgoing international traffic (minutes) per capita

Note: The indicator "Mobile cellular subscribers per 100 inhabitants" appears in both indices.

Source: ITU.

eleven separate indicators in three clusters of opportunity, infrastructure and utilization. It has a modular structure and can be split into fixed and mobile components. The index was launched at WSIS in November 2005 and the first full release (180 economies) appeared in last year's World Information Society Report. This Report presents the second full edition of the DOI (see Chapter three of this Report and Table 1 in the Statistical Annex).

» ITU's ICT Opportunity Index (ICT-OI)[6], which was developed by ITU and other organizations, is an analytical tool to track the digital divide by measuring the relative difference in ICT Opportunity levels among economies, and over time. The ICT-OI, which provides measurement across 183 economies, relies on ten indicators that help measure ICT networks, education and skills, uptake and intensity of the use of ICT. For analytical purposes, economies are grouped into four categories, ranging from high to low ICT Opportunities. Apart from cross-country comparisons, the index's methodology highlights relative movements between 2001 and 2005 (see Chapter seven of this Report and Table 4 in the Statistical Annex).

Both indices draw upon the core set of ICT indicators developed by the Partnership for Measuring ICT for Development. Nevertheless, there is relatively little overlap in the indicators chosen (see Table 1.1). Only one indicator (mobile cellular subscribers per 100 inhabitants) appears in both indices. For this reason, both indices illustrate different aspects of the digital divide. For instance, the DOI includes tariffs and advanced services (such as mobile broadband), whereas the ICT-OI focuses on more traditional ICTs (such as tel-

evision) and includes measures of literacy and school enrolment. Although neither index uses weights, the DOI expresses scores between 0 and 1, whereas the ICT-OI has no theoretical maximum. Furthermore, the DOI uses arithmetic average scores, whereas the ICT-OI uses a geometric mean. For 2005-06, the highest score in the DOI was the Republic of Korea with 0.80, whereas for the 2005 ICT-OI, it was Sweden with 377.

Despite their different methodologies, there is a high correlation between the ICT-OI and the DOI with a correlation (R-squared) coefficient equal to 0.94, suggesting that the two indices are consistent in their measurement of digital opportunity. This high correlation arises because both indices are, in turn, related to underlying variations in wealth and income.

1.3.2 Other composite indices

Although the DOI and the ICT-OI were the two composite indices noted in the WSIS outcome documents, they are by no means the only ones available.[7] Other indices include:

- The ICT Diffusion Index, developed by UNCTAD in the context of its support of the UN Commission for Science and Technology for Development (CSTD) and first published in 2003. The most recent edition was published in 2006 in the UNCTAD Digital Divide Report 2005[8], with data from 1997 to 2004 for a total of 180 economies. The index contains eight indicators clustered into two categories of connectivity and access. (The scores and rankings are shown in Table 4 of the Statistical Annex).
- The Network Readiness Index, published by the World Economic Forum (WEF) and INSEAD, and launched in 2002. The 2006 edition covers 122 economies and appears in the "Global Information Technology Report".[9] The index uses a mix of hard data and subjective ratings obtained from surveys. The methodology is similar to that used for the WEF/INSEAD Global Competitiveness Report. (The scores and rankings are shown in Table 4 of the Statistical Annex).

These composite indices measure different aspects of the Information Society. Over the long-term, it is ITU's intention to develop a single ICT index, as requested in Resolution 131 (Antalya, 2006).

1.4 Conclusions: Structure of the report

This World Information Society Report tracks progress in implementing the outcomes of the WSIS and assesses the extent to which the digital divide is being turned into digital opportunity for all. In doing so, it directly responds to the request by the Geneva Plan of Action for international performance evaluation and benchmarking.

- In Chapter two, a range of techniques are used to assess the digital divide from different perspectives. The analysis suggests that the digital divide is a complex concept reflecting underlying inequality in wealth and incomes. The divide is also strongly differentiated by technology, with the more recent technologies (such as broadband Internet) being the most unevenly diffused. However, bold moves in telecom sector reform and the huge strides being made by developing countries such as China promise greater access to ICTs by more people, in line with the objectives of the WSIS.
- In Chapter three, the Digital Opportunity Index 2006 is used to track the growth of the Information Society and analyze which economies are making the greatest progress in digital opportunity. The DOI monitors eleven indicators for 181 economies, including trends in price data and broadband Internet access (fixed and mobile). Digital opportunity is growing strongly around the world and there are encouraging gains among developing countries – five out of the top ten gainers in the DOI are from Africa. DOI scores since 2000/1 are used to examine key trends shaping the future Information Society, as consumers "cut the cord" and move to mobile; the relentless spread of broadband and slow death of dial-up Internet access; and rapid growth in 3G mobile telephones.
- In Chapter four, individual country strategies for developing the ICT sector are examined. Successful examples of ICT strategies are highlighted for the broader experience they may offer to policy-makers in other countries. The DOI is a tool for policy analysis, as it can be used to highlight aspects of a country's ICT framework (e.g. opportunity, infrastructure or utilization) where any given country is doing better or worse than its peers. In last year's Report, the DOI was used to benchmark

the extent of the gender divide in the Czech Republic and urban/rural regional divides in Brazil. In this year's Report, the DOI is used to assess the extent of the age divide in Singapore.

» In Chapter five, we examine some of the challenges faced in building a safe and secure Information Society. The deployment of new technologies opens the door to new threats, along with the good. As ICTs offer ever greater power and performance, the damage that ICTs can be used to inflict also grows. As usage of ICTs increases, the typical user is less likely to be a specialist, and may be less aware of the need to ensure security and data privacy. The WSIS process identified cybersecurity as one of the eleven principles or Action Lines for building a people-centred, inclusive and development-oriented Information Society. This Chapter examines some of the steps being taken to promote a global culture of cybersecurity.

Table 1.2: WSIS action lines, themes and their focal points

Action Line	*Possible moderators/facilitators*
C1. The role of public governance authorities and all stakeholders in the promotion of ICTs for development	ECOSOC/ UN Regional Commissions/ ITU/ ***UN DESA***
C2. Information and communication infrastructure	**ITU**/ *APC*
C3. Access to information and knowledge	ITU/ **UNESCO**/ *FAO/ UNIDO*
C4. Capacity building	**UNDP**/ UNESCO/ ITU/ UNCTAD/ *UN DESA/ FAO/ UNIDO*
C5. Building confidence and security in the use of ICTs	**ITU**
C6. Enabling environment	ITU/ **UNDP**/ UN Regional Commissions/ UNCTAD/ *UN DESA/ UNIDO/ APC*
C7. ICT Applications	
· E-government	UNDP/ ITU/ ***UN DESA***
· E-business	WTO/ **UNCTAD**/ ITU/ UPU/ *ITC*
· E-learning	**UNESCO**/ ITU/ UNIDO
· E-health	**WHO**/ ITU
· E-employment	**ILO**/ ITU/ *ITC*
· E-environment	WHO/ **WMO**/ UNEP/ UN-Habitat/ ITU/ ICAO
· E-agriculture	**FAO**/ ITU
· E-science	**UNESCO**/ ITU/ UNCTAD/ *WHO*
C8. Cultural diversity and identity, linguistic diversity and local content	**UNESCO**
C9. Media	**UNESCO**
C10. Ethical dimensions of the Information Society	**UNESCO**/ECOSOC
C11. International and regional cooperation	UN Regional Commissions / UNDP/ ITU/ UNESCO/ ECOSOC/ ***UN DESA***

Notes: *For more information, including planned meetings, see www.itu.int/wsis/implementation.*
Those agencies shown in purple are the focal point for each action line, confirmed by action line facilitation meetings.
Additional co-facilitators (not included in the Annex of the Tunis Agenda for the Information Society) are in italics.

Source: WSIS.

» Chapter six presents an overview of progress in implementing the WSIS goals and describes activities and projects underway around the world to promote participation in the Information Society. It presents a number of ICT success stories and highlights the role of multi-stakeholder partnerships in shaping our common future. It examines how ICTs can be used to promote digital opportunity and extend access to ICTs, especially in education, telemedicine and telecentres in developing countries.

» Chapter seven provides the background, methodology, conceptual framework and results of the 2007 release of the ICT Opportunity Index. The index is based on ten indicators and covers 183 economies, classifying them into four categories: high, upper, medium, and low. The ICT-OI shows that significant progress has been made across almost all economies and all areas of the telecommunication/ICT sector since 2001. At the same time, its results highlight that between 2001 and 2005, the divide increased between those economies that already have very high ICT levels and the rest of the world. It decreased between the medium group and the low group. Chapter seven is based on an extract from ITU's publication, "Measuring the Information Society 2007", which was published in February 2007.

» Finally, chapter eight provides a summary of the main findings of the report.

Chapters five and six of this report focus on two of the eleven Action Lines agreed for WSIS follow-up, namely communication infrastructure (C2) and building confidence and security in the use of ICTs (C5). These are the two Action Lines for which ITU was given the primary responsibility for facilitating the multi-stakeholder implementation process (see Table 1.2).

The time horizon covered by the report looks back to the WSIS preparatory process, which began in 2002, and looks forward to 2015, the date by which the WSIS commitments should be fulfilled. This Report, the second in the series, is published roughly midway between 2000 and 2015 and offers a good opportunity to reflect on the goals set and the strategies for WSIS implementation. The report will be made available to the WSIS-related meetings due to take place in Geneva from 14-25 May 2007, as well as for the annual meeting of the UN Commission on Science and Technology for Development (UN CSTD), a functional commission of ECOSOC, which will take place from 21-25 May 2007, also in Geneva. ECOSOC has been given the mandate by WSIS to oversee the UN system-wide follow-up of the Geneva and Tunis outcomes of WSIS (Tunis Agenda for the Information Society, Para 105).

It is the sincere hope of the authors of this Report – the Digital Opportunity Platform – that it will prove an invaluable input and stimulus to WSIS implementation and that it will contribute to the building of a people-centred and development-oriented and inclusive Information Society for all.

Notes for Chapter One

1 For more information on the World Summit on the Information Society (WSIS), see www.itu.int/wsis.

2 The full text of the WSIS outcome documents is available online at: www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=2316|0.

3 The text of the 2006 inaugural edition of the World Information Society Report is available at: www.itu.int/osg/spu/publications/worldinformationsociety/2006/report.html.

4 The proceedings of the ITU/London Business School workshop on Digital Transformations in the Information Society, Geneva, 1-2 June 2006, are available online at: www.itu.int/osg/spu/dtis/meeting.phtml).

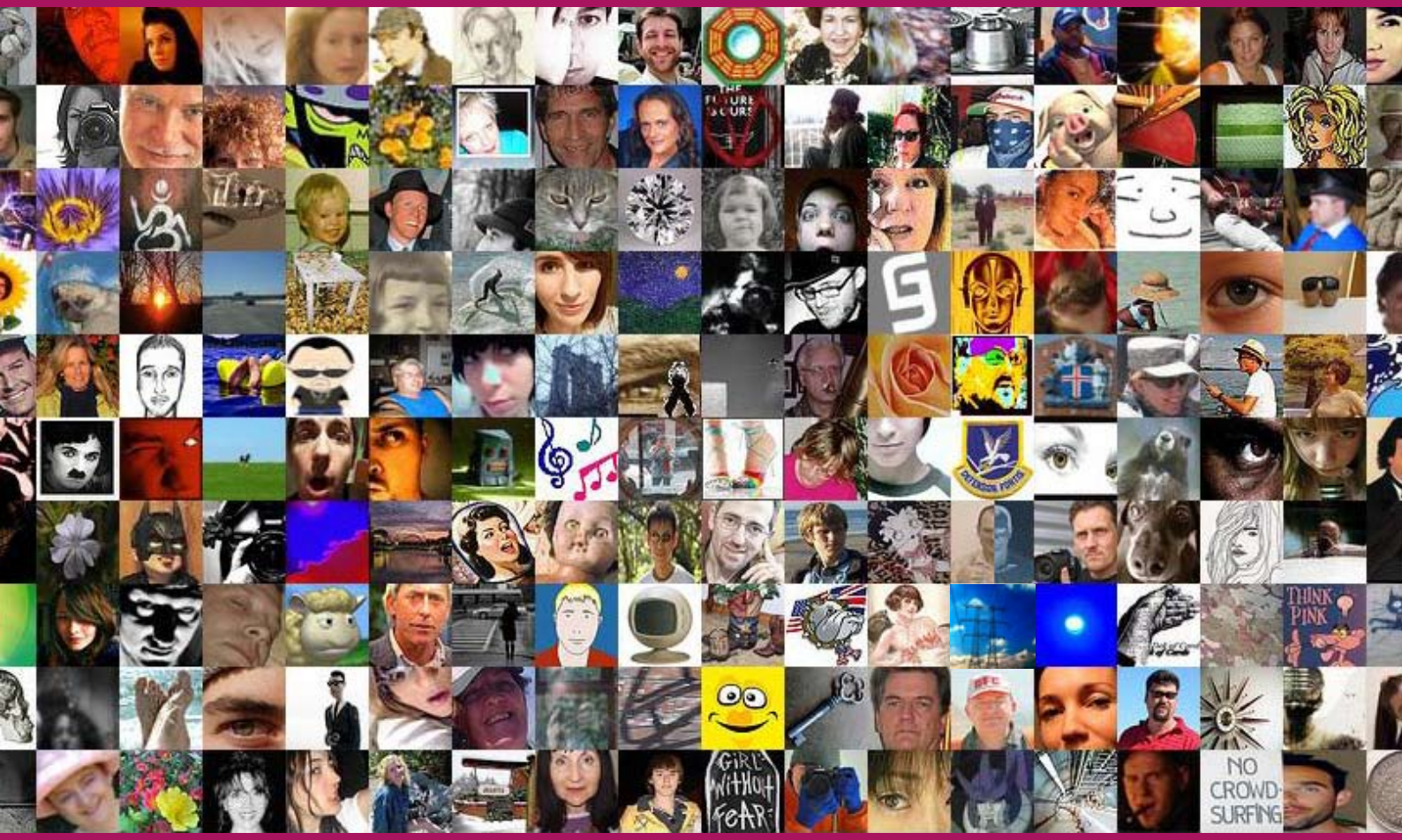
5 For more information on the Digital Opportunity Index, see www.itu.int/doi.

6 For more information on the ICT-OI, see: www.itu.int/ITU-D/ict/publications/ict-oi/2007/index.html.

7 For a more complete discussion of available indices, see Chapter one of the 2006 edition of the World Information Society Report, available at www.itu.int/wisr.

8 The UNCTAD "Digital Divide Report: ICT Diffusion Index 2005" is available for download at: www.unctad.org/en/docs/iteipc20065_en.pdf.

9 For more information on the WEF/INSEAD Global Information Technology Report 2007, see: www.weforum.org/en/media/Latest%20Press%20Releases/gitr_2007_press_release.



chapter two

Bridging the digital divide

2.1 Measuring the divide: Quantity or quality?

The digital divide is a familiar concept. Indeed, the earliest ITU statistics on telecommunications (published in 1871, recording data on telegraph operations since 1849) show a clear divide between the Member States of the Union, mainly within Western Europe at that time. Such gaps have narrowed and, in some cases, even reversed over time, but other disparities have arisen. This suggests that:

- The digital divide is a dynamic concept, which evolves over time;
- Older technologies tend to be more evenly diffused than newer ones. For example, TV sets are more evenly distributed than 3G mobile phones;
- There is not a single divide, but multiple divides: for instance, within countries, between men and women, between the young and the elderly, different regions etc.
- The main factor underlying these divides is differences in wealth, between countries and between individuals. While disparities in wealth continue to exist, the digital divide will persist.

Some have argued that the digital divide is not a useful concept from an analytical perspective.[1] Certainly it is true that the divide has become a political construct and has been used as an argument for advocating changes in policy or, conversely, as a reason why current policies should not be altered (in case the digital divide should widen). Nevertheless, the digital divide continues to provoke intense debate, including within the WSIS process.

2.1.1 Penetration rates by development status

The digital divide can be measured using the ratio in penetration rates between different groups of economies: for example, "developed" and "developing" economies.[2] However, these categories use UN definitions, which may not be totally up-to-date (for example, the Republic of Korea, which is ranked first in the Digital Opportunity Index (DOI), is classified as a "developing economy" by the UN). Furthermore, "developing economies" includes both emerging middle-income and least developed economies. For these reasons, more refined categories are useful. Three groups of countries may be recognized:

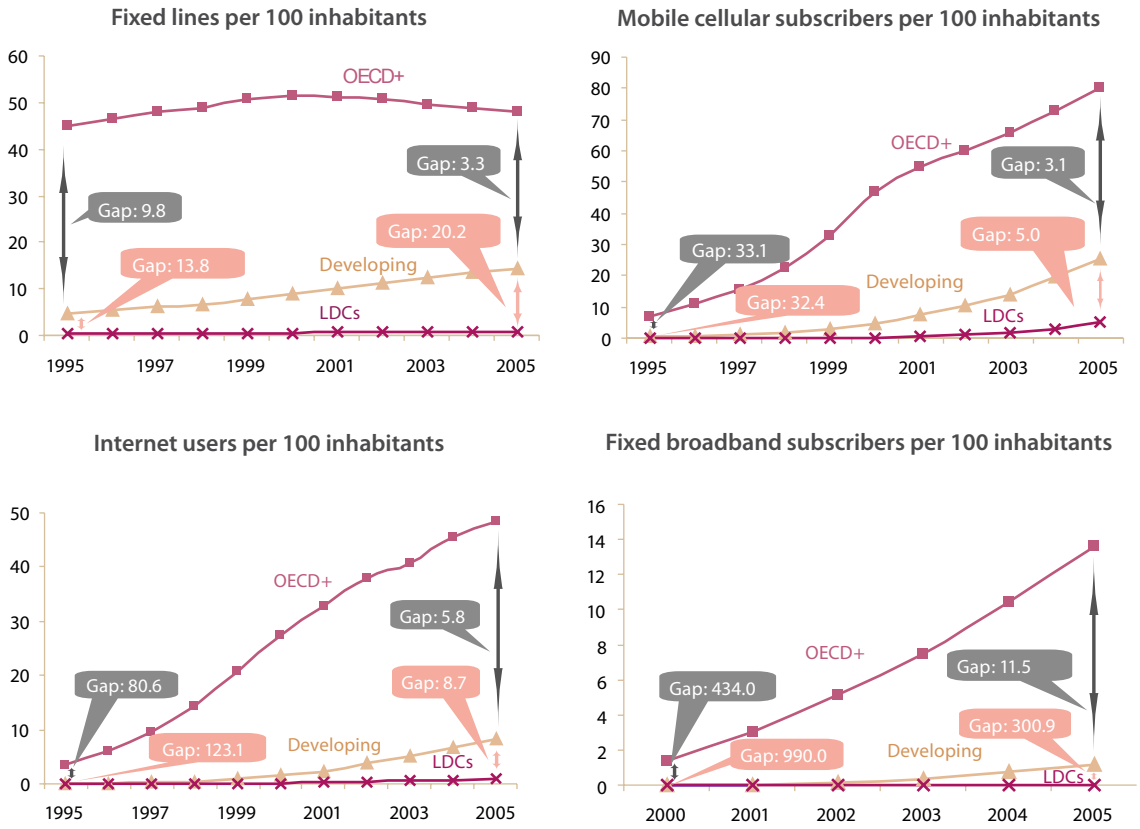
- "OECD+" includes the 30 economically advanced Member States of the Organisation for Economic Cooperation and Development (plus their dependencies) and the four Asian Tigers (Hong Kong SAR, Macau SAR, Singapore and Taiwan-China), representing 18.7 per of the world's population.
- "LDCs" are the 50 Least Developed Countries recognized by the United Nations as requiring special attention in development assistance, accounting for 11.9 per cent of the world's population.
- "Developing" includes all other economies. Notably, they include the most populous economies of India and China. They account for 69.4 per cent of the world's population.

Figure 2.1 illustrates the digital divide in four major ICTs – fixed lines, mobile cellular subscribers, Internet users and broadband subscribers – and trends over the decade from 1995-2005 (2000-2005 for broadband). The clearest evidence of the narrowing of the digital divide is to be found in fixed lines, where OECD+ economies have seen declining teledensity since 2000, while the teledensity of developing economies continues to grow. Thus, the gap in fixed lines between OECD+ and developing economies (measured by the ratio between average penetration rates) has shrunk from 9.8 in 1995 to 3.3 in 2005 (Figure 2.1, top left chart). Furthermore, the absolute difference has also shrunk (in terms of total percentage points between the averages), falling from 40.4 per cent in 1995 to 33.5 per cent in 2005. However, at the bottom of the chart, the position is not so encouraging. The gap between developing and LDCs has actually widened for fixed lines, from 13.8 to 20.2. In other words, while middle-income developing countries (led by China and India) are rapidly closing the gap in fixed line access, LDCs seem to be stagnating.

Mobile communications have grown most rapidly, especially among developing economies. In the developing economies, the number of mobile cellular subscribers rose from just 12 million in 1995 to over 1.15 billion in 2005, at a compound annualized growth rate of 58 per cent per year (Figure 2.1, top right chart). Thus, in mobile communications, the ratio between OECD+ and developing economies has been practically eradicated, falling from 33.1 to 3.1. LDCs have done well

Figure 2.1: The digital divide: Shrinking for most technologies, but growing in others

Measures of the gap between different groupings of countries in 1995, 2000 and 2005 in the penetration rates of fixed lines, mobile cellular subscribers, Internet users and fixed broadband subscribers. The gap is measured as the ratio of average penetration rates between different groups of countries in 1995 and 2005 (2000 and 2005 for broadband subscribers).



Note: "OECD+" includes the 30 Member States of the OECD, their dependencies and the four Asian tigers (Hong Kong SAR, Macao, SAR, Singapore and Taiwan-China). "LDCs" are the 50 Least Developed Countries. "Developing" refers to all other economies. This analysis is based on a total of 213 economies.

Source: ITU World Telecommunication Indicators Database.

too in mobile, growing their subscriber base by a phenomenal 93 per cent per year over 1995-2005. Indeed, among the LDCs, mobile cellular subscribers outnumber fixed lines by seven to one. ITU's World Telecommunication Development Report 2002 made a startling claim with a chapter entitled, "We've found the missing link: It's Mobile Communications". Mobile communications overtook fixed line phones in 2002 and, in the three years that followed, a further billion mobile cellular subscribers were added around the globe, mainly in the developing world.

The term "digital divide" often refers to Internet access and here, users in developed countries are much better off than their developing country counterparts (Figure 2.1, lower left chart). In 2005, half of all OECD+ citizens were Internet users, compared with just one in every twelve citizens in developing economies and one in every hundred in the LDCs. Nevertheless, even for Internet access, the digital divide has shrunk remarkably, with the ratio between OECD+ and developing economies plummeting from 80.6:1 to 5.8:1 in the past decade. Indeed, in 2005, almost twice as many new Internet users were added in developing economies and LDCs as in OECD+ economies. As OECD+ economies approach saturation at around 65-70 Internet users per 100 inhabitants, or up to 80-85 per cent of the active population[3] (see

Figure 2.2), the potential for fresh Internet growth derives mainly from the developing world.

For these reasons, the debate over the future digital divide is now moving away from inequalities in basic "quantity" and "access" to ICTs to differences in the "quality" of the user experience and "capacity", as illustrated by fixed line broadband subscribers (Figure 2.1, lower right chart). Although the ratio of broadband subscribers in OECD+ economies to developing economies has collapsed from 434 to 11.5, the absolute gap measured in percentage points has grown almost tenfold between 2000 and 2005, and this is what gives the strongest visual impression in the chart. Furthermore, broadband penetration is far from common in LDCs, with a mere thirty thousand broadband subscribers in the 24 LDCs with broadband service in 2005 (out of a total of fifty LDCs). LDC users are asked to pay extortionate rates for relatively low-speed broadband access – over US$2'000 per 100 kbit/s per month in Cape Verde, for instance, and over US$100 per 100 kbit/s per month in at least 12 other LDCs where broadband is available, compared with below 10 US cents per 100 kbit/s per month in Japan and the Rep. of Korea.

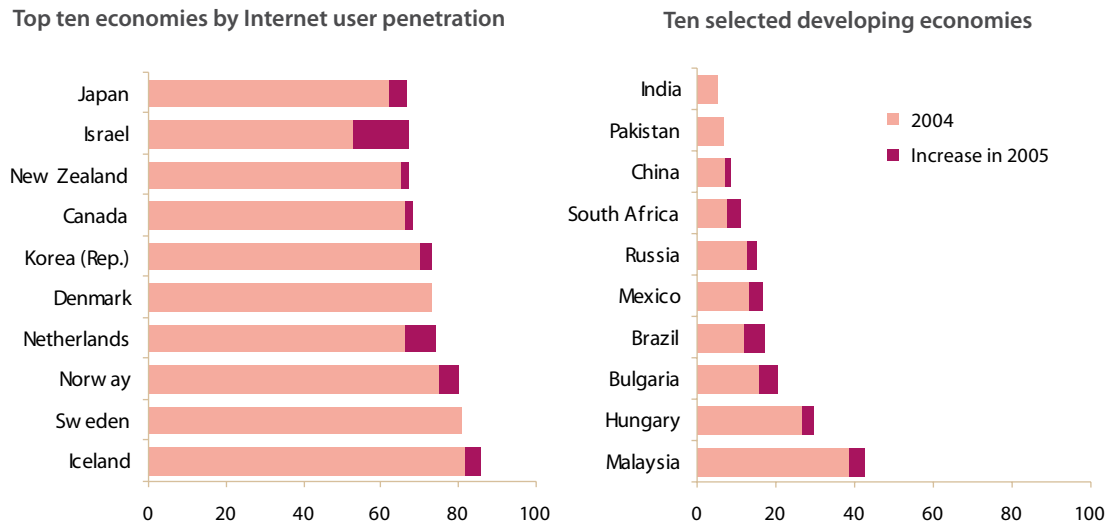
2.1.2 Penetration rates by income

An alternative approach for measuring the distribution of ICTs is based on the World Bank categories of high-, upper-middle, lower-middle and low-income states. By comparing the shares of ICTs with population, it is possible to determine whether the digital divide reflects underlying disparities in wealth or whether it is actually reinforcing them. As shown in Table 2.1, although high-income economies represent less than 16 per cent of world population, they account for almost 80 per cent of global Gross Domestic Product (GDP). Low-income economies account for over a third of world population, but just 3 per cent of global GDP.

Inequality in the distribution of ICTs is not as extreme as inequality in the distribution of global wealth (see Figure 2.3). Mobile phones are the most evenly distributed and fixed broadband connections the least. Intriguingly, among low-income countries, their largest share of global ICTs is in Internet users, with low-income countries accounting for 10.2 per cent of global Internet users in Figure 2.3, since Internet usage

Figure 2.2: What a difference a year makes in the Internet economy

Growth in Internet user penetration, between 2004 and 2005. Among the top ten economies, penetration increased by an average of 7 per cent, while among developing economies, it increased by 27 per cent or three times as much.



Note: In the left chart, estimates are based on user surveys and may be expressed as a percentage of the active population, i.e., in a particular age group (e.g., for Iceland, it is as a percentage of the 16-74 age group). For the right chart, since survey data is not available for all economies, the penetration rate is expressed as per 100 inhabitants.

Source: National statistical offices and ITU World Telecommunication Indicators Database.

Table 2.1: Distribution of population and GDP by income group

Income group	Number of economies 2005	GDP per capita US$, 2005	Population millions 2005	Population % 2005	Total GDP % 2004
High	55	29'434	1'013.3	15.7%	79.9%
Upper-middle	39	4'344	584.8	9.0%	6.7%
Lower-middle	54	1'521	2'479.1	38.3%	10.1%
Low-middle	58	503	2'396.3	37.0%	3.2%
World	206	5'768	6'473.5	100.0%	100.0%

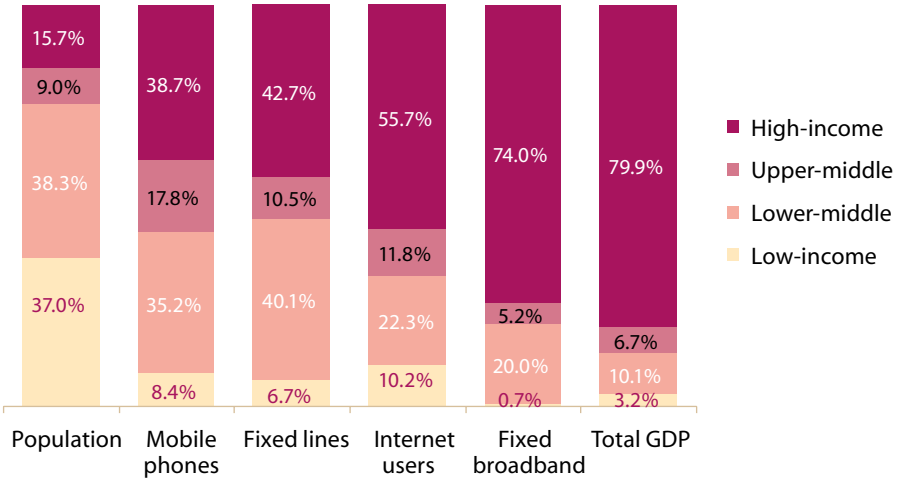
Note: Population and income data are for year-end 2005, GDP data relate to year-end 2004

Source: ITU World Telecommunication Indicators Database.

in low-income countries includes many forms of communal access (e.g., through schools or tel-ecentres – see Chapter 6, Section 6.2.1). Overall, mobile phones are more evenly distributed than fixed line telephones, given that, at the end of 2005, there were 1.7 mobiles for every fixed line. However, surprisingly, fixed lines are more evenly distributed than mobile phones in lower-middle income economies, reflecting a few economies – mostly transition economies, such as Armenia or Turkmenistan – where fixed lines still outnumbered mobile phones at the start of 2006.

Some 74 per cent, or nearly three-quarters, of broadband subscribers worldwide were located in high-income countries in 2005 (Figure 2.3), which accounted for just 16 per cent of world population. Furthermore, two economies – India and Vietnam – accounted for 94 per cent of all broadband subscribers in low-income countries, while a single economy – China – accounted for 87 per cent of broadband subscribers in the lower-middle income group (Figure 2.6, left chart).

Figure 2.3 : Distribution of major ICTs by income group of economies

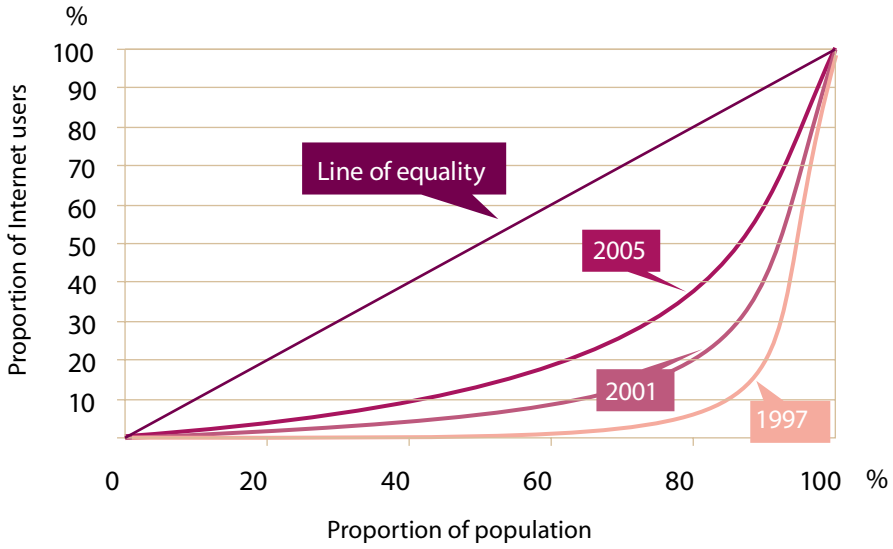


Note: Population data and ICT data are for year-end 2005, GDP data relate to year-end 2004.

Source: ITU World Telecommunication Indicators Database.

Figure 2.4: Narrowing of the digital divide in Internet usage, 1997-2005

Growing equality in the worldwide cumulative share of Internet users in 1997, 2001 and 2005.



Source: UNCTAD, adapted from ITU data.

2.1.3 Measures of inequality

Inequality in the distribution of goods and services can also be analyzed using mathematical techniques, such as the Lorenz curve and Gini coefficient.[4] A Lorenz curve for Internet users is illustrated in Figure 2.4. If the rate of Internet usage were the same across nations, the Lorenz curve would be a 45-degree diagonal line, matching the world distribution of population. The Gini coefficient summarizes the Lorenz curve in a single number, the ratio of the area between the Lorenz curve and the diagonal to the total area under the diagonal. Perfect equality yields a Gini coefficient of zero (e.g., where everyone is an Internet user, so the distribution of Internet users and diagonal of equality coincide) and perfect inequality gives a Gini coefficient of one (e.g., where a single individual has the only Internet access in the world). Figure 2.5 shows the trend of growing equality over time with Gini coefficients for several key ICTs.

In 1997, the lower 80 per cent of the world's population situated mainly in developing countries accounted for only around 5 per cent of Internet users. The Lorenz curves for 2001 and 2005 are above those for 1997, indicating increasing equality with time. Indeed, in 2001, 80 per cent of the world's population accounted for nearly one fifth of all Internet users, but by 2005, they accounted for just over a third of all Internet users.

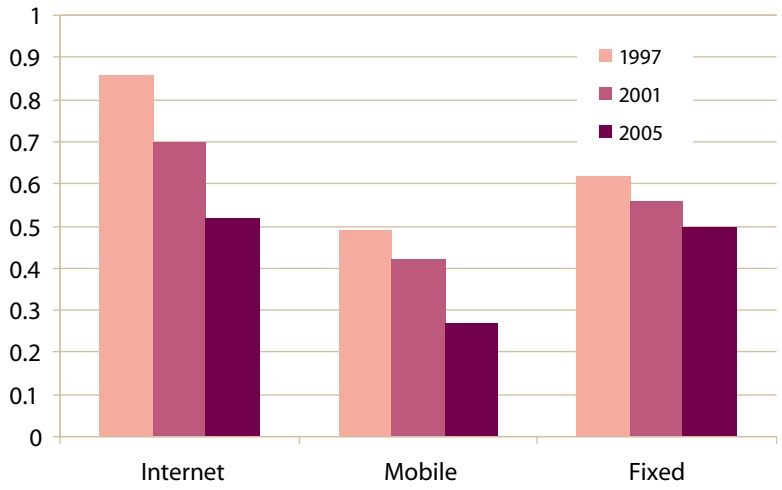
Gini coefficients have declined during this period, indicating increasing equality. The biggest drop has been seen in mobile access, with mobile subscriptions becoming more widespread. By 2008, one half of all the world's inhabitants are expected to have access to a mobile phone. Mobiles are the most equally distributed ICT, with a Gini coefficient of 0.27 at the end of 2005. This is not surprising, given that a basic mobile telephone is easy to buy and cheap and does not need the same, advanced literacy skills as Internet access. In contrast, the Gini coefficient for fixed lines has not fallen as much, as growth in fixed lines has been more sluggish. In developed nations, the number of fixed lines is dropping as consumers switch to broadband (negating the need for an extra dial-up line – see Chapter three) and mobile. In developing nations, consumers are opting for mobile as their main, and often only, phone.

2.2 Connectivity

Analysis of international differences in broadband prices reveals one underlying cause. A broadband connection in a high-income economy costs, on average, around US$16 per 100 kbit/s of data transmission capacity per month (and in Japan and the Rep. of Korea, even less at under 10 US cents per month). The average price in low-income economies is more than US$186

Figure 2.5: Gini coefficients for ICT services

Growing equality over time in the global distributions of Internet users, mobile and fixed lines, for 1997, 2001 and 2005.



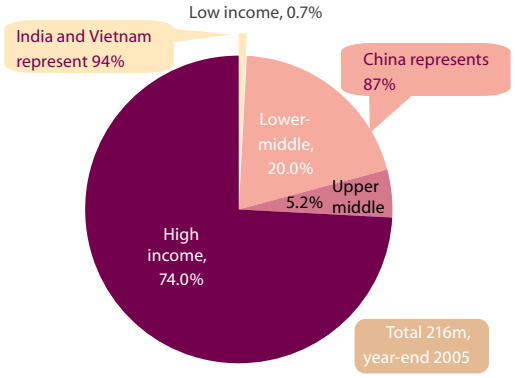
Source: UNCTAD, adapted from ITU data.

per month, almost twelve times more (Figure 2.6, right chart). Furthermore, in terms of affordability (or price relative to monthly income), the gap between high- and low-income economies is a staggering ratio of 432. Consumers in a high-income economy spend only 2 per cent of their average monthly income on broadband connectivity, whereas in a low-income economy, even the cheapest broadband offering costs more than 900 times average income.[5]

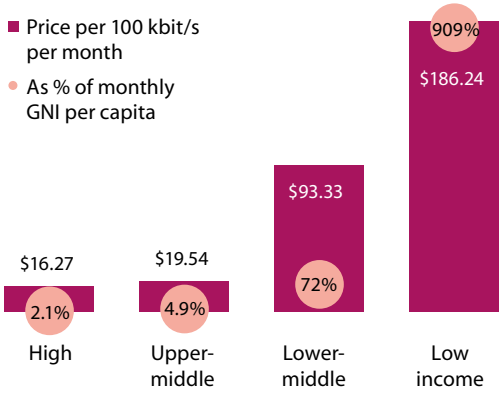
These differences in price are due to structural and economic reasons in both access and wholesale markets. Low-income countries are less likely to have infrastructure-based competition in their broadband markets, whereas many high-income

Figure 2.6: Broadband inequality … and its cause

Distribution of fixed broadband subscribers, by income group, 2005



Broadband prices and affordability, by income group, 2006 (in USD per month)



Source: ITU World Telecommunication Indicators Database, UNCTAD and "ITU Internet Report 2006: digital.life"

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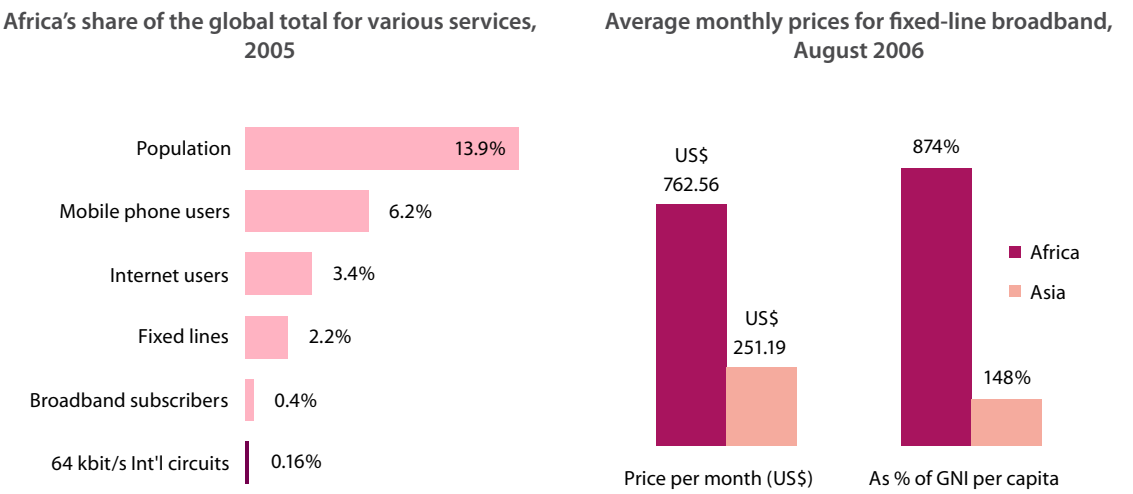
countries have markets that are open to competition from both cable modems and DSL, as well as fibre, satellite, metro Ethernet, fixed wireless access etc (see the discussion of ICT growth strategies in market and regulatory reforms in Chapter four).

In the wholesale market, low-income countries also suffer from a lack of supply. The major reason for the shortage of international bandwidth in developing nations is cost. The small size of Internet markets in many low-income countries means that economies of scale in discounted bulk purchases of international bandwidth are not available. Some developing nations are landlocked or, even if they have sea access, they may not have access to submarine fibre optic cables. They must rely on satellite connectivity, which can be more expensive and provide less capacity. Another reason for high costs is the difference in payment arrangements for Internet connectivity compared to voice telephone traffic. For voice telephony, developing countries receive income for terminating calls. For Internet, developing countries must pay the full costs of the connection to developed countries, where most content originates.

Take the case of the market for wholesale Internet capacity in Africa, for example. Data for 2005[6] show that Africa accounted for a total of 19'512 international circuits (i.e. 64 kbit/s circuit equivalents) or just 0.16 per cent of the global total of 12.2 million international circuits, compared with nearly 14 per cent of world population. Indeed, Africa has fewer international circuits than Ireland, despite the fact that Africa has more than 200 times as many inhabitants. Furthermore, as shown in Figure 2.7 (left chart), Africa's lack of connectivity is even more stark compared to the rapid progress it has made in other ICTs: for example, in expanding its Internet user base, where Africa accounts for 3.4 per cent of the global total, or mobile phone ownership, where Africa accounts for 6.2 per cent of the world's mobile phones.

This lack of connectivity means that African Internet users are starved of bandwidth, which translates into higher prices and slower connection speeds. For example, a sample of representative offers for broadband service in Africa (on the basis of 100 hours per month or 1 Gigabyte of data per month) costs on average US$745 per month, more than three times the average for Asia (and nearly six times higher, expressed as a percentage of GNI per capita - see Table 11 in the Statistical Annex). Higher prices for basic services choke demand and reduce incentives for investment. Furthermore, higher prices for fixed line-bandwidth are also evident in higher cellular mobile prices, which are, on average, 24 per cent higher in Africa than in Asia (see Table 7 in the Statistical Annex).[7] Although mobile phone users do not directly use

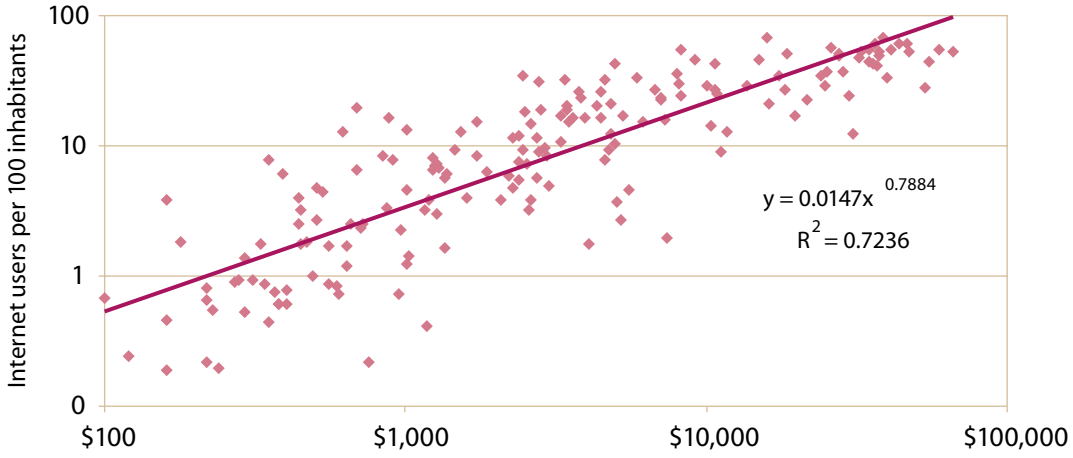
Figure 2.7: Bandwidth scarcity and its consequences in Africa



Note: In the right chart, the price sample is based on the 22 African economies that had fixed-line broadband service at the end of 2005. The average value is inflated, since in a high proportion of the economies in this sample, broadband is offered through leased lines and is priced as a business service, rather than for residential users.

Source: ITU World Telecommunication Indicators Database.

Figure 2.8: Relationship between Internet user penetration and Gross National Income per capita, 2005



Logarithmic scale.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform, adapted from ITU World Telecommunication Indicators Database.

fixed-line bandwidth, it is still an important cost component for mobile operators, especially where the fixed-line incumbent still has a monopoly over international communications. However, not all African economies have a gloomy outlook for high-speed Internet access. One African nation that is forging ahead with investment in broadband infrastructure is Rwanda (Box 2.1), while Morocco and Senegal are introducing higher-speed Internet access (see Boxes 3.1 and 3.2 in Chapter three).

Table 2.2: ICT affordability by income group of economies, 2006

Income group	Monthly basket of Internet use		Monthly basket of fixed broadband use		Broadband Prices (USD per 100 kbit/s)	
	USD	% monthly per capita income	USD	% monthly per capita income	USD per 100 kbit/s	% monthly per capita income
High	$22	0.9	$15	0.7	$16	2.1
Upper-middle	$22	4.9	$12	2.6	$19	4.9
Lower-middle	$24	19.7	$11	7.6	$93	71.8
Low	$44	172	$13	54.9	$186	909
World average	$29	55.2	$13	18.3	$72	225.1

Methodological Note: The Internet basket is based on 10 hours of peak rate and 10 hours of off-peak use. Where applicable, telephone usage charges are included, but not the monthly rental of the telephone line. The mobile basket is based on the OECD low-user definition. Averages are not weighted, with each county in the income group having equal weight. For broadband tariffs, the price is calculated as the cost of 100 kbit/s broadband access per month based on a selection of representative offers for 100 hours per month (time-based packages) or 100 Mbit/s data download (for content-based packages).

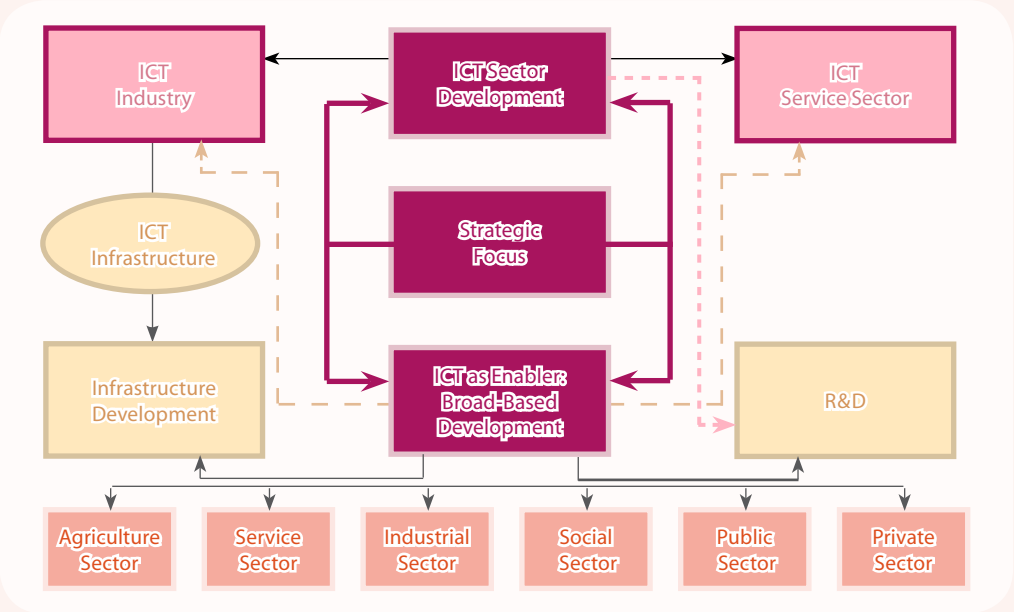
Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Box 2.1: Rwanda: ICT4D

Rwanda was rocked by a devastating civil war and genocide in 1994. Today, it is keen to reconcile its past and look towards the future. The Government views ICTs as a major means of lifting Rwanda out of poverty and has developed a National Information and Communication (NICI) Plan. These rolling five-year plans began in 2001 and cover a twenty-year period in the nation's Vision 2020. The goal is to transform a mainly agricultural economy into a Predominantly Information-rich, Knowledge-based Economy (or PIKE).

The latest plan, covering 2006-2010 , has a dual focus: to build up an export-oriented ICT industry and to use ICTs to boost development across all sectors (See Box Figure 2.1). The Rwanda Information Technology Authority (RITA) is a key agency for implementing the NICI plan. It aims to promote pro-ICT development by pairing local ICT companies with international players. RITA's headquarters in Telecom House is being converted to a "cyber building" with fibre connectivity. It hosts the Rwanda Internet Exchange and a number of local IT companies.

Box Figure 2.1: The dual focus of Rwanda's ICT Plan



Source: Government of Rwanda, The NICI-2010 Plan.

Rwanda has forged ahead with structural reforms. It privatized the incumbent Rwandatel in 2005 when 99 per cent of shares were sold for US$ 20 million to Terracom, a Rwandan ISP owned by an American entrepreneur. This is the highest private ownership of any incumbent operator in Africa and helps ensure independence from government influence. The new Rwandatel/Terracom has launched a fibre frenzy, laying fibre optic lines in the capital Kigali, as well as a national backbone extending to the Ugandan and Burundi borders.

Rwandatel has also launched a broadband wireless network to compete with Rwanda's first mobile operator, a subsidiary of MTN South Africa. The new wireless network is Africa's fastest 3G system with broadband speeds of up to 2 Mbit/s. Rwanda has a small territory with one of the highest population densities in Africa and achieved a mobile population coverage of around 90 per cent by 2006, one of the highest in Africa.

Although international Internet bandwidth has grown, bandwidth is constrained by the landlocked country's reliance on satellite technology. Part of the incentive of running fibre to Uganda is the hope of connecting to the planned East Africa Submarine System (EASSy), of which Rwanda is a founding member. Rwanda's ICT aspirations are high and it has undertaken some admirable initiatives. Even if only some of its goals are met, it will have gone a long way towards developing an information society.

Source: UNCTAD, from the ITU/UNCTAD/KADO Digital Opportunity Platform.

2.3 Affordability

Another way of considering the digital divide is in terms of the affordability of services. Overall, differences in the price and affordability of ICT services – such as Internet access or mobile phone service – are not as great as for higher-capacity services such as broadband. Table 2.2 shows the average monthly prices for Internet and mobile use by income group. In high-income countries, monthly Internet access costs less than one per cent of per capita income. Internet prices are on average twice as great in low-income countries, where the high price of Internet access exceeds the low average incomes, putting Internet access out of reach for most consumers.

Figure 2.8 illustrates the close relation between per capita income and Internet usage. Although other factors influence Internet usage (e.g., literacy, education and age), the ability to pay for ICTs is one of the most important. This is particularly true in developing nations, where incomes are lower and more sensitive to pricing and where the impact is much greater, as shown by the non-linear trend line in Figure 2.8. For example, an increase in average annual income from US$ 100 to US$ 1'000 per capita is associated with an increase in Internet user penetration of 2.9 percentage points, whereas an increase in income from US$ 10'000 to US$ 11'000 per capita is associated with an increase in penetration of just 1.6 percentage points.

For mobile telephony, the average price of the low-user basket of monthly mobile use in low-income countries is US$ 13, the same as the world average (Table 2.2). This helps to explain why mobile penetration is far higher than Internet user penetration in low-income countries (7.5 per 100 capita, compared with 2.8 per capita). Nonetheless, monthly mobile prices are still over half the average per capita income in low-income economies. There are several factors influencing the price of mobile services. One is the size of ICT markets - markets may be too small to generate the economies of scale needed for lower prices. Regulatory environment is another factor – even where markets are open, there may be other barriers to access by competitors, such as high license fees, lack of transparency and the dominance of incumbent operators. A third factor is taxes (import duties, VAT and excise duties on telecom services). A study from the GSM Association found that taxes on mobile services add 20 per cent to the overall cost of ownership in around one third of the countries analyzed and that a one per cent reduction in taxes could result in a two per cent increase in mobile penetration by 2010.[8] The case of Jamaica is interesting, showing how one island economy overcame regulatory barriers to liberalize its market and boost mobile penetration (Box 2.2).

2.4 Sector Reform

Sector reform is a vital factor shaping the digital divide. Sector reform usually involves a mix of:

- Market liberalization and the introduction of competition: e.g., by licensing new operators;
- Private sector participation: e.g., through privatization of the incumbent and/or by admitting new, privately-owned, operators to the market;
- Effective sector regulation: e.g., by establishing a regulatory body independent of government and the licensed operator(s).

ITU has carried out a wealth of research into the progress of sector reform around the world through its annual "Trends in Telecommunication Reform" publication series.[9] The relationship between telecommunication reform and the digital divide is complex. Historically, gaps in service provision between urban and rural areas have been used by incumbent operators as a justification for resisting reforms. Incumbents have argued that private investors, without universal service obligations, would neglect rural areas and the incumbent would lose its cross-subsidies that enabled it to subsidize service to less profitable rural areas on the basis of profits made from more populated and affluent urban areas.

In contrast, some countries have used targeted sector reforms as a means of addressing the digital divide. In South Africa, for instance, VoIP was at first licensed only for use by the incumbent and initially in those areas designated as being underserviced. [10]

For most countries, however, the evidence suggests that sector reform has played a positive role in promoting ICT development and narrowing the digital divide (see the case of Jamaica in Box 2.2).

From a methodological viewpoint, one of the hardest things to prove is that a particular policy change led to a particular reaction in the market. In the case of Jamaica (Box Figure 2.2), the timing

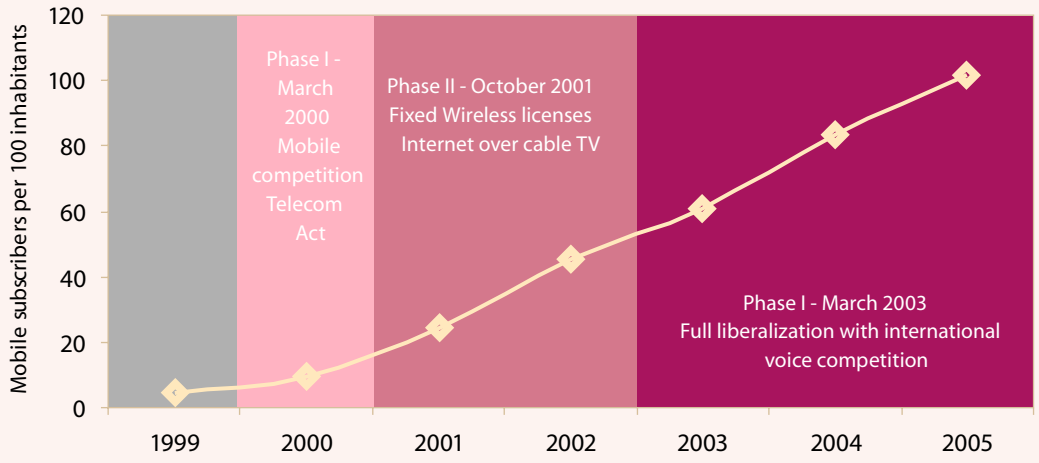
Box 2.2: Jamaica: Setting an example for the Caribbean

According to the Policy Institute of Jamaica, Jamaica had 2.75 million mobile subscribers at the end of 2005 or a penetration rate of 102 per 100 inhabitants. This makes Jamaica the first middle-income nation to break the theoretical 100 per cent mobile penetration barrier and gives it a higher mobile subscription rate, for instance, than Japan. Jamaica's mobile penetration is significantly above where it should be, given its average per capita income.

Jamaica has achieved this success thanks to a market liberalization process that began in 1999. It renegotiated the 25-year monopoly held by Cable and Wireless, allowing the country to introduce competition on a phased basis (Box Figure 1.3). Liberalization began in April 2000, when Jamaica became one of the first Caribbean countries to liberalize its mobile market by granting licenses to two new mobile operators, Digicel and Oceanic Digital, for around US$ 92 million in total. The second phase began in October 2001, when licenses were issued for Fixed Wireless and Internet access over cable television networks. Liberalization was completed when the international long-distance market was opened up to full competition in March 2003.

Digicel launched its mobile network in April 2001 and became an overnight success story. In its first 100 days of operation, Digicel gained 100'000 subscribers, a target it had originally envisaged reaching after one year. After its first year of operation, Digicel had 400'000 subscribers; roughly what the incumbent had taken a decade to achieve. Jamaica's success is significant, as it disproved a long-established theory that small island economies were too small to sustain competition. One positive factor for mobile competition in small island economies is that they are often tourist destinations. Given the rise of mobile telephony and roaming, these markets are attractive to investors, as they can reap significant roaming revenues from tourists.

Box Figure 2.2: Mobile penetration and market liberalization phases, Jamaica



Source: Adapted from the Jamaican Office of Utility Regulation (OUR), Planning Institute of Jamaica (PIOJ) and Spectrum Management Authority (SMA).

Jamaica is one of the largest Caribbean countries and is watched closely by its neighbours, many of which have followed Jamaica's example and ended their monopolies. Digicel, the pioneer mobile operator in Jamaica, has exploited the new environment to launch mobile services in numerous Caribbean neighbours. Today, it has networks in over 20 economies in the region. It has also expanded to island nations in the Pacific, with licenses in Fiji, Papua New Guinea, Samoa and the Solomon Islands.

Source: UNCTAD, from the ITU/UNCTAD/KADO Digital Opportunity Platform.

of changes can be compared with the situation before and after. However, the impact of policy changes is often delayed over a few years. Furthermore, it is difficult to find the counterfactual (would mobile penetration have grown anyway, even without the policy change?). Also, given that nearly all countries are gaining in ICT, a single country may sbe doing well, but it may still be falling behind its neighbours.

One innovative approach adopted recently in the Asian market is to try to quantify the extent of sector reform. LIRNEAsia has conducted research into the regulatory environment in six Asian economies (India, Indonesia, Pakistan, Philippines, Sri Lanka and Thailand). Their research is based on interviews rating performance in market entry, scarce resources, interconnection, prices, anti-competitive practices and universal service. Their evaluation of the regulatory environment is in general agreement with sector performance, as measured by the DOI. However, the fit is not perfect: for instance, Sri Lanka actually gained two places in the DOI, but it lagged behind, ranked fourth out of the six countries in regulatory performance.[11] This suggests lags in relating changes in the regulatory environment to sector performance.

2.5 Conclusions

This chapter has shown that the digital divide is shifting over time and is most evident for more recent ICTs, such as broadband and 3G mobile. It is also increasingly apparent in growing gaps between middle-income and the Least Developed Countries. However, this chapter has also demonstrated that the digital divide is durable and lasting, which, in turn, reflects underlying disparities in wealth distribution. It seems likely that, in a world where wealth is unequally distributed, there will always be a digital divide in ICTs, in the same way that there is a persistent "luxury divide" in, say, ownership of fast cars and yachts.

Does it matter? Yes. Similar to differences in the distribution of luxury items, the digital divide in ICTs reflects past and existing wealth divides. But, more fundamentally, the digital divide suggests how future divides in wealth may take shape, as ICTs are increasingly determining the ability of individuals, firms and nations to create future wealth. ICTs drive access to the information economy and ICT-intensive services. Further, from the experience of countries that have succeeded in establishing ICT hubs (such as India, Malaysia and Singapore), there are important multiplier effects from ICT investments, in their ability to generate income and drive supplier and consumer industries throughout the economy. With only limited access to ICTs, some developing countries risk being left behind in the new information economy. However, based on the astounding growth in ICTs in economies like China, one can safely predict that some developing countries will be among the economic powerhouses of the coming century.

Notes for Chapter Two

[1] See, for instance, Kenny, Charles and Fink, Carsten (2003) "W(h)ither the digital divide?", presenting a World Bank view at: www.itu.int/wsis/docs/background/themes/digital_divide/fink-kenny.pdf or the Economist article "The real digital divide", 10 March 2005, available at: www.economist.com/opinion/displayStory.cfm?story_id=3742817.

[2] See, for instance, chapter one of ITU "World Telecommunication/ICT Development Report 2006: Measuring ICT for social and economic development", Geneva, 2006.

[3] Although certain economies may exceed this theoretical level of saturation, allowing for young children and older people who may not access the Internet. Sweden and Norway had Internet penetration rates above 80 per cent in 2005, apparent exceptions to this theoretical level of saturation. Iceland had a high Internet penetration in 2005 of 86 per cent among the age group 16-74.

[4] Both the Lorenz curve and the associated Gini coefficient have been widely used to measure income inequality, but they can also be used to compare cumulative shares of ICT equipment and utilization. The Lorenz curve is typically used to illustrate the distribution or cumulative share of count data across the population.

[5] The analysis presented here for unit prices (in US$ per 100 kbit/s per month) is based on the best available offer in a particular country. In Switzerland, for example, this is based on Bluewin's ADSL 3500 service offering 3.5 Mbit/s download speed. The analysis for affordability is based on the lowest sampled price in a particular as a percentage of average monthly GNI per capita. In Switzerland, Bluewin's ADSL 600 service is used offering 600 kbit/s service (its 150 kbit/s did not qualify under ITU's definition of broadband, which includes any dedicated connection of 256 kbit/s or more for both upload and download speed). Price comparisons are based on August 2006 data.

[6] The 2005 International Circuits Report was issued by the FCC in January 2007. It is available from: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-269605A2.pdf. For more information, see the FCC International Bureau website at: www.fcc.gov/ib. Although the report covers only US facilities-based international carriers and therefore omits some inter-regional connectivity, in practice, due to reporting requirements, this still covers most of the world's carriers.

[7] The average price for the OECD low-user basket in Africa is US$12.83, compared with US$10.32 in Asia. These price estimates are for March 2006 - see Table 7 in the Statistical Annex.

[8] GSM Association, Tax and the digital divide, 2005, available at: www.gsmworld.com/news/press_2005/press05_22.shtml

[9] ITU's "Trends in Telecommunication Reform" series was launched in 1998 and is published annually. The latest edition (2007) is "The Road to Next-Generation Networks". For a full list of previous titles, see: www.itu.int/ITU-D/treg/publications/index.html.

[10] See, for instance, Chetty, Marshini et al (2006), "VoIP deregulation in South Africa: Implications for underserviced areas", available at: http://pubs.cs.uct.ac.za/archive/00000381/01/policy_paper_mchettyf.pdf.

[11] Work to evaluate the Telecommunication Regulatory Environment by LIRNEAsia is ongoing. For interim results, see the presentation by Rohan Samarajiva et al (March 2007) at: www.lirneasia.net/wp-content/uploads/2007/03/telecom-regulatory-environment-rohan-samarajiva.pdf. For ongoing work on refining the methodology, see: www.lirneasia.net/2007/03/colloquium-on-refining-tre-methodology/.

chapter three

The Digital Opportunity Index (DOI)

3.1 Using the Digital Opportunity Index (DOI)

The Digital Opportunity Index (DOI) has been designed to as a tool for tracking progress in bridging the digital divide and the implementation of the outcomes of the World Summit on the Information Society (WSIS). As such, it provides a powerful policy tool for exploring the global and regional trends in infrastructure, opportunity and usage that are shaping the Information Society.[1] As explained in Chapter one, the DOI is one of two tools adopted by WSIS as part of an agreed implementation methodology. It has a focus on the adoption of new technologies, such as broadband and mobile Internet. A time series has been developed to monitor implementation of WSIS targets since the first phase of WSIS and will continue until the WSIS review in 2015 (see Data Table 3).[2] The DOI thus complements the other WSIS-endorsed composite index—the ICT Opportunity Index—which has a stronger focus on traditional ICTs, such as fixed-lines and televisions, as well as on measures of literacy and educational achievement.[3]

This chapter explores key trends in the Information Society. Section 3.2 explains the structure of the DOI and indicators that are used to assess digital opportunity. Section 3.3 examines the latest DOI scores and rankings, for 2005/06. Section 3.4 reviews trends in the DOI over time. Section 3.5 uses the DOI to examine the key trends shaping the Information Society. It shows that many parts of the developing world are making strong gains in mobile telephony. By the end of 2008, over half the world's population should have access to a mobile phone. Meanwhile, however, developed countries are forging ahead with new technologies and ever-faster access. As shown in Chapter two, the digital divide is changing from inequalities in basic availability of ICTs to differences in the quality of the user experience. Policy-makers need to adjust their policy responses to take account of "quality", not just the "quantity" of access to ICTs.

3.2 Structure of the DOI

The DOI is a composite index comprising eleven separate indicators, grouped in three clusters of *Opportunity*, *Infrastructure* and *Utilization* (Figure 3.1d).[4] The choice of indicators is notable, as:

» The DOI includes price data for mobile telephony and Internet access relative to local incomes to reflect the affordability of ICTs and whether consumers can pay for mobile phone or Internet access in different countries. The DOI is the only index to date that includes price data for 181 economies, which is vital in assessing effective market demand.

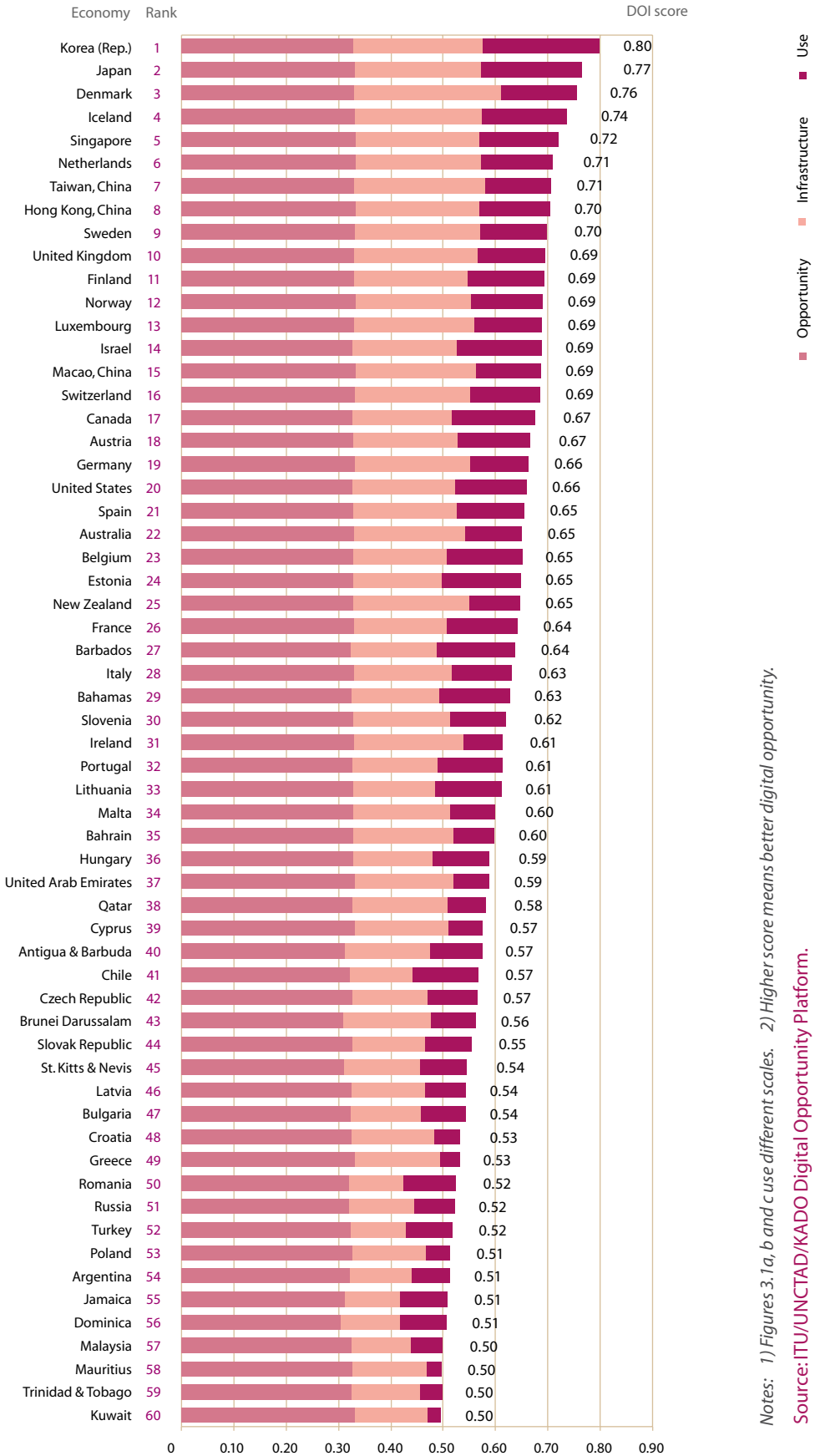
» The DOI uses household penetrations (rather than per capita penetrations) for fixed lines, Personal Computers (PCs) and Internet access, as access to ICTs often begins in the home. Household penetration is appropriate for fixed lines, as they are provided on a household basis, while home access to the Internet is significant in many countries (Figure 3.7). Using household penetrations reflects more accurately the true state of access to ICTs in developing countries, where average family size is larger, so per capita penetrations appear artificially suppressed and are lower.

» The DOI includes measures of more advanced technologies in broadband access (for both fixed broadband access and mobile broadband or 3G). This means that the DOI can reflect the startling growth in these markets. It can also be used to assess market maturity, in the proportion of Internet and mobile subscriptions that have migrated to high-speed broadband access (see Figure 3.4 on the "New Substitution").

Indicators in various data series are standardized on a scale of zero to one, by indexing relative to a reference value (data series and reference values are given in the Annex to this Chapter). For most indicators, this is 100 per cent, making the DOI simple and straightforward to calculate (simply dividing the indicator value by 100). Index scores in the three clusters are then averaged by simple average to give the overall DOI score for a country, between zero and one (no country achieves the upper or lower limit scores). Scores are directly comparable between countries and between years.

The results are remarkably straightforward and easy to use. Access to and the affordability of ICTs is condensed into a single index number between one and zero, permitting comparison of countries' scores in any one year, as well as over time. A time series has been established, stretching back to the start of the WSIS process in 2000/01. This Report presents the latest results for the DOI 2006 (Data Table 1 in the Statistical Annex). As explored in the next section, results for the DOI show strong gains in digital opportunity around the world.

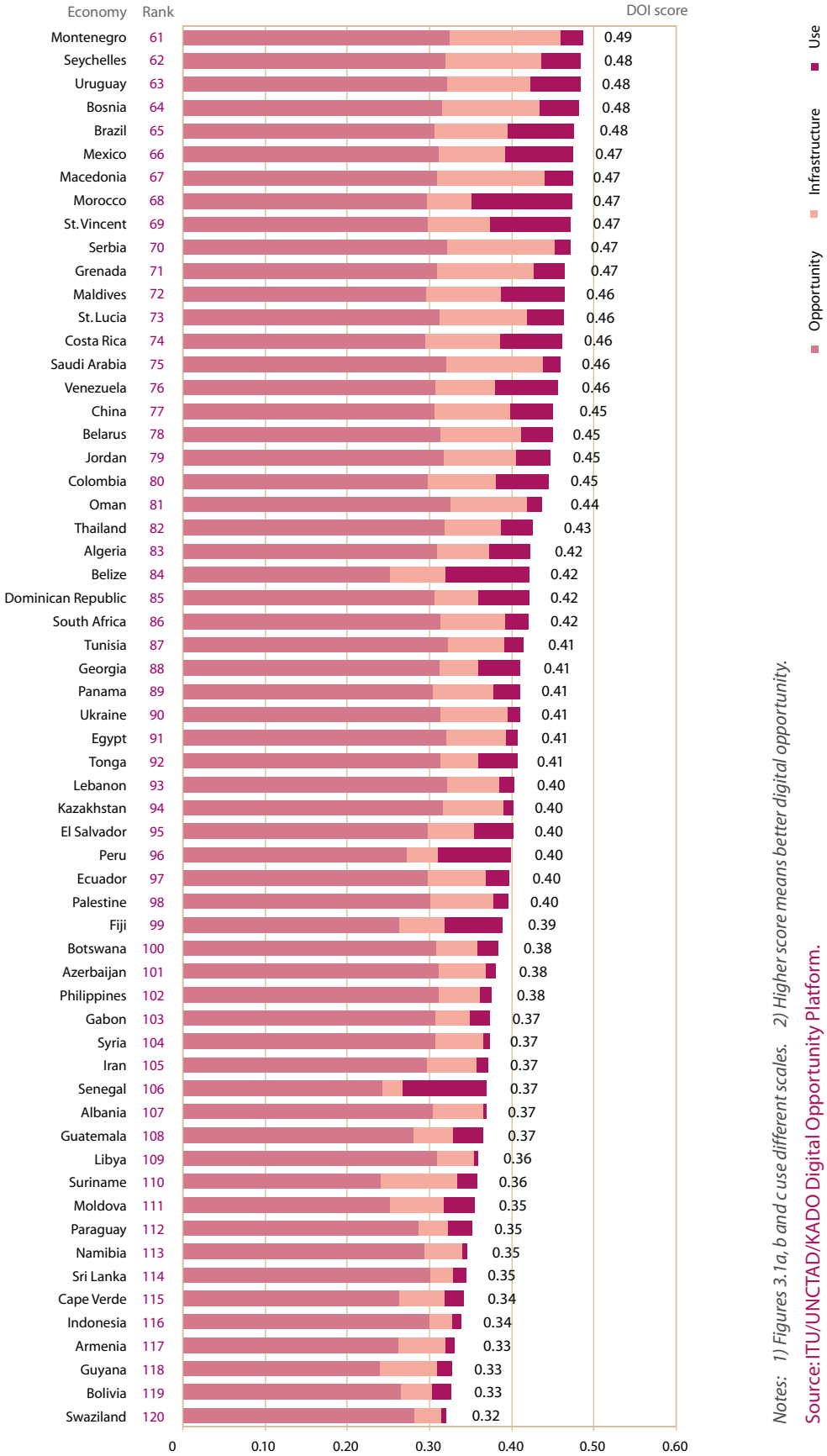
Figure 3.1a: Digital Opportunity Index 2005/06 – World



Notes: 1) Figures 3.1a, b and c use different scales. 2) Higher score means better digital opportunity.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

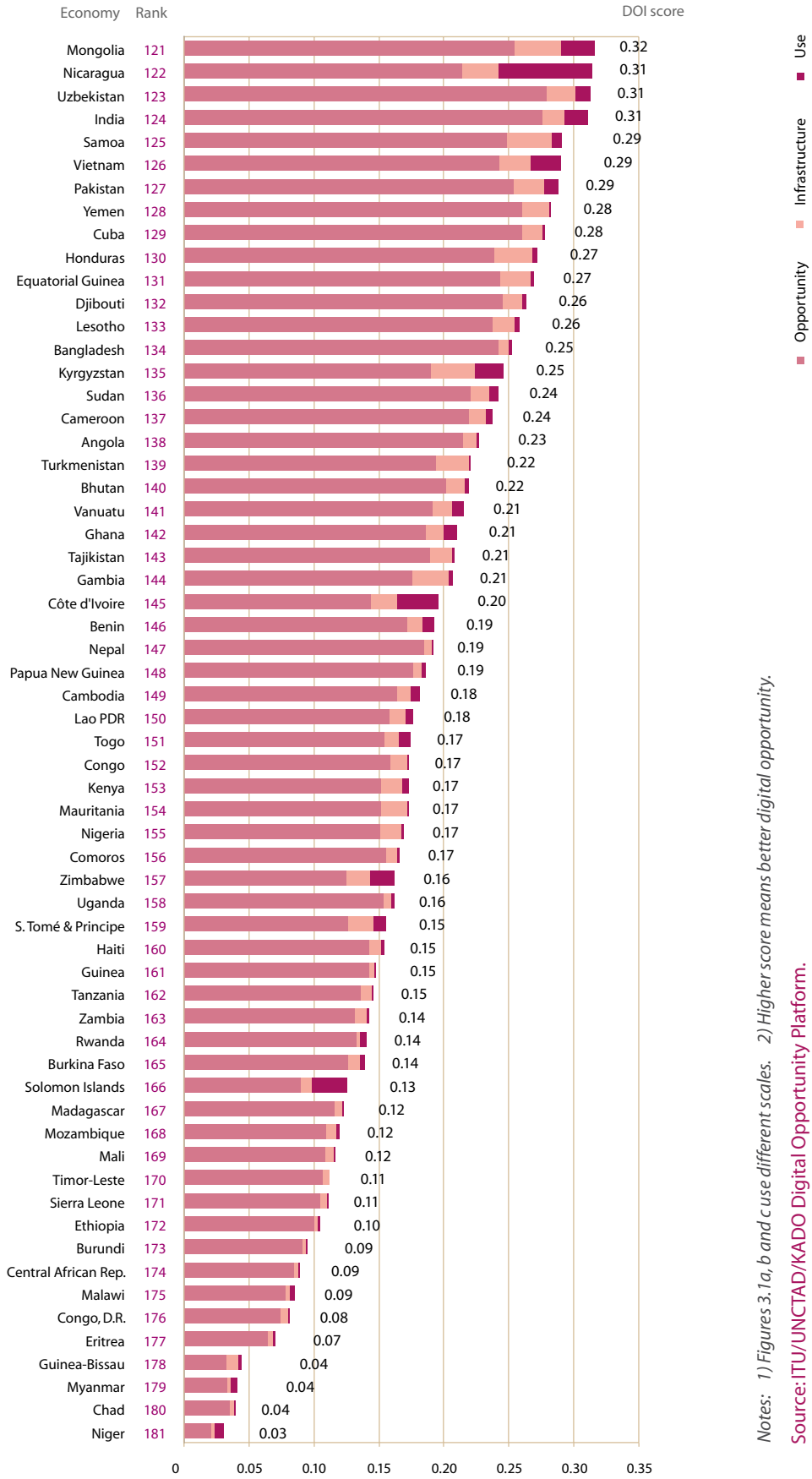
Figure 3.1b: Digital Opportunity Index 2005/06 – World



Notes: 1) Figures 3.1a, b and c use different scales. 2) Higher score means better digital opportunity.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Figure 3.1c: Digital Opportunity Index 2005/06 – World

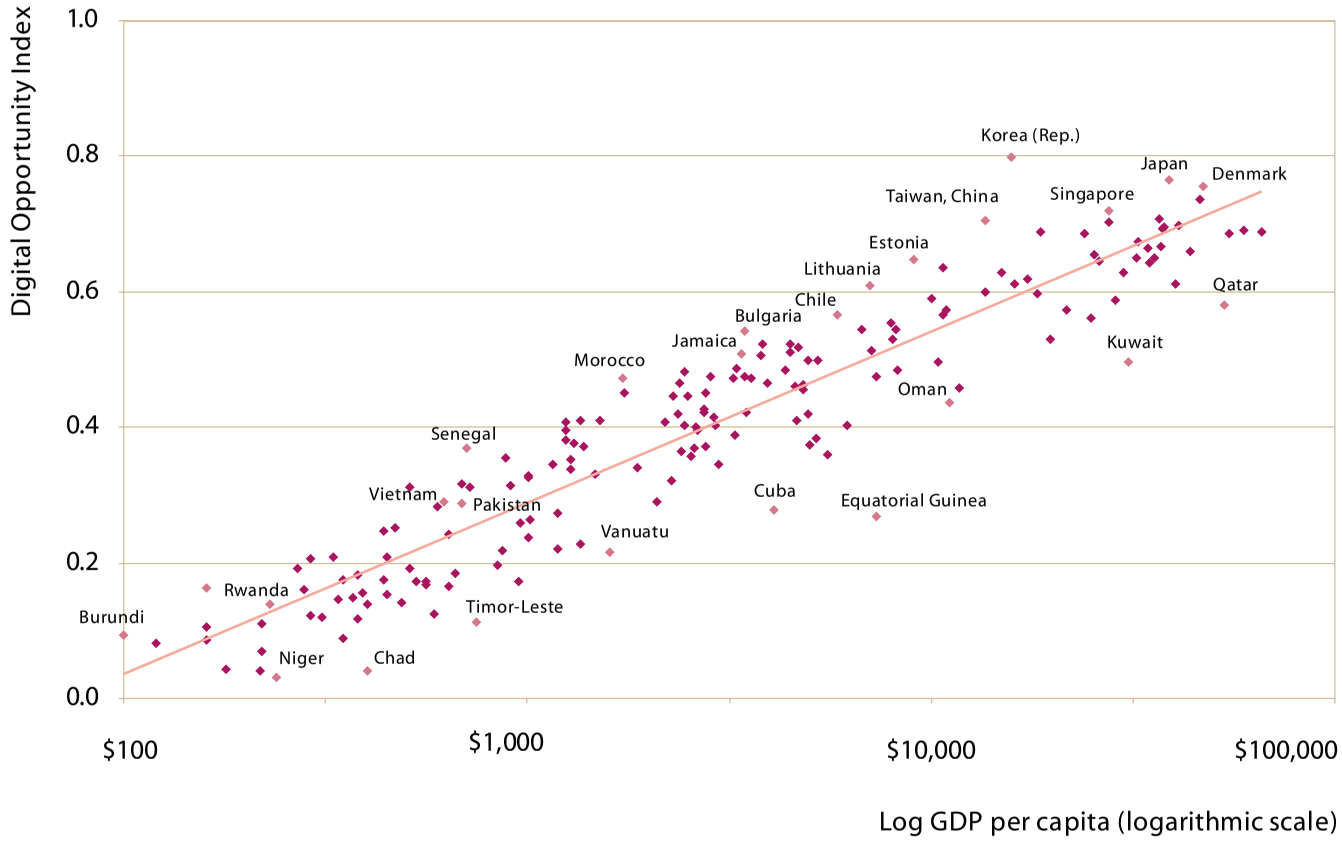


Notes: 1) Figures 3.1a, b and c use different scales. 2) Higher score means better digital opportunity.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Figure 3.1d: How Digital Opportunity relates to national economic performance

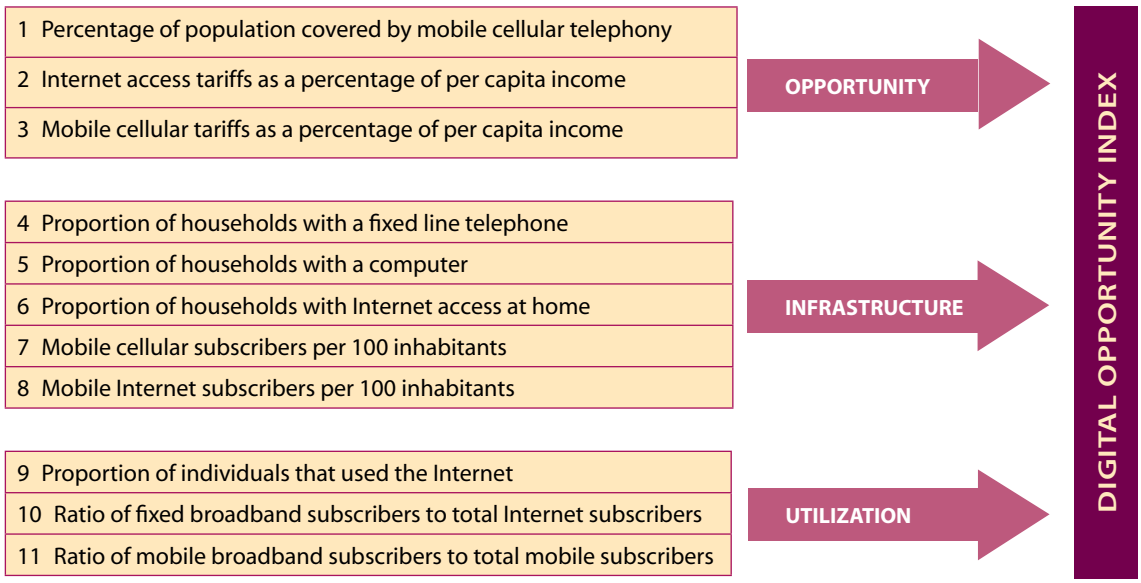
The chart shows the relationship between DOI and national wealth, as indicated by GDP per capita, using a logarithmic scale.



Note: Economies shown above the line have a higher DOI score than would be predicted by their GDP per capita. Economies below the line have a lower DOI score than would be predicted by their GDP per capita.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Figure 3.1e: Structure of the Digital Opportunity Index



Note: *The indicators are averaged within each category and categories are averaged to obtain the Digital Opportunity Index value.*

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

3.3 Digital Opportunity around the world

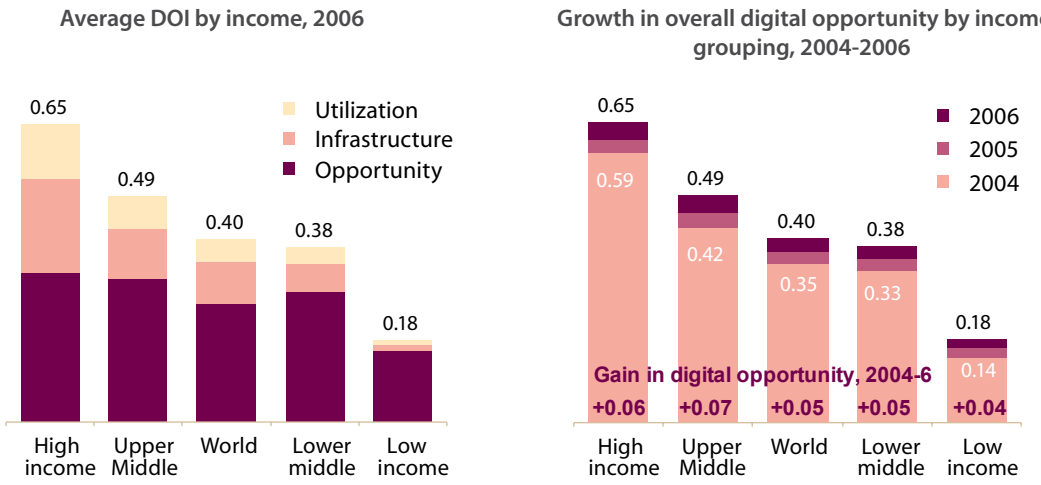
The average DOI score worldwide in 2005/2006[5] was 0.40, up from 0.37 a year earlier (an increase of 8 per cent: See Data Table 3). However, there are big disparities, with low-income economies averaging less than half of this, at 0.18. In contrast, the average DOI score for high-income economies is more than three times the low-income score at 0.65 (Figure 3.2, left). Basic access to telecommunications and affordability are the main areas of achievement for most countries (the purple area in Figure 3.2, left), especially for low-income countries. High- and upper-middle income countries have made the strongest gains in digital opportunity since 2004, mainly through growth in high-speed broadband infrastructure and use of advanced technologies (Figure 3.2, right). However, small increases in average income have a much greater impact in raising digital opportunity at lower levels of income – a 'logarithmic' relationship (Figure 3.1e). This is similar to the relationship observed with Internet user penetration and average income (Figure 2.8). The larger gains achieved by the higher income groupings[6] since 2004 suggest that absolute inequality[7] (measured in percentage points) in digital opportunity may be growing.

DOI scores are also sharply differentiated according to region (Figure 3.3, left). Europe and the Americas have average DOI scores higher than the world average, Asia's is equal to the world average, while Africa has an average DOI score of 0.22, mainly due to limited utilization and fixed line infrastructure. Europe has achieved the largest overall gain in digital opportunity over the last two years, followed by the Americas, which made especially remarkable progress in 2006. Asia and Africa have witnessed smaller gains in digital opportunity (Figure 3.3, right). The implications for the digital divide are clear: digital opportunity is becoming more sharply divided by region, not less.

3.3.1 Economies with High DOI scores (0.49+) – Surge in High-Speed Access

Economies with high DOI scores are mostly developed economies in Europe, North America, East Asia and the Pacific. They include all 30 OECD member states except Mexico. These economies

Figure 3.2: Digital Opportunity by income grouping

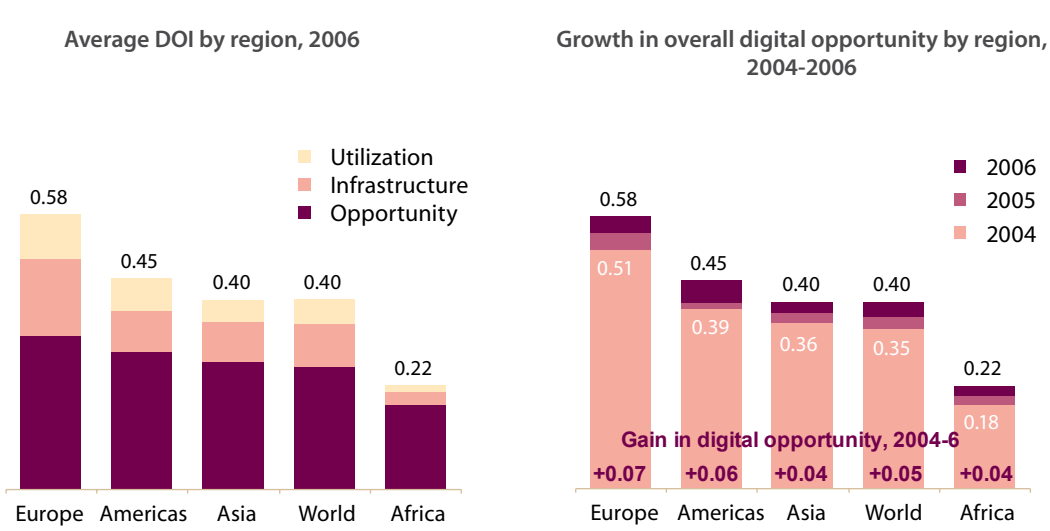


Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

provide good digital opportunity for most of their inhabitants, with varied and extensive infrastructure, relatively low prices and widespread use of new technologies. Virtually all high-DOI economies have high Opportunity, in excess of 0.99, except for a few Caribbean island states (Antigua & Barbuda, St. Kitts & Nevis and Dominica, with somewhat lower mobile coverage). High-DOI economies generally also have widely available infrastructure, with an average Infrastructure index of 0.54.

The factor that continues to set this group of countries apart, however, is their high Utilization averaging 0.33 (up from 0.25 last year), due to their high Internet usage and broadband subscriber penetrations. The Rep. of Korea stands out with an overall DOI score of 0.80, ahead of Japan at 0.77 and Denmark at 0.75. Japan and Denmark have made strong gains in digital opportunity and, if their current growth rates continue, it is likely that they will overtake the Rep. of Korea in digital opportunity in 2006/07.

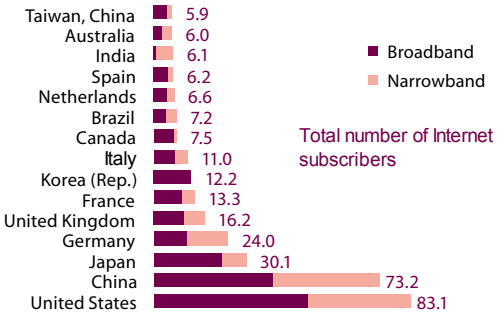
Figure 3.3: Digital Opportunity worldwide



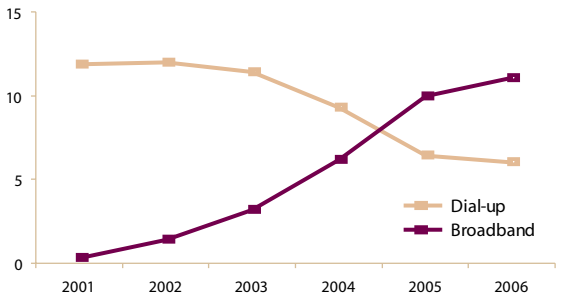
Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Figure 3.4: The New Substitution

Top economies by total number of Internet subscribers, in millions, 2005



Type of Internet connections in the United Kingdom, total in millions, 2001-2006



Source: ITU/UNCTAD/KADO Digital Opportunity Platform (left chart); OFCOM (UK), "The Communications Market 2006", at: www.ofcom.org.uk/research/cm/cm06/ (right chart). See also Table 10 in the Statistical Annex.

The top 25 economies in the DOI have been remarkably stable over the period 2004-2006. Indeed, the only economy to drop out of the top twenty-five was Slovenia, replaced by Estonia (studied further in Chapter four, Section 4.2.2). Rankings within the top twenty-five are consistent (suggesting the index is robust), with generally changes of only a few places up or down – the only exceptions are the United Kingdom (which rose eight places due to strong gains in broadband, with subscribers renouncing their dial-up connection – see Figure 3.4, right chart), and Canada (which falls seven places, due to its relatively weak cellular mobile penetration). Mauritius is the highest-ranking African economy, at 59th. Chile remains the highest-ranking Latin American country at 41st, followed by Argentina at 54th. The Gulf States continue to do well (including Bahrain at 35th place, the United Arab Emirates in 37th rank and Qatar in 38th rank), as do the Caribbean and other small island states.

Evolution in Internet subscriptions depends on both growth in the total size of the market, as well as the speed (quality) of connections. 2005 was a year of startling Internet growth in many countries, thanks to the boost from broadband, although the United States still remains the largest Internet market in terms of number of subscribers (Figure 3.4, left). Growth rates in Internet subscriptions are lower in high-DOI economies, but substitution is strong, with subscribers exchanging narrowband dial-up for a broadband connection. One example is the substitution of broadband for dial-up in the United Kingdom (Figure 3.4, right). In the United States, some 60 per cent of all Internet connections are now broadband, while in Japan and Spain, efforts by operators to encourage consumers towards broadband have resulted in three-quarters of Internet subscribers now using broadband. In the Rep. of Korea and Canada, virtually all Internet users are already broadband subscribers and enjoy access to faster, advanced services such as video, teleconferencing, multiplayer gaming and triple play. Substitution of broadband for dial-up has also been observed in Qatar, where broadband now accounts for two-thirds of all Internet accounts.[8]

3.3.2 Economies with Medium DOI scores (0.30-0.49) – Rounded growth

The group with medium DOI scores comprises diverse economies from Latin America and the Caribbean, Asia and North Africa. Notably, it includes the developing country giants of China, Brazil, Egypt and Indonesia, as well as India, which joins the medium-DOI countries for the first time in this year's release of the DOI. It also includes the upper-middle income African states of South Africa, Botswana and Gabon, as well as Namibia and Senegal (Box 3.1). Non-OECD European countries generally also have medium-DOI scores (e.g., Albania, Belarus, Bosnia and Ukraine). China and the Maldives are the highest-ranked developing countries from Asia in the group. Medium-DOI countries have high average *Opportunity* at around 0.89, due to good mobile coverage and relatively low prices. What distinguishes this group from the low-DOI economies is their reasonable infrastruc-

ture and growing use of advanced technologies, but only at levels around a third of those achieved by high-DOI economies. They are also growing very fast - Brazil is now the tenth-largest Internet market in the world, while India appears in the top fifteen largest Internet markets for the first time.

One interesting observation among the medium-DOI group is that there are a growing number of countries where *Utilization* scores exceed *Infrastructure*. Last year, *Utilization* exceeded *Infrastructure* scores in only six economies.[9] This year, *Utilization* exceeds *Infrastructure* scores in nineteen economies, thirteen of which are medium-DOI economies. The strong growth in broadband worldwide means that some economies are successfully leveraging their investments in infrastructure to yield more rounded growth and more advanced forms of usage across a broad Information Society. For example, in Morocco, broadband now accounts for 98 per cent of all Internet connections in 2006 due to an aggressive marketing campaign between operators fighting for market share, resulting in high utilization more than twice its infrastructure index (Box 3.2). This may represent a new form of technological 'leapfrogging', where operators investing in Internet infrastructure are able to adopt the latest technologies.

3.3.3 Economies with Low DOI scores (0.30 and less) – Mainly mobile

Digital opportunity in low-DOI economies is still expressed in terms of potential access to the Information Society that has not yet been fully realized. Low-DOI economies include many lower-income African and Asia-Pacific countries, with low levels of infrastructure, limited availability of the Internet and broadband and high prices as a proportion of local incomes. An hour's Internet access per day exceeds the average daily income in most of these countries. In order for these countries to fully participate in the Information Society, prices must be reduced so that telecommunication services become more affordable.

Box 3.1: Senegal – Reaping the Rewards of Early Reforms

Senegal has succeeded in raising its DOI score from 0.22 in 2004 to 0.37 in 2006, whilst its ranking has risen 22 places to 106th in 2006. This makes it the third-fastest rising economy worldwide in terms of increase in ranks (Table 3.3) and second-fastest in Africa. It is interesting to examine how Senegal has achieved this.

The Government undertook early reforms in important areas. The incumbent operator, SONATEL, was partly privatized in 1997, the first African telecommunication operator to be listed on a stock exchange. In 2001, Senegal established the Telecommunications and Posts Regulatory Agency (ARTP). In 2004, the Ministry of Posts, Telecommunications and New Information Technologies was created. The Government aims to make ICTs a driver of economic growth and modernization. The Government issued a sector note on telecommunications in January 2005 which calls for an increase in telephone subscribers to 3 million by 2008. This target is likely to be achieved, with 2.5 million telephone subscribers by June 2006 already.

Senegal was also connected to two submarine fiber optic cables, dramatically increasing its international connectivity. SONATEL doubled traffic bandwidth on Internet services in less than 2 years surpassing in September 2006 the mark of 1.24 Gbit/s, according to SONATEL. By 2006, Senegal had 775 Mbit/s of international Internet bandwidth, one of the highest per capita capacities in Africa. Senegal hopes to leverage its abundant bandwidth by serving as a hub for western Africa. SONATEL has launched ADSL and, by the end of 2005, some 89 per cent of all Internet connections were already broadband, suggesting a successful "technological leapfrogging" strategy.

Despite these impressive accomplishments, Senegal needs to go further if it is to be successful at using ICTs for development. Although the growth of broadband subscribers has averaged 2'000 per cent over the last five years, Internet subscriber penetration is just 2.3 per 100 inhabitants, due to widespread use of community multimedia telecentres (Box 6.3 in Chapter six). The growth in Internet traffic reflects the boom in the number of users in Senegal in recent years. As broadband prices fall, more people are using the Internet, both at work and home. Standard broadband subscriptions cost EUR80 for installation and EUR40 per month for the service, although cheaper deals are becoming available. The real key to growth in Internet use has been the surge in popularity of cybercafés, which offer a high speed Internet line for as little as EUR0.45 per hour (Box 6.3).

Source: UNCTAD, adapted from Agence de Régulation de Télécommunications (ART, Sénégal), "Le marche de l'Internet", web page, at: www.artp-senegal.org/telecharger/Fiche_Internet_2005.pdf

For many developing countries, wireless communications are driving digital opportunity. Many low-DOI economies are in sub-Saharan Africa. As a region, Africa's mobile market was the fastest-growing market over the last five years, with a 50 per cent annual average growth rate over 2000-2005, more than twice the global average over the same period (24 per cent). Mobile phones now outnumber fixed phones by nearly five to one in Africa, with some 137.2 million mobile subscribers by the end of 2005. This ratio is even higher in Sub-Saharan Africa, where nine out of every ten subscribers are using a mobile. African mobile penetration doubled from 6.5 per 100 inhabitants in 2003 to 13.1 per 100 inhabitants in 2005.

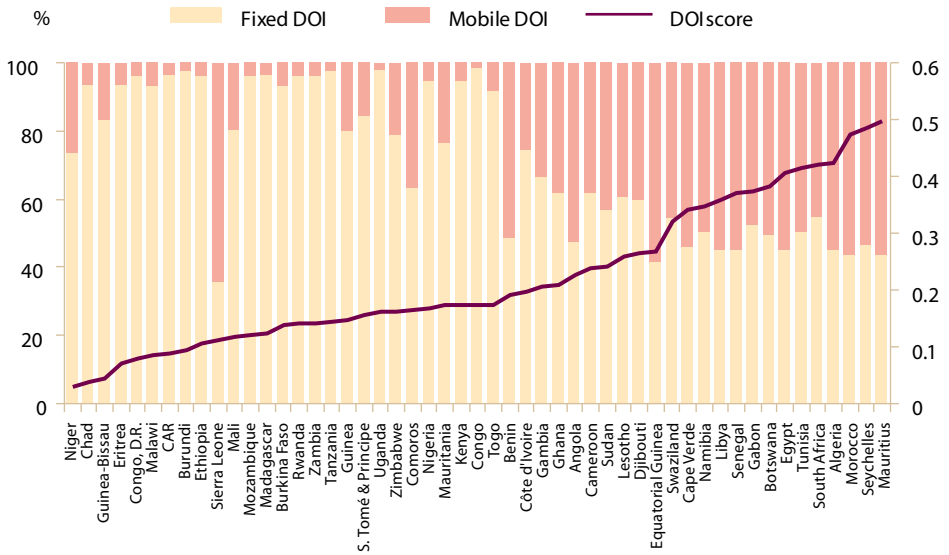
The DOI can be used to compare the fixed and mobile sectors separately, allowing policy-makers, especially in developing countries, to adapt national policies to their own national circumstances, as called for by Para 28 of the Geneva Plan of Action.[10] The economies where mobile components contribute the highest share towards the overall DOI score are mostly in Africa, where the mobile sector can account for as much as four-fifths of digital opportunity, although DOI scores remain generally low overall at around 0.22 (Figure 3.5). Prepaid has been a major driver in Africa's mobile growth, with some 92 per cent of African subscribers using a prepaid package in 2005. Large African mobile strategic investors (such as Celtel, MTN and Vodacom) have emerged (Table 3.1), enjoying subscriber growth rates far greater those found in mature mobile markets. These pan-African operators have been able to exploit the growing demand for mobile telephony across many countries to build large-scale operations with significant economies of scale, negotiating group-wide purchases of equipment at lower costs.

Figure 3.5 also implies that, for African countries with strong mobile sectors, cell phones could be leveraged to also provide Internet access. There is substantial work within the industry to promote mobile Internet use beyond simple applications for chatting, email or simple browsing:

"A cellphone, despite its small screen size, 12-digit keypad (in most cases), and potentially slower connection speed, has the ability to provide the most popular web-based services. According to Jupiter Research, the most popular online activities are sending and receiving e-mails, researching and purchasing products online, obtaining local news, listings, maps and traffic information, using instant messaging,

Figure 3.5: The Mobile Information Society in Africa

Strength in mobile is the main driver of digital opportunity in Africa, where the mobile sector (represented by the pale yellow area) accounts for over half of total digital opportunity (purple line) in the majority of African countries, 2005.



Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Table 3.1: Africa's mobile strategic investors

Strategic investor	Subscribers (000s) 2006	Subscribers (000s) 2005	% change 2005/06	Revenue (m US$) 2005	% change 2004/05	Yearly ARPU (US$)*	African Countries where the Investor has Operations
MTN	24'300 (Mar 2006)	15'600 (Mar 2005)	56%	$4' 545 (Mar 2005)	21%	$291	Afghanistan, Benin, Cameroon, -, Congo, Ghana, Guinea, Guinea-Bissau, Liberia Nigeria, Rwanda, South Africa, Swaziland, Sudan, Syria, Uganda, Yemen.
Vodacom	23'520 (Mar 2006)	15'483 (Mar 2005)	52%	$5'328 (Mar 2006)	25%	$227	Congo (DR), Lesotho, Mozambique, Mauritius, South Africa, Tanzania
Orascom	21'128 Africa (total 46'522)	17'500 (total 30'383)	53% (total)	$3'216	-0.30%	$69	Algeria, Egypt, Iraq, Pakistan, Tunisia, Zimbabwe.
Celtel	15'270 (Sept 2006)	5'375 (Sept 2005)	184%	$953	60%	$62	Burkina Faso, Chad, Congo, Congo (DR), Gabon, Kenya, Niger, Nigeria, Madagascar, Malawi, Sierra Leone, Sudan, Tanzania, Uganda, Zambia.
Orange	n/a	5'188 (Sept 2005)	n/a	n/a	n/a	n/a	Botswana, Cameroon, Côte d'Ivoire, Egypt, Eq. Guinea, Madagascar, Mali, Mauritius, Reunion, Senegal.
Millicom	12'800 (Sept 2006)	8'929 (Sept 2005)	43%	$1'084	6%	$85	Chad, Congo (DR), Ghana, Mauritius, Senegal, Sierra Leone, Tanzania.
Etisalat	n/a	4'534	n/a	$3'512	+23%	$775	Benin, Burkina Faso, Central African Rep., Côte d'Ivoire, Gabon, Niger, Pakistan, Qatar, Saudi Arabia, Sudan, Tanzania, Togo, UAE.
Total	97'018	72'609	n/a	$18'638	18%	$145	

Source: ITU, abridged from company reports.

** Estimated by ITU – not operators' official figures.*

utilizing search portals, banking and reading news. Most of these activities can be done fairly easily on the average cellphone with a data connection today. Cellphones do not require a consistent power supply, can be charged every few days, and can be carried securely in a pocket, an important feature in developing countries. Moreover, data and voice can be purchased in small increments."[11]

Source: rcrnew.com

3.4 Growth in Digital Opportunity over time

As emphasized in Chapter one, the main purpose of the DOI is to track progress towards bridging the digital divide and meeting the WSIS targets. This release of the DOI includes a three-year time series for 181 economies from 2004-2006. As shown in Figure 3.2, scores in the Digital Opportunity Index have been increasing steadily over the last couple of years. Virtually every economy has succeeded in improving access to ICTs in some way. It is only by making international comparisons that it is possible to identify those policies that have been the most effective resulting in above average growth. For this reason, an approach based on comparative rankings is more meaningful than one that uses absolute growth rates.[12]

Table 3.3 lists the top ten gainers in terms of increases in ranks (see also Data Table 3). Economies with lower ranks tend to exhibit more mobility in the index (both up and down). Analysis of changes in DOI scores over time shows that economies are gaining in strength in different areas. Five of the top ten gainers come from Africa (Table 3.2). Morocco has the greatest overall gain in rankings this year due to its remarkable improvements in Utilization (Box 3.2). Senegal has also made strong inroads in broadband access, with 89 per cent of all Internet subscribers subscribing to broadband in 2005 (Box 3.1), as well as widespread Internet access through multimedia telecentres (Box 6.3 in Chapter Six).[13] The other African economies in the top ten (Ghana, Gabon and Côte d'Ivoire) have witnessed increased mobile coverage and greater access to telecommunications at reduced prices.

Other major gainers in the DOI include the Russian Federation and Romania, which have made strong gains in Utilization, mainly through growth in Internet usage and broadband access. Only the Russian Federation and Antigua and Barbuda have succeeded in boosting Infrastructure by an increase of more than 15 percentage points over the three-year period, suggesting that improved infrastructure is a longer-term goal for most economies. Overall, however, Table 3.2 suggests that improvements in the DOI are not limited to any particular region – varied countries with different profiles in the development of their Information Society have enjoyed gains in digital opportunity.

In many countries, growth in digital opportunity is being driven by reductions in price of telecommunication services. ITU has measured the price of different telecommunication services since 2002 notably for mobile, Internet and broadband services. Prices for mobile, Internet and broadband services have fallen since 2003[14], due to grow-

Table 3.2: Top Ten Gainers in the Digital Opportunity Index, 2004-2006

	Economy	DOI 2004	DOI 2006	Rank 2004	Rank 2006	Δ ranks	Drivers
1	Morocco	0.33	0.47	104	68	+36	U
2	Russian Federation	0.38	0.52	78	51	+27	I,U
3	Senegal	0.22	0.37	128	106	+22	O,U
4	Ghana	0.10	0.21	161	142	+19	O
5	Antigua & Barbuda	0.44	0.57	58	40	+18	I,U
6	Gabon	0.26	0.37	121	103	+18	O
7	Belize	0.34	0.42	100	84	+16	U
8	Bhutan	0.12	0.22	155	140	+15	O
9	Cote d'Ivoire	0.12	0.20	158	145	+13	O
10	Romania	0.42	0.52	63	50	+13	U
	Average (top 10)	0.27	0.39	113	93	+ 20	
	Average (world)	0.35	0.4				

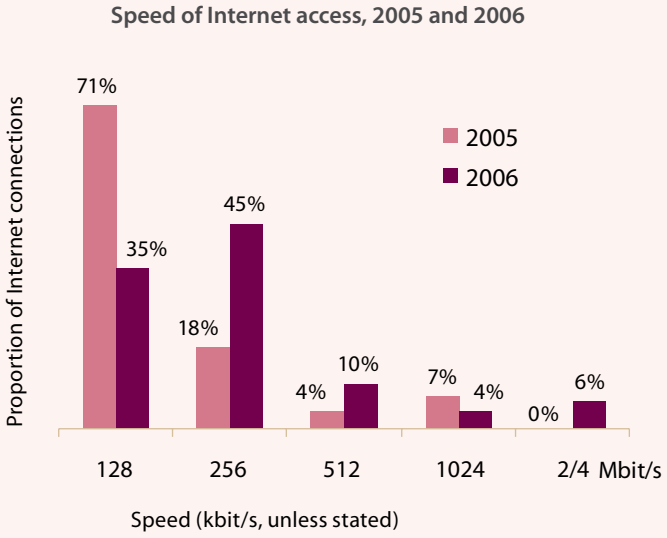
Note: O = Opportunity; I = Infrastructure; U = Utilization sub-index. A driver is defined as a sub-index where there is an improvement of score of 0.15 or more over the period 2001-2006.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Box 3.2: Morocco – An African Success Story

Morocco initiated market liberalization relatively early. In mobile communications, it became one of the first North African countries to introduce competition when it licensed a second mobile operator, Médi Telecom, in July 1999. A few months later in December 1999, the government sold 35 per cent of incumbent Maroc Telecom to Vivendi of France (see Box 4.2 in Chapter four). Intense competition between the two operators led to mobile phones overtaking fixed lines in August 2000, just six months after the second operator had launched its network. By June 2001, Médi had 755'000 customers and a population coverage of 70 per cent. Maroc Telecom responded by investing US$ 275 million in its network and innovating with its price strategy. It achieved a client base of one million customers in June 2000, two million in November 2000 and three million by May 2001. The recent growth in Morocco has significantly surpassed all its North African neighbours.

Box Figure 3.1: Evolution in the speed of Internet access in Morocco



Source: Agence Nationale de Régulation des Télécommunications (ANRT).

Now, some of the same dynamism is reaching the Moroccan Internet market. Helped by Morocco's proximity to fibre networks in the Mediterranean, Maroc Telecom and the ISP Menara have launched a range of high-speed packages at comparatively low prices, including the highest speed broadband package in Africa at 4 Mbit/s. Surveys of the residential market carried out by the regulator, the National Agency of Telecommunication Regulation (ANRT), show that broadband connections are moving to progressively higher speeds. With nearly 400,000 ADSL connections at the end of 2006, Morocco is the top country in Africa in terms of the total number of broadband subscribers, well ahead of South Africa (although Mauritius had the highest broadband penetration). At the end of 2006, ADSL accounted for 98 per cent of all Moroccan Internet connections (including dial-up and leased lines). Broadband connections increased by 58 per cent over 2005-2006, compared to dial-up, which lost ground with a 40 per cent drop. These changes in the Sector all helped Morocco to take the position of "fastest gainer" in the DOI between 2004 and 2006.

Source: Moroccan household survey 2006, Moroccan regulator, the Agence Nationale de Régulation des Télécommunications (ANRT), available in French from: www.anrt.net.ma/fr/.

ing liberalization and more competitive markets. For example, in South Africa in February 2007, the operator MTN increased data capacity and reduced broadband prices by up to 20 per cent, seeking "to bring mobile data within reach of a larger proportion of our population".[15] Broadband providers in South Africa are innovating with a greater range of packages, pay-as-you-go or contract options for broadband, extended contracts and 'shaped' or 'unshaped' offers (prioritizing traffic according to consumers' specific needs) to attract customers. In some countries, reductions in prices for telecommunication services have directly resulted in a growing number of subscrib-

ers: the UAE incumbent Etisalat reports that after rates of its high-speed Internet service Al Shamil were reduced by 46 per cent in 2005, the number of subscribers grew by 140 per cent.[16] Greater choice of products, pricing and access platforms has fuelled growth in broadband in the UK.[17]

3.5 Key Trends in the Information Society

3.5.1 Cutting the cord

The DOI measures the proportion of households with access to fixed lines (widely available from surveys or by derivation, i.e., residential telephone lines per 100 households). Fixed lines have historically been important for voice, faxes, text and data communications. The DOI shows that fixed lines in homes are declining, mainly in response to the rise of mobile communications. This trend makes it likely that countries will never achieve 100 per cent fixed household penetration.

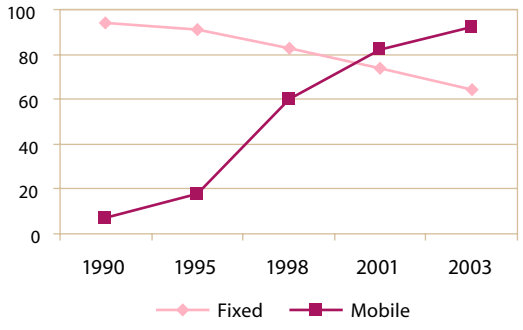
A good example is Finland, which has seen a dramatic drop in the proportion of homes with fixed telephones from 94 per cent in 1990 to 64 per cent in 2003 (Figure 3.6) and an estimated 57 per cent by 2005.[18] Nearly all Finnish from homes that do not have a fixed line nevertheless own a mobile phone or have access to one. Remarkably, over 80 per cent of Finnish homes with a fixed telephone line are connected to DSL broadband service - many Finns are keeping their fixed telephone line mainly for broadband access.

Given the preference of many users for mobile rather than fixed telephony, this indicator could be adapted to measure the existence of a telephone in the household, regardless of whether it is fixed or mobile. However, the DOI already measures mobile penetration through a per capita subscription indicator, since mobile telephones are personal and are less likely to be shared. While mobile telephone networks are evolving in their ability to offer higher-speed Internet access, high-speed wireless networks have yet to be widely launched around the world. There are, in general, only a small proportion of households that currently use high-speed mobile networks to access the Internet, although fixed usage of 3G wireless for broadband Internet service is increasing. One example is the Czech Republic, where more than a third of the one million broadband subscribers at the end of December 2006 were using fixed wireless broadband.[19] Despite this reduction in fixed lines in developed nations and lower rates of growth in developing ones, an indicator measuring the availability of telephony and potential home access to the Internet is vital for policy analysis.

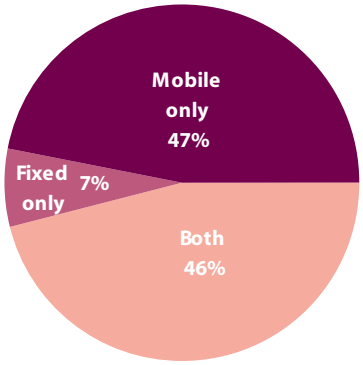
The growing use of Voice over Internet Protocol (VoIP) worldwide suggests that over time, fixed voice services will be provided over broadband

Figure 3.6: Abandoning fixed lines

Proportion of Finnish households with telephones



Proportion of Finnish households with fixed lines, mobile phones and both, 2005



Source: Adapted from Statistics Finland (left) and Eurobarometer (right).

connections.[20] In the future, it would be interesting to include subscriptions to connections capable of providing broadband access to the household. This would include not only fixed telephone lines, but also cable television and suitable equipped wireless connections, such as third generation mobile or fixed wireless access.

3.5.2 Getting connected to the Internet

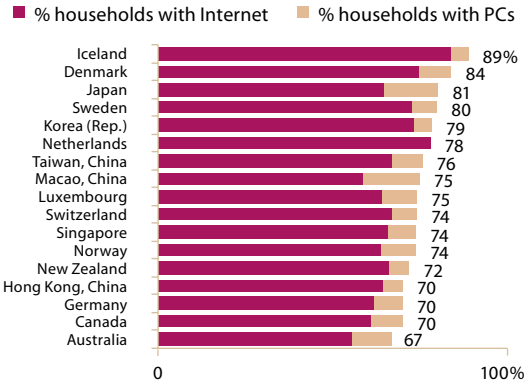
The price of computers remains a major obstacle to wider household penetration, especially in developing nations. However, one would assume that, having bought a computer, most households would then want to connect it to the Internet. In developed economies, access to the Internet is more likely to be from home than from the workplace, with high household Internet and PC penetrations in all high-DOI economies (Figure 3.7, left). Iceland leads the world, with a household penetration of Internet access at 84 per cent and PCs at 89 per cent. In many developing countries, home is not the main place of access for users. There has been an explosive growth in public Internet facilities in many countries to cater to those without home Internet access (see the examples given in Chapter six). In fact, access from public facilities may be so successful that it may even be constraining growth in home Internet access in developing nations.

However, intriguingly, not all home computers are connected to the Internet. The ratio of home computers with Internet access differs widely. The ratio of home computers connected to the Internet ranges from 95 per cent in Estonia to 20 per cent in Lebanon (Figure 3.7, right). In the Baltic nations, Estonia and Latvia have computer to Internet ratios of some 95 per cent, yet in Lithuania, only 50 per cent of computers are connected to the Internet. Average income in Lithuania is lower than the other two countries, but Internet tariffs are cheaper and access is more affordable (See Data Table 9 in the Statistical Annex). Therefore, it is unclear why Lithuania has such a lower ratio of computers with Internet access. In Latvia, the ratio was just below 100 per cent in 2005 and exceeded it in 2006. The national statistical office reported that many households were accessing the Internet through mobile phones.

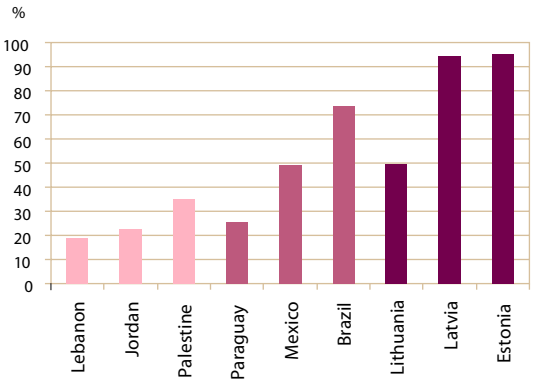
Japan has a high proportion of households with PCs without Internet (Figure 3.7, left) – partly due to the popularity of mobile Internet access in Japan. Mobile Internet access could result in relatively limited functionality in the passive web experience of cell phones, instead of positive participation in online web intelligence. These different patterns of Internet usage could result in the development of different skill sets and could shape the Information Society differently, according to the type, speed and capacity of Internet access available.

Figure 3.7: Household Internet Access

Household Internet and PC penetration for the economies with highest household penetrations, 2005

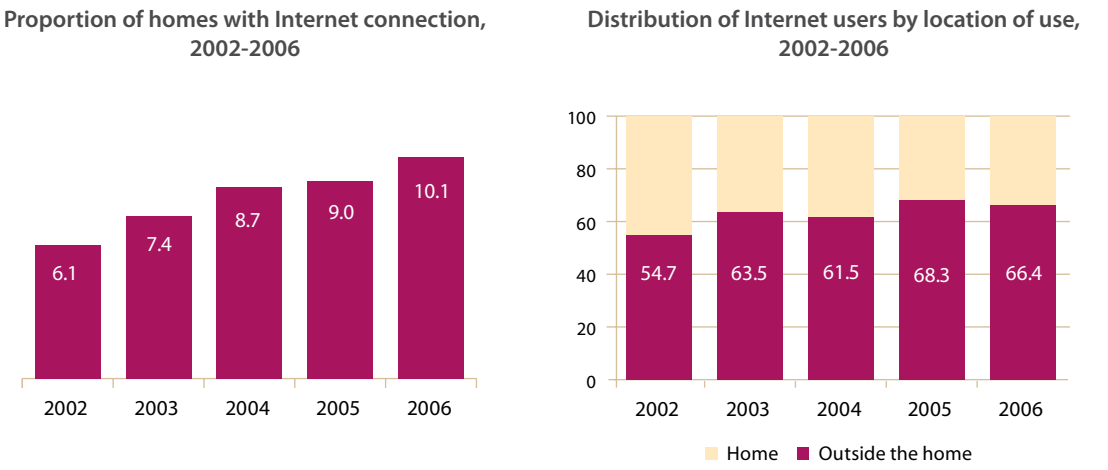


Ratio of household computers with Internet access, selected economies by region, 2005



Source: ITU/UNCTAD/KADO Digital Opportunity Platform, adapted from national statistical office data and ITU World Telecommunication Indicators Database.

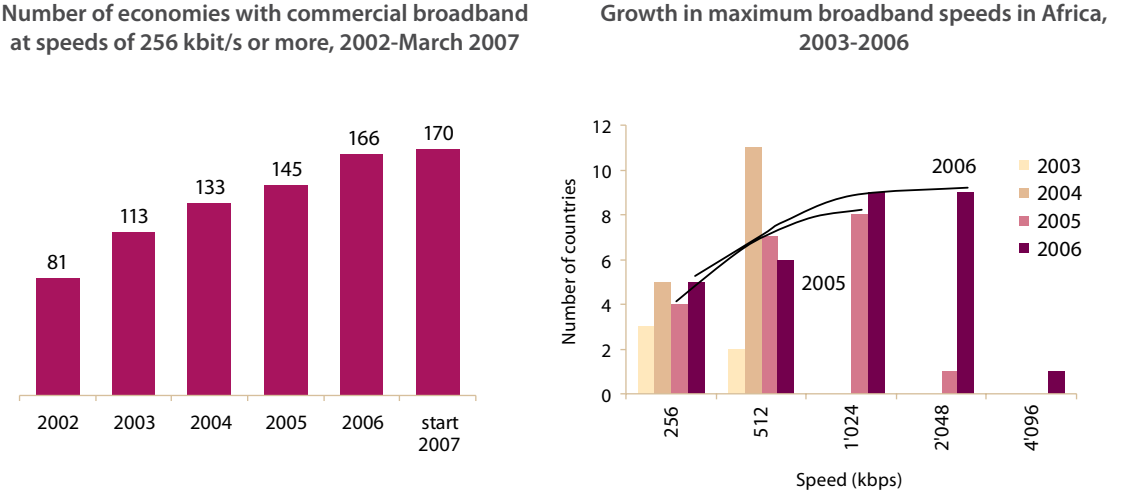
Figure 3.8: Internet access, at home and elsewhere, in Mexico



Source: Adapted from INEGI.

In Latin America, Brazil and Mexico had the same household computer penetration of 18 per cent in 2005, yet in Brazil, 74 per cent of computers were connected to the Internet. In Mexico, only 9.4 per cent of homes had Internet access. In terms of affordability, Mexico's per capita income is twice as large as in Brazil and Internet costs consume a smaller proportion of income in Mexico. Furthermore, the home Internet penetration rate in Mexico grew only very slowly from 2002-2006 (Figure 3.8). Further, most new Internet users in Mexico access the Internet from outside the home. While home and outside-home use was roughly equal in 2001, two-thirds of all Mexican Internet users now access the Internet from public facilities (i.e., Internet cafes and schools). Mexico has flat-rate local call pricing, whereas in Brazil, local calls are charged on a timed usage basis. From an economic perspective, there should be more Mexican households connected to the Internet

Figure 3.9: Growth of broadband



Note (right chart): Maximum advertised broadband speeds may not be always available, depending on network congestion, latency, routing of data etc.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

than Brazilian ones, but this is not the case. More research is needed on the reasons why people living in households with computers may not connect to the Internet.

While the explosion of public facilities offering Internet access is admirable (see Chapter six), policy-makers should focus on the benefits of each household having its own, regular Internet access.

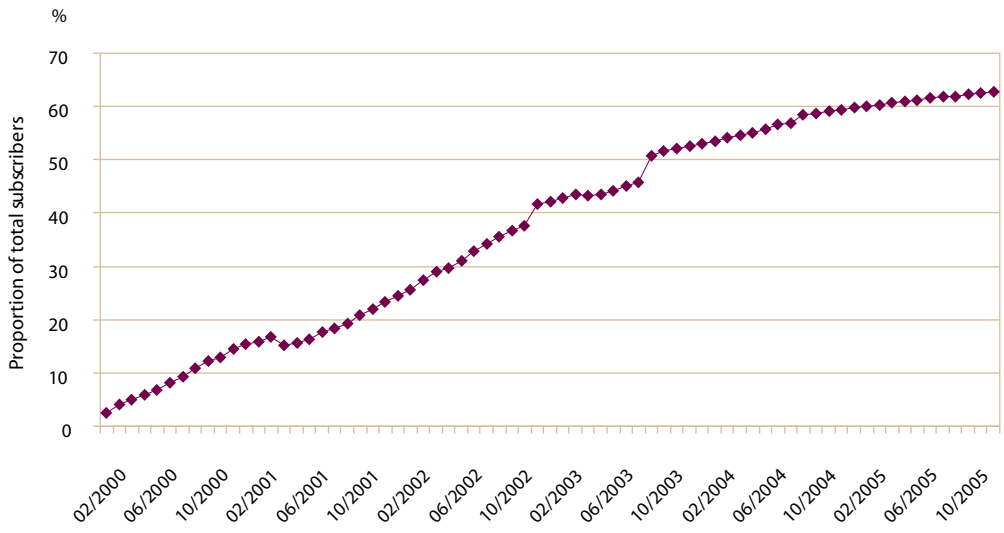
3.5.3 The death of dial-up?

The Digital Opportunity Index tracks access to new and advanced technologies, including fixed and wireless broadband. The telecommunication industry reached a key milestone in 2005, when broadband subscribers exceeded dial-up for the first time as the primary way of accessing the Internet. By the end of 2005, there were nearly 218 million broadband subscribers around the world, accounting for 53 per cent of all Internet subscriptions. At current rates of growth, the vast majority of Internet subscriptions should be at broadband speeds (equal to or greater than 256 kbit/s) by the end of this decade.

There is a widespread perception that broadband is less relevant for developing countries, but this is not the case. Broadband is increasingly available in developing countries. By the start of 2007, ADSL at speeds of 256 kbit/s and above was available in 170 economies (Figure 3.9, left). DSL was rolled out in Ghana[21] and Libya[22] during 2006. In 2007, Telecom Lesotho will introduce ADSL to improve Internet services and has submitted its proposed tariffs to the Lesotho Telecommunications Authority, which launched a Public Consultation on ADSL tariffs[23], with a pilot project to be launched in Maseru.[24] As long ago as December 2003, Macedonia became the last unserved European country to introduce broadband, with an ADSL service. However, due to Maktel's monopoly over access to Internet bandwidth, Macedonia is focusing on wireless broadband, for example, for USAID's school connectivity project to connect 461 schools.[25]

Meanwhile, the speed and choice of services available are growing. Maroc Telecom launched Internet Protocol Television (IPTV) over DSL in May 2006[26] and has recently launched the first four Mbit/s broadband package in Africa[27] (Figure 3.9, right). Qtel (Qatar) is one of the first telecommunication operators in the Middle East to have introduced a triple play offering over ADSL.[28] Meanwhile, for many developing countries, wireless broadband offers an attractive way of reaching greater number subscribers at reduced costs. In 2006, Africa Online Uganda introduced broadband wireless with a wider coverage, designed to suit both business and home users. Wireless broadband can be much cheaper compared to leased lines, as bills are based on usage, rather than fixed monthly payments.[29]

Figure 3.10: Ratio of broadband to total Internet subscribers, Hong Kong, SAR



Source: Adapted from Office of the Telecommunications Authority (OFTA), Hong Kong, SAR.

Some economies are taking longer to convert their Internet subscriber base to broadband, however, especially where there is a competitive market and tariffs are relatively low. In Hong Kong SAR, the broadband market boomed after 2000 with the ratio of broadband to total Internet subscribers increasing by around one per cent a month (Figure 3.10).[30] However, broadband growth has stagnated recently and the ratio of broadband to total Internet subscribers only increased by four per cent in 2005 to 63 per cent.

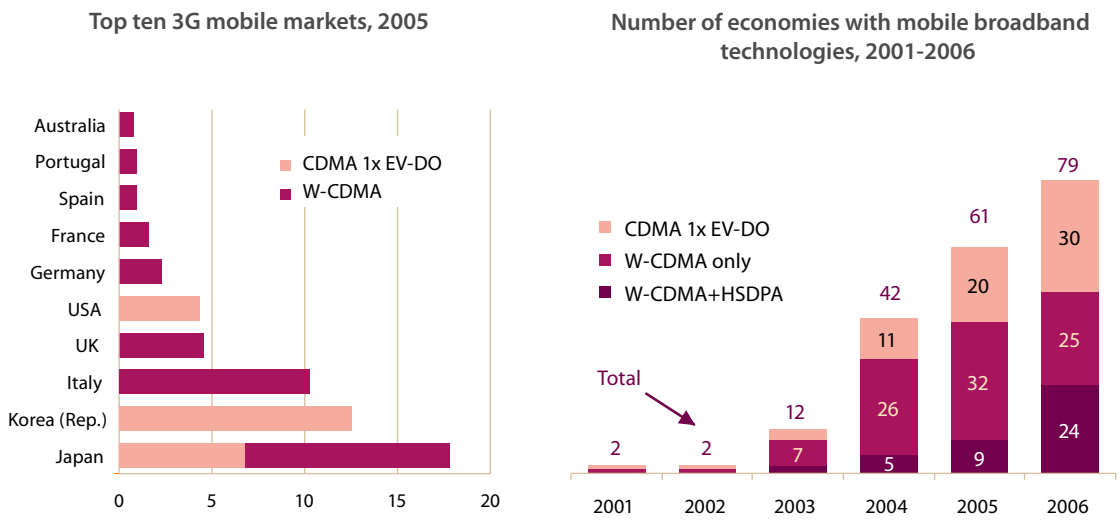
What explains this resistance to broadband?[31] One factor is that even though broadband prices have dropped dramatically and bandwidth has risen, dial-up is still often cheaper in many economies, particularly those, such as Hong Kong SAR, that do not charge for local calls. Also, some users do not like the always-on feature of broadband, fearing it makes them more vulnerable to cyber-intrusion (an issue examined in Chapter five). Some users simply do not need broadband since they use mostly low-bandwidth applications such as email. Finally, there are users who do not have access to broadband because they live in remote areas, outside of the range of DSL or cable. This group of users is increasingly important as one focus of debates over universal service.

3.5.4 Growth in 3G mobile

There is strong growth in third generation (3G) mobile services, particularly in Asia and Europe, where nearly all the top ten largest markets are situated (Figure 3.11, left). Mobile broadband has grown in speed and by the first quarter of 2006, operators were advertising commercially available download velocities of between 384 kbit/s – 1.4 Mbit/s. The industry promises even higher speeds in the future. For example, Telstra, a mobile operator in Australia claims that it will soon be providing peak network speeds of 14.4 Mbit/s over its High Speed Download Packet Access (HSDPA) network. Mobile broadband (3G) services are now offered in many developing countries throughout central and eastern Asia, Latin America and the Caribbean (Figure 3.10, right). Wideband CDMA networks were operational in 49 countries by the start of 2007, with 24 HSDPA networks. Twelve economies had separate networks supporting both W-CDMA and CDMA 2000 1x in 2006.[32]

As operators introduce these advanced mobile services, they are now deriving a greater proportion of their revenues from data services. In Africa, data revenues are small, but growing. Vodacom

Figure 3.11: Expansion of mobile broadband and 3G mobile



Source: ITU/UNCTAD/KADO Digital Opportunity Platform and ITU Internet Report 2006: digital.life.

reports data revenues of 2 billion Rand for 2006 (USD 0.3 bn), up 52 per cent from 1.3 bn Rand in 2005 (USD 0.2 bn). Data revenues constituted 7 per cent of total service revenues for Vodacom Group in 2006, up from 5.6 per cent in 2005.[33] Vodacom considers that it is in an excellent position to take advantage of growth opportunities in the cellular and converged communications industry and recently launched "mobile TV on the move" over its HSDPA network. Vodacom plans to continue to grow mobile data revenues by mobilizing office tools and software applications such as 3G, HSDPA, Vodafone Mobile Connect Cards and live TV-streaming Blackberry at acceptable prices.[34] Data revenues represent a much higher proportion of total revenues in the mature markets of Asia-Pacific, where consumers are at ease with using their mobile for mobile gaming, m-commerce and access to news and sports alerts.

However, there are some concerns that in the development of the global Information Society continues to be uneven. Although the developing world is making strong gains in mobile telephony and, to a lesser extent, Internet access, Europe and Asia are gaining ground in the adoption of new technologies such as broadband and mobile Internet. This suggests that discrepancies in access to ICTs between countries are not only measured in terms of basic penetration and access, but are taking on new dimensions in speed, mobility and capacity of access. Through its measurement of mobile/fixed components and new technologies, the DOI can measure all these trends and can be used to improve and enrich policy-making. Speed and quality of access considerations must be taken into account in future assessments of the digital divide, as well as in the broader debate over provision of universal service.

3.6 Conclusions

This chapter has tracked progress in WSIS implementation, with regards to the three clusters of the digital opportunity index (DOI) namely Opportunity, Infrastructure and Utilization. It has shown that the Information Society has grown steadily since the start of the WSIS process in 2003.

Notes for Chapter Three

1 More information on the Digital Opportunity Index is available from: www.itu.int/doi.

2 A time series has been calculated for the full set of 181 economies since 2004 and for sixty-two economies since 2001.

3 The use of the ICT Opportunity Index is explored in greater detail in a separate ITU publication, published in February 2007: "Measuring the Information Society", available at: www.itu.int/ITU-D/ict/publications/ict-oi/2007/index.html.

4 For more practical information on how the DOI is constructed, see the DOI user guide at: www.itu.int/osg/spu/statistics/DOI/doi-guide.pdf and the methodology report "Measuring digital opportunity" (November 2005), at www.itu.int/osg/spu/statistics/DOI/linkeddocs/Measuring_Digital_Opp_Revised_23_Nov_2005%20(2).pdf.

5 The DOI scores for each country have a mix of infrastructure indicators (valid for year end 2005) and tariff and coverage measures (valid for 2006). For that reason, the DOI scores presented here are classified as 2005/06 but, for convenience when making time-series analysis, they may be simply referred to as " 2006".

6 Income classifications are updated each year, based on Gross National Income. This comparison of digital opportunity uses the 2005/2006 income classification, applied to the DOI scores for 2004-2006.

7 As measured by the range in digital opportunity (high income – low income) and dispersion around world average.

8 "Qatar Internet and Datacomm Landscape", report by the Arab Advisors Group, 21 February 2007, available from: www.arabadvisors.com.

9 Namely: Maldives, Morocco, Peru, Myanmar, Senegal and Venezuela; all of these were medium-DOI economies.

10 The Geneva Plan of Action can be downloaded from: www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=1160|0.

11 www.rcrnews.com/apps/pbcs.dll/article?AID=/20070326/FREE/70322019/1026/FREE.

12 P. 51, Chapter 4, World Telecommunication Development Report (2002), ITU, Geneva, available from www.itu.int/publications/

13 Agence de Régulation de Télécommunications (ART, Sénégal), "Le marche de l'Internet", web page, available at: www.artp-senegal.org/telecharger/Fiche_Internet_2005.pdf.

14 The 2006 World Information Society report noted that "In mobile telephony, worldwide, prices have been falling by an average of 10 per cent per year. Internet access has fallen by a similar amount and in 2005, cost only three-quarters of its price in 2003. As a more recent technology, broadband Internet access is the most expensive, but it has also fallen the most – broadband has enjoyed a 40 per cent reduction in price since 2003 due to growing competition and changes towards flat-rate, unmetered pricing packages".

15 Press Release, 21 February 2007, available from MTN Press Release, at: www.mtn.co.za/?pid=9522&fullstory=382

16 Page 4, Etisalat Annual Report 2005, available from: www.etisalat.ae/assets/CCD/Digital%20Press%20Office/Financial%20Informaiton/Etisalat%20E%20AR05.pdf.

17 P. 109, Chap. 3: Telecommunications, The Communications Market 2006, available from: www.ofcom.org.uk/research/cm/cm06/. In relation to the UK broadband market, Chapter 3 notes that "in addition to widespread availability, consumers now have an increased choice of broadband service providers… Together with the cable operators and the fast-growing wireless broadband sector, consumers have never had more choice of broadband products, pricing packages and access platforms. This in turn has fuelled the growth of broadband take-up and consumption", page 109.

18 The first two figures are from Statistics Finland Household Budget Surveys (www.stat.fi/tk/el/kulutustutkimus/kulutust_t4_1.html), while the latter is from the following report commissioned by the European Commission: Eurobarometer, E-Communications Household Survey, July 2006.

19 For more detail, see the OECD's December 2006 broadband subscriber estimates at: www.oecd.org/document/7/0,2340,en_2649_34223_38446855_1_1_1_1,00.html.

20 See for example, "Status of VoIP worldwide, 2006", Background Paper prepared for the ITU workshop, "The Future of Voice", 15-16 January 2007, available at: www.itu.int/osg/spu/ni/voice/papers/FoV-VoIP-Biggs-Draft.pdf.

21 www.ghanatelecom.com.gh/gt_aboutus/newsdetails.asp?pnum=3&id=228&catid=0.

22 www.lttnet.com/english/coming.php and www.lttnet.com/english/sr_libyadsl.php.

23 www.lta.org.ls/Consultations/Tariffs/29012007_TL_ADSL.html

24 Telecom Lesotho submission to LTA, Page 1, www.lta.org.ls/20070126082548627.pdf

25 www.dot-com-alliance.org/newsletter/article.php?article_id=127

26 See Maroc Telecom press release, 31 May 2006, available from: www.iam.ma/details.aspx?id=101 and www.iam.ma/fichiers/Maroc-Telecom-Communique-TVADSL-31mai06-VF(2).pdf.

27 The Moroccan regulator, the Agence Nationale de Régulation des Télécommunications (ANRT), available in French from: www.anrt.net.ma/fr/and Balancing Act Africa, www.balancingact-africa.com/news/back/balancing-act_340.html.

28 Annual report 2006, p.30, available atwww.qtel.com.qa/documents/ar/ANNUAL%20REPORT%20ENGLISH%202006.pdf.

29 www.africaonline.com/country.news.php?mode=getitem&itemno=115&cid=12

30 ITU, "Broadband as commodity: Hong Kong, China Internet case study", April 2003, available at: www.itu.int/.

31 "The slow death of dial-up", The Economist, 8 March 2007, available at: www.economist.com/search/displaystory.cfm?story_id=E1_RSGGDSP.

32 Australia, Israel, Japan, the Republic of Korea and the United States, Czech Republoc, New Zealand, Romania and Taiwan (China).

33 Page 11, Vodacom Annual report 2006, available from the Vodacom Group website at: www.vodacom.com/vodacom/investor_relations/docs/Vodacom%202006%20AR%20Full.pdf.

33 P. 12, Vodacom Annual report 2006, available from the Vodacom Group website at: www.vodacom.com/vodacom/investor_relations/docs/Vodacom%202006%20AR%20Full.pdf.

Annex: Methodological Note on Digital Opportunity Index

The definitions of the core indicators used to compile the Digital Opportunity Index (DOI) are available from the Partnership for Measuring ICT for Development. The latest available data (year-end 2005) was used, except where noted otherwise. Where 2005 data were not available, later data was used for tariffs while for other indicators, earlier data was used or an estimate was made. This section identifies the methodology used to compile the indicators for this version of the DOI, including the time period of the data, and where necessary, the estimation technique.

Indicator	*Core code*	*Note*
Percentage of population covered by mobile cellular telephony	A-7	The base year is 2005. This data is generally available from many mobile network operators. If national data are not available from an official source, the figure for the largest operator is used. In rare instances, this may understate actual coverage since different operators could cover different sections of the country. In the absence of data for a few countries, the percentage of the urban population is used on the assumption that it is less costly to install infrastructure in those areas and they have a greater number of potential clients that can afford service.
Internet access tariffs (20 hours per month) as a percentage of per capita income	A-8	The base year is 2006 since this is the latest year for which a complete set of comparable data is available. Data are based on the cheapest available package for 20 hours of use per month and do not include telephone line rental. The basket is divided by 2004 Gross National Income per capita (from the World Bank).
Mobile cellular tariffs as a percentage of per capita income	A-9	The base year is 2005, since this is the latest year for which a complete set of comparable data is available. A monthly charge is compiled based on a basket of peak and off-peak and on-net, off-net and fixed calls. The basket is divided by 2004 Gross National Income per capita (from the World Bank).
Proportion of households with a fixed line telephone	HH-3	This indicator, which is based on 2005 data, should ideally be compiled from a household survey. If not available, administrative records can be used for the number of residential telephone lines divided by the number of households.
Proportion of households with a computer	HH-5	This indicator, which is based on 2005 data, should be compiled from a household survey. If not available, data on the number of computers in the country could be used, adjusted for the estimated amount in homes. If that data is not available, then the data are estimated based on the per capita income of regional peers.
Proportion of households with Internet access at home	HH-7	This indicator, which is based on 2005 data, should be compiled from a household survey. I not available, data on the number of Internet subscriptions, adjusted for the estimated amount in homes, can be used. If that data is not available, then the data are estimated based on the per capita income of regional peers.
Mobile cellular subscribers per 100 inhabitants	A-2	The base year is 2005. Data are universally available for this indicator.
Mobile Internet subscribers	A-4†	The base year is 2005. Since mobile Internet access is relatively recent, many countries either do not report data on the number of subscribers or definitions vary.. There are a variety of indicators used to reflect mobile Internet use. Some operators report the number of high-speed subscriptions and others report the number of subscriptions to their mobile portal services. Some users utilize mobile cellular networks to access the Internet using laptop computers. There is little consensus as to whether these types of users should be considered fixed Internet subscribers or mobile Internet subscribers. Finally, the concept of Internet access is seriously challenged when including mobile, since the users' experience is entirely different and many so-called mobile Internet users are not actually surfing websites per se but downloading logos and ring tones or sending picture messages. In general, either the number of Wireless Access Protocol (WAP), General Packet Radio Service (GPRS) or mobile portal subscribers is used. In the absence of data, estimates are based on the number of post-paid subscribers, the availability of mobile data networks (e.g., GPRS, EDGE, CDMA2000 or WCDMA) and regional trends.
Proportion of individuals that used the Internet	HH-8	The base year is 2005. A growing number of countries have carried out surveys. In the absence of survey data, national estimates are used. If these are lacking, then estimates are derived from the number of subscribers.
Proportion of fixed broadband subscribers to total Internet subscribers	A-5†	The base year is 2005. There is a growing consensus that a service should be considered broadband only if it offers speeds of at least 256 kbit/s in at least one direction. Note that this indicator refers to 'fixed' type of broadband access such as DSL, cable modem, Ethernet LAN, fibre optic and Fixed Wireless Access. This data set is generally complete for most countries that have broadband service.
Proportion of mobile broadband subscribers to total mobile subscribers	A-5†	The base year is 2005. Mobile broadband subscribers refer to users of mobile networks providing speeds of at least 256 kbit/s in at least one direction. This data set is generally complete for countries that have mobile broadband service.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

† = Derivation of core indicator

chapter four
ICT growth strategies

4.1 Introduction: Strategies that work

The remarkable growth of the Information and Communication Technology (ICT) sector over the last two decades has transformed many economies. The drivers of economic growth have become more information-intensive and less dependent on natural resources. Affordable access to high-quality ICTs has become a key priority for policy-makers and businesses. Chapter two of this report examined disparities in access to ICTs and Chapter three reviewed trends in the deployment of ICTs. In this chapter, the focus shifts to ICT growth strategies or "e-strategies" and what can be done to promote the adoption of ICTs. Case studies from different regions are used to illustrate ICT growth strategies and key enablers in the transition towards modern ICT-intensive economies.

The WSIS process recognized that the development of national e-strategies is the responsibility of all stakeholders, not just governments (Box 4.1). During the Geneva Phase of WSIS, stakeholders committed to developing national e-strategies by 2005 and to achieving the WSIS goals by 2015. Many economies already have national strategies for the ICT sector, telecommunications and/or information technology. National growth strategies are path-dependent and no two economies start from the same point. Furthermore, strategies vary according to social policy objectives, the market and policy tools adopted, the size of the economy, income and demographic distribution, among other factors. There is no "one-size-fits-all" strategy for creating digital opportunity. As the WSIS outcome documents makes clear, each country must set its own specific targets, in accordance with national development policies and taking into account national circumstances.[1]

Developing countries are often disadvantaged by limited infrastructure and human resources, insufficient policy incentives and scarce investment, while the high cost of services and other barriers may constrain growth in ICTs. There is a close correlation between digital opportunity and GDP per capita: digital opportunity tends to be greater in wealthier economies, but digital opportunity can also generate wealth, resulting in a positive feedback cycle.[2] Where both digital opportunity and wealth are limited, as is the case in some LDCs, it can be difficult to break out of the trap of limited investment in infrastructure. For instance, there were only two economies—Turkmenistan and Zimbabwe—that experienced falls in their Digital Opportunity Index (DOI) scores, between 2004-2006. In each case, their GDP per capita also fell in USD terms.

Countries with similar levels of digital opportunity may experience different growth outcomes depending on their policies. In some cases, for instance, these disparities may result from the adoption (or failure to adopt) of a particular technology.[3] In certain cases, innovative technologies (or services) have been used by developing countries to leapfrog—examples include China, which is moving directly to broadband Internet access without a large installed base of dial-up Internet users; and India, which moved directly to digital mobile service without investing first in analogue services. In general, developed countries benefit from the faster adoption and greater diffusion of new technologies, while developing countries often experience faster rates of growth (in percentage terms).

Box 4.1: National e-strategies in the WSIS Geneva Plan of Action

"The effective participation of governments and all stakeholders is vital in developing the Information Society requiring cooperation and partnerships among all of them.

a) Development of national e-strategies, including the necessary human capacity-building, should be encouraged by all countries by 2005, taking into account different national circumstances.

b) Initiate at the national level a structured dialogue involving all relevant stakeholders, including through public/private partnerships, in devising e-strategies for the Information Society and for the exchange of best practices.

c) In developing and implementing national e-strategies, stakeholders should take into consideration local, regional and national needs and concerns. To maximize the benefits of initiatives undertaken, these should include the concept of sustainability. The private sector should be engaged in concrete projects to develop the Information Society at local, regional and national levels. …"

Source: WSIS Geneva Plan of Action, Para 8.

As ICT policies and strategies are cross-cutting in nature, they are being mainstreamed into the frameworks for national strategies for development and poverty alleviation in many developing countries.[4] This chapter illustrates different ICT growth strategies using a range of country case studies. The chapter begins by examining the role for government in leadership (Section 4.2), before examining market liberalization and competition (Section 4.3) privatization (Section 4.4), regulatory reforms (Section 4.5), the promotion of infrastructure (Section 4.6), an enabling environment for investment (Section 4.7), before concluding with the need to establish human resource policies (Section 4.8).

4.2 What role for government?

In market economies, both the public and private sector can promote digital opportunity. Government has an important role to play in establishing an enabling environment for investment and market competition, as well as intervening to achieve socio-economic goals in areas where normal market incentives may be insufficient to create balanced growth. In reality, the roles of governments and the private sector overlap and include additional elements:

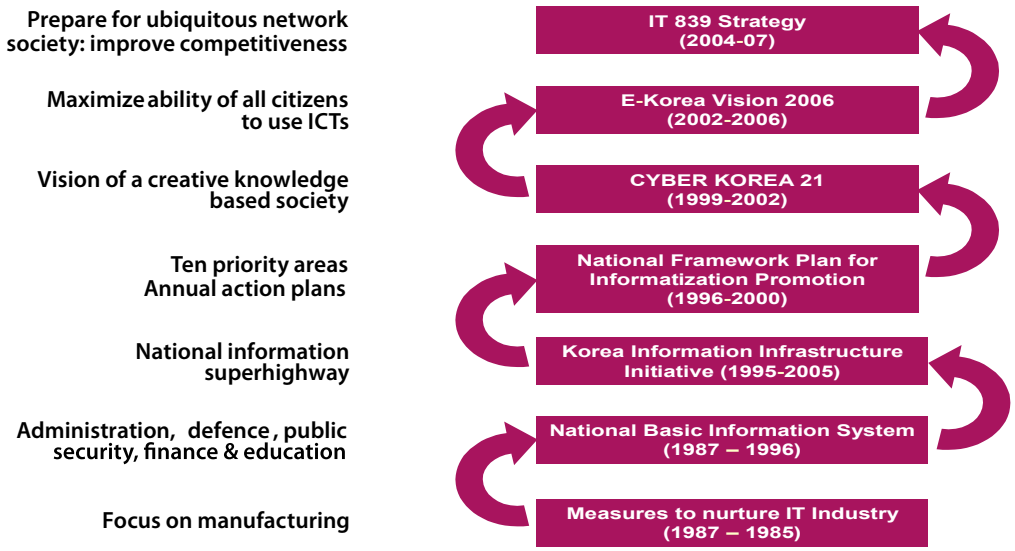
- First, positive incentives stimulating market dynamics: for instance, by establishing an enabling environment for investment, ensuring private sector participation or in promoting the take-up of broadband;
- Second, measures preventing uneven development (for example, by use of regulatory criteria or restrictions) or counteracting negative effects (for instance, by combating the rise of spam).

4.2.1 Republic of Korea: The government's role in broadband deployment

Despite disputes over the role of government in a market economy, government-led initiatives can promote successful ICT deployment. The Government of Korea's successful deployment of broadband and its rapid transformation towards an Information Society is one notable example.

Ranked first in the DOI since 2002 (when it overtook Iceland: see Table 3 in the Statistical Annex), Korea's success in digital opportunity is the result of a combination of: environmental factors (e.g. high literacy and school enrolment, tech-savvy consumers and a largely urbanized population); policy factors (e.g. a strong government push

Figure 4.1: The Korean Government's approach to public/private cooperation for ICT sector promotion



Source: Updated from ITU (2003) "Broadband Korea: Internet Case Study", available at: www.itu.int/ITU-D/ict/cs/korea/material/CS_KOR.pdf.

towards the Information Society and high investment by the private sector in new technologies and services); and a highly competitive market structure. However, what sets Korea apart from many other economies is the strong guiding role played by government (Figure 4.1).

During the 1990s, Korea experienced unprecedented political, economic and social turmoil, including the North Korean nuclear crisis in 1994, the Asian financial crisis in 1997-8 and democratization. New momentum was needed to help Korea maintain economic growth. The Government recognized the role of ICTs as an engine for economic growth from an early stage. In order to prioritize ICT development, the Government centralized ICT-related functions previously scattered across different agencies in a new Ministry of Information and Communication (MIC) in 1994. MIC has played a central role in the planning and implementation of ICT development policy ever since.[5] MIC launched an ambitious plan, the Korea Information Infrastructure Initiative (KII), in 1995 to roll out an advanced network infrastructure nationwide. Upgraded initiatives, such as the 'National Framework Plan for Informatization Promotion', 'Cyber Korea 21', 'e-Korea Vision 2006' and 'IT839', have followed the KII Initiative.

A key element in MIC's success in promoting broadband deployment was the establishment of a framework for facilities-based competition in 1998. In response to delays in unbundling the existing network (i.e. to promote service-based competition), new policy approaches were introduced to encourage infrastructure investment and competition in the broadband market. Open access to market and network technology triggered fierce competition with new entrants in network and service provision. Moreover, MIC held regular consultations with operators to seek broad consensus on its policy priorities of keeping user costs low and promoting access throughout the country. The Government also maintained asymmetric regulation for fair competition in the mobile market since 2000.

In order to maintain momentum in ICT roll-out and use, the Government has sought to stimulate market demand. Since investment in infrastructure alone is no guarantee of smooth development towards the Information Society, MIC introduced a series of policy measures to promote active usage of the Internet. Nationwide training programmes for PC and Internet skills were carried out, with government support. Large-scale education for children, housewives, the elderly and the disabled has raised the profile of ICTs on the national agenda. They have also given a positive image to manufacturing and service industries. In summary, targeted investments by the Government in infrastructure and usage promotion have maximized the benefits of broadband deployment.

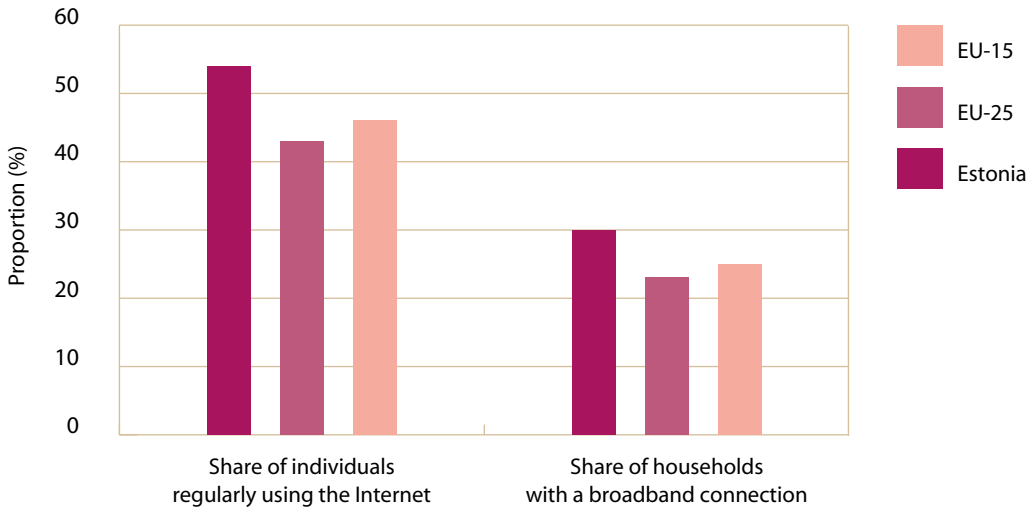
4.2.2 Estonia: Leaping Tiger

Estonia has proved an ICT success story, due to Government-led initiatives and an early decision to transform the economy from a state-planned economy to a market-oriented economy. This year, it has entered the top twenty-five economies in digital opportunity with a DOI score of 0.65, the only Central and Eastern transition economy to make it to the top twenty-five (see Section 3.3.1). The incumbent was privatized in 1993, mobile competition introduced in 1994 and full service competition from 2002. Over half the Estonian population uses the Internet and Estonia has the highest Internet and broadband penetration in Central and Eastern Europe. Estonia's levels of ICT development exceed EU average (Figure 4.2), although it only joined the EU in 2004.

The Estonian Parliament adopted the "Principles of the Estonian Information Policy" as early as May 1998 as a roadmap for the country's development in ICTs. Annual information policy action plans are coordinated by the Ministry responsible for communications and specify detailed actions, responsibilities and targets. Various institutions have been established, such as the Informatics Council, which includes government and private sector experts that provide policy input. Different programmes have been created, focusing on specific areas.

In February 1996, the Government launched the "Tiger Leap" programme to modernize education. Tiger Leap had the slogan "one computer for every 20 pupils"[6] and has helped provide IT facilities to schools. All schools had computers by 2000; by the start of 2003, 98 per cent were also connected to the Internet. ICTs have been integrated into the curriculum, as a subject and a tool for teaching other subjects. Over 100 software packages have been created in Estonian, covering history, culture, and nature. The Estonian Educational and Research Network (EENet) was created in 1993 as a nationwide scientific and educational computer network. By 2003, over 200'000 researchers, students, and teachers used the network and 455 institutions had a permanent connection. Most of the institutions (85 per cent) were schools and

Figure 4.2: Selected Information Society indicators, Estonia, 2005



Source: EUROSTAT.

universities, but they also included public Internet access points, libraries and archives.

Estonia has also been successful in e-government and ranks 19th out of 191 countries in the UN's global e-government report 2005[7], higher than any other Central or Eastern European nation. The Government comprised some 64 public agencies staffed by 21'400 people in 2003. Nearly all staff needing a PC with Internet access have it. Estonia ranks fourth in the EU for interactive government services[8], while three-quarters of all Estonian Internet users file their income taxes online.

In rural areas, the law requires that Estonia's 4'000 villages be connected to the PSTN network, if connection is technically possible. With mobile signal covering 99 per cent of the population, virtually all villages have access to voice services. The number of mobile subscriptions in Estonia has exceeded the population and, by the first quarter of 2005, 81 per cent of Estonian households had a mobile phone. In broadband, the KülaTee 3 (VillageWay 3) programme ensures that over 90 per cent of Estonian territory has broadband access, with the Government supporting broadband roll-out in rural areas. In community access, Estonia had 0.76 Public Internet Access Points (PIAPs) per 1'000 inhabitants in 2003, the highest among new EU member states. Government policy provides for free Internet access from PIAPs.

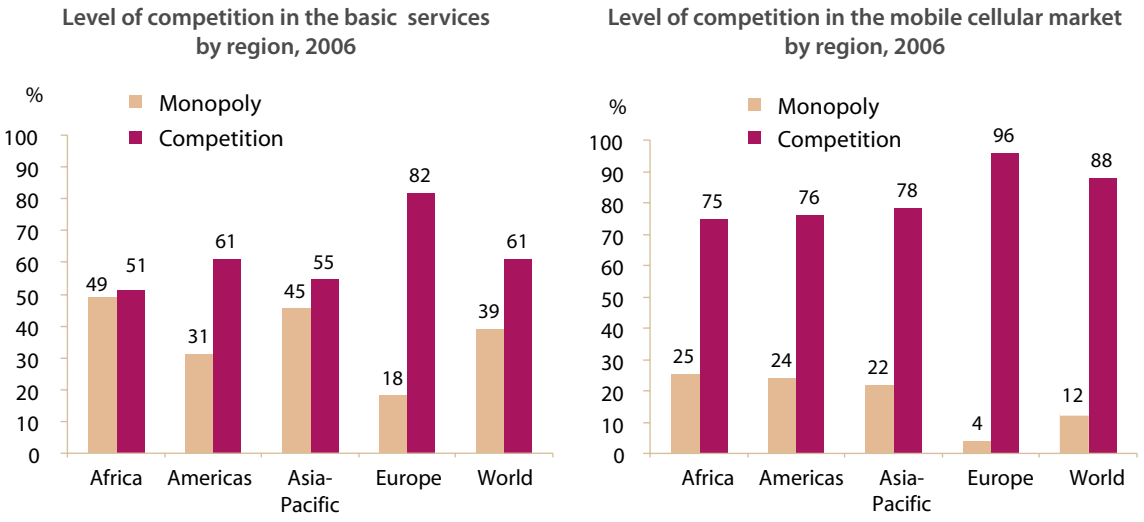
Tiger Leap is an apt name for Estonia's school ICT programme and, indeed, applies to the whole country. The nation has taken a giant leap forward in ICTs. The word "tiger" implies a connection to the Asian Tigers, where rapid economic growth has made them developed economies. In the same way, Estonia is a Baltic tiger whose ICT sector today is as strong as most developed nations.

4.3 Market liberalization and competition

Market-focused strategies allow governments to meet social and economic goals, such as increasing access to ICTs and revenue from telecommunication services. Market reforms can boost productivity and profitability and stimulate investment, enhancing the performance of the ICT sector. Sector reform includes: (1) market liberalization and competition; (2) private sector participation; and (3) effective regulation. Liberalized markets are generally more efficient than markets under government control, and they are more likely to generate greater benefits for consumers and businesses.

Mobile and Internet markets are generally more competitive than fixed line markets, due to the proliferation of multiple new, private entrants in these markets (Figure 4.3). Basic voice services are less competitive than mobile services, but still, over 60 per cent of the world's economies have opened up their basic services market to some

Figure 4.3: Competition in basic services and cellular mobile markets worldwide



Source: ITU World Telecommunication Regulatory Database.

degree of competition (Figure 4.3, left chart). Europe is the most competitive region, in both basic and mobile services. Relatively speaking, Africa is less competitive, but still, more than half its markets were open to some form of competition by 2006.

Competition may take many different forms, however, as the experience of Vietnam's alternative approach to sector reform demonstrates.

4.3.1 Vietnam: Sector reform by a different model

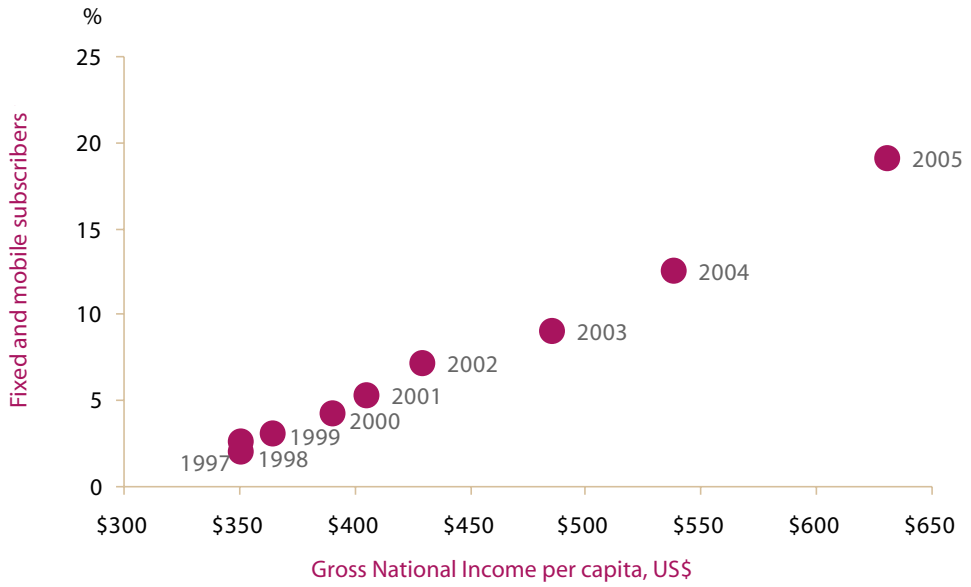
At first glance, Vietnam may not seem to have an appropriate environment for high ICT growth: the incumbent operator has not been privatized, there is no separate regulator and foreign investment, although allowed, is limited by various constraints. Despite this, Vietnam has achieved one of the highest ICT growth rates over the last decade. One reason is that its economy has boomed, with per capita income almost doubling between 1997 and 2005. The rise in fixed and mobile penetration has matched the increase in per capita income (Figure 4.4).

Vietnam has progressed cautiously with ICT sector reform. In 1993, operations and supervision were separated, with the Directorate General of Posts and Telecommunications assuming responsibility for regulation and the state-owned Vietnam Posts and Telecommunications (VNPT) becoming the operator. Vietnam has allowed foreign investment in the ICT sector, but investment has been through Business Cooperation Contracts (BCCs), rather than direct equity stakes. BCCs are similar to Build-Operate-Transfer schemes, where the investor shares the revenue with local partners. At the end of the BCC, the assets revert to the local partners.

Vietnam's unique approach to liberalization has resulted in a fair degree of competition, through rivalry between different state-owned entities such as VNPT, municipal operators, the military and the electricity company. Although VNPT tends to dominate, there are now several operators in the fixed, long-distance, mobile and Internet markets. The wireless market provides an example of how the combination of different government entities and BCCs has resulted in a high level of competition. By 2007, there were six wireless operators:

- VinaPhone: A GSM network owned by VNPT.
- S-Fone: A BCC between SK Telecom of the Republic of Korea and SPT (Saigon Post and Telecommunications Service Corporation, the local operator in Ho Chi Minh City).
- Mobifone: Vietnam's first GSM network, established as a BCC between Millicom and VNPT (through the Vietnam Mobile Services Company). The BCC ended in May 2005.

Figure 4.4: Per capita income and total teledensity in Vietnam, 1997-2005



Source: ITU World Telecommunication Indicators Database, adapted from General Statistics Office of Vietnam.

Millicom had hoped to convert its investment to an equity stake, but these efforts have not yet come to fruition.

- EVN Telecom: A subsidiary of Electricity of Vietnam, with a CDMA 2000 1x EV-DO network.
- VIETTEL: The telecommunication arm of the Vietnamese military. It operates a GSM network.
- Hanoi Telecom: A BCC between the local operator in Hanoi and Hutchison Telecommunications.

While Vietnam's managed competition among government entities has contributed to its ICT sector development, it will need to pursue greater liberalization, if it is to become a regional ICT hub. The country joined the WTO in 2007 and Vietnam was obliged to further open up its ICT markets. Vietnam's WTO commitments include allowing a progressively higher degree of foreign participation, ending the requirement for BCCs and opening up markets to greater competition.

4.4 Privatization of incumbent operators

By the end of 2006, some 145 economies had fully or partly privatized their incumbent operators.[9] Just over half of the world's developing countries had sold all or part of their incumbent operator (Figure 4.5). Of the 78 developing countries with partly or fully private telecom operators, around four-fifths initially sold assets to strategic foreign investors, with the remainder issuing public share offerings. Privatization and liberalization can unleash new market potential and emerging new markets have attracted considerable investment. Some US$ 83 billion was raised through privatizations of incumbent public telecommunication operators in developing countries between 1990 and 2006.

The flow of funds over time shows that privatizations tend to cluster in one region over time, before investors move on to other regions. This suggests some degree of "imitation", with countries emulating their neighbors, and with investors vying for similar assets. The early 1990s was the era of Latin America, where ten incumbent operators were privatized. The tide then switched to Central and Eastern Europe. Apart from Albania and Bosnia Herzegovina, every incumbent telecom operator in Central and Eastern Europe has

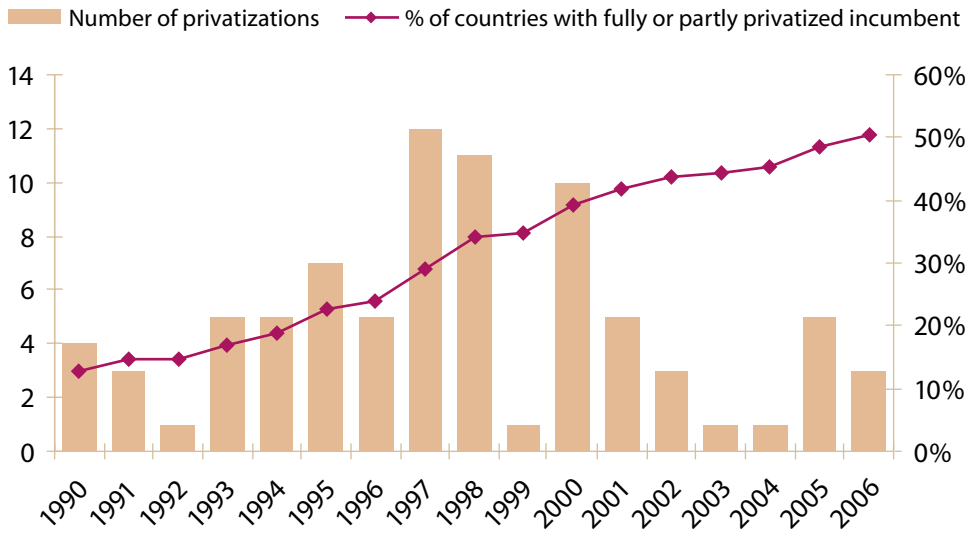
now been privatized. The least privatized region is the Commonwealth of Independent States. The type of privatization also varies by region. In general, in Asia, public offerings are preferred as a means of raising funds from the sale of government assets in incumbents, whereas in Africa and Latin America, stakes have been sold to strategic investors. Between 2005-06, developing country privatizations focused on the Arab States and neighboring countries. Many of these sales were to consortia headed by Arab investors or listings on domestic stock markets (see Table 4.1 and Box 4.2).

The remaining countries that would like to privatize their operators may find that investors are no longer as enthusiastic. While telecommunication privatizations were highly attractive in the 1990s, the gloss has worn off. For example, there were 39 privatization transactions between 1997-2001, but only 13 between 2002-2006. One reason is the burst of the dot.com bubble in 2000, which had a knock-on effect for the telecommunication sector. Another reason is that fixed line assets are no longer so valuable, now that mobile phones outnumber fixed lines by a ratio of 2:1 worldwide. Unless an incumbent has a mobile license (or good prospects for getting one), it is less attractive to investors.

Strategic operators from developed countries are withholding from foreign investment in the telecommunication sector in developing countries, while remaining investors are no longer willing to spend the high sums of the past. This lack of ready buyers has plagued a number of governments who have been trying to privatize their incumbents over recent years.[10] Of the ten developing country privatizations in 2005-06, only three involved strategic investors from developed countries (Telefónica of Spain investing in Colombia; Terracom of the United States investing in Rwanda; and Telecom Italia, as part of a consortium investing in Turkey - see Table 4.1). The rest were either public offerings or sales to foreign investors from developing countries.

In a privatization, the flow of funds is usually from the investor to the government. Although there are cases where the capital base of the privatized company increases (which adds to the total funds available for investment), these are rare.[11] Instead, one of the main benefits of privatization is where the investor is strategic and confers know-how and technology transfer to its new subsidiary. Although this benefit is not available with public listings, fully or partially private companies tend to be more efficient and therefore more profitable, with greater access to external capital markets.

Figure 4.5: Number and value of privatizations of incumbent public telecommunication operators in developing countries*, 1990-2006



**Note: As a percentage of the 155 developing economies that had fully or partly privatized their incumbent telecom operators by the end of 2006.*

Source: Adapted from ITU and World Bank.

Table 4.1 Privatization transactions of incumbent operators in developing countries, 2005-06

Country	Company	% sold	Date sold	Price (US$ m)	Note
Bulgaria	BTC	35%	Jan-05	$ 424	Listing on Bulgarian Stock Exchange
Burkina Faso	ONATEL	51%	Dec-06	$ 289	Private sale to Maroc Telecom (held by Vivendi)
Colombia	TELECOM	50%	Apr-06	$ 368	Sale to Telefonica (Spain). Purchase to be invested in capital increase.
Egypt	Telecom Egypt	20%	Nov-05	$ 890	Listing on Egyptian and London stock exchanges
Montenegro	Telekom Montenegro	51%	Apr-05	$ 148	Private sale to Matáv (Hungary)
Oman	Omantel	30%	Jul-05	$ 748	Listing on Muscat Securities Market
Pakistan	Pak-Telecom	26%	Mar-06	$ 1'400	Private sale to ETISALAT (UAE).
Rwanda	Rwandatel	99%	Jun-05	$ 20	Private sale to Terracom (US)
Sudan	SUDATEL	4%	2005	$ 80	Ongoing sale of government shares on Khartoum, Bahrain and Abu Dhabi stock exchanges
Tunisia	Tunisie Telecom	35%	Apr-06	$ 2'250	Private sale to Telecom Dubai/Etisalat (UAE)
Turkey	Türk Telekom	55%	Nov-05	$ 6'550	Private sale to Ojer Telekomünikasyon (Consortium led by Saudi Oger and Telecom Italia)

Source: ITU/UNCTAD, adapted from company reports.

One of the difficulties in assessing the beneficial effects of privatization is that what is good for shareholders or governments may not be perceived as good for others. In general, privatizations may result in reduced headcount and employment in the quest to increase efficiency.

From a more global perspective, however, the growth of the ICT sector may result in more and new jobs. New business models are often based on skilled manpower, subcontracting, outsourcing and consultancy, which may stimulate the development of Small and Medium-sized Enterprises (SMEs) in the local ICT sector (which may have been previously "crowded out" by a monopoly incumbent). Indeed, often, SMEs are founded by former employees of the incumbent. Although rare, "reverse" foreign investment has also happened in a few countries, where an incumbent was initially sold to a foreign investor, but later reverted to government ownership.[12]

4.5 Reform of the regulatory environment

Besides market liberalization and private sector participation, the third most important element in the recipe for sector reform is effective regulation. Regulation can help ensure market competition and intervention to address areas of market failure, where market mechanisms alone may be insufficient to achieve desired policy outcomes (for example, in universal access). The majority of ITU Member States have now established a regulatory authority separate from government (Figure 4.6) and in charge of regulatory mechanisms to promote the use of ICTs (such as licensing strategies, spectrum allocation, interconnection settlements, dispute resolution, etc.).

Effective regulation has been a key to rapid ICT growth, in developed and developing countries alike. The regulator's mandate varies from one country to another and also evolves to match

Box 4.2: Privatization and FDI in the Moroccan telecom sector

Morocco is a good example of Foreign Direct Investment (FDI) in the telecommunication sector, as it has experienced both incumbent privatization to a strategic foreign operator, as well as foreign investment in a new mobile operator. It also illustrates the emerging trend of South-South FDI.

The government-owned incumbent operator, Maroc Telecom, was partially privatized in 2001, when 35 per cent of the operator was sold to Vivendi of France for US$ 2.1 billion. This amount reverted to the Moroccan government, so there was no actual increase in capital expenditure from the foreign investor. Maroc Telecom was later listed on the Casablanca and Paris Stock Exchanges in 2004, when 14.9 per cent of government holdings were floated for US$ 1 billion. Again, the money reverted to the state, with no actual increase in the company's capital. In 2005, Vivendi acquired an additional 16 per cent of government shares for US$ 1.4 billion, with the purchase price going to the government. Furthermore, half of the amount paid by Vivendi was to be raised from Moroccan capital markets, resulting in local investment, rather than foreign.

Vivendi has accrued significant financial benefits from its investment in Maroc Telecom. Maroc Telecom has not taken on any new debt since privatization and has been reducing its old, pre-purchase debt. Maroc Telecom has proved financially robust, generating dividends every year since privatization. Indeed, Vivendi's share of accumulated dividends since purchase was US$ 700 million and the market value of its holdings (based on the share price of December 2005) was around US$ 5 billion, a premium of US$ 3.5 billion over its initial investments.

Maroc Telecom has also emerged as a strategic foreign investor in its own right. It purchased 54 per cent of Mauritel, the incumbent operator of Mauritania, for US$ 48 million in 2001 and paid US$ 289 million in late 2006 for 51 per cent of ONATEL, the incumbent operator in Burkina Faso. This was followed by the purchase of 51 per cent of Gabon Telecom for US$ 80 million in February 2007.

In addition to privatizing Marco Telecom, Morocco has also injected foreign investment into its telecommunication sector through the licensing of new operators. In 1999, a consortium comprising Telefónica of Spain, Portugal Telecom and local investors formed Médi Telecom and paid US$ 1.1 billion for Morocco's second mobile license. The results have been impressive, with mobile penetration rising from just 1 per cent in 1999 to 41 per cent in 2005. Médi Telecom won the bid for Morocco's second fixed license in 2005, paying US$ 8.3 million.

In total, the Moroccan government has earned around US$ 5.6 billion from privatization receipts and license fees paid by foreign investors in the 7-year period between 1999 and February 2007, while outgoing FDI amounted to US$ 417m (Box Figure 4.2). Morocco's privatization policy has also boosted its ICT sector and Morocco scored the highest rise in DOI scores between 2004 and 2006 (see Table 3.3 and Box 3.1).

Box Figure 4.2: Receipts by the Moroccan government from Foreign Direct Investment (FDI) in the telecommunication sector, 1999-February 2007

Note: Figures for 2007 relate to the first quarter only.

Source: Adapted from Vivendi, Maroc Telecom and ANRT.

progress in technologies and changing business models. Today, regulators may be expected to remove barriers to entry, monitor tariffs (for instance, to identify predatory pricing strategies), manage interconnection settlements, apply numbering policies and regulate radio spectrum etc. All these activities can help create a favorable investment climate and competition.

The regulatory framework should minimize barriers to investment, such as complex licensing regimes or excessive license fees. While many countries have begun reform through the establishment of a regulatory authority and allowing competition, they may not have simplified licensing procedures yet (Box 4.3). A number of developing countries still charge high license fees, limiting competition. Some countries also have multiple service-specific licenses, which are increasingly outdated given technological convergence, with inter-modal competition between platforms.

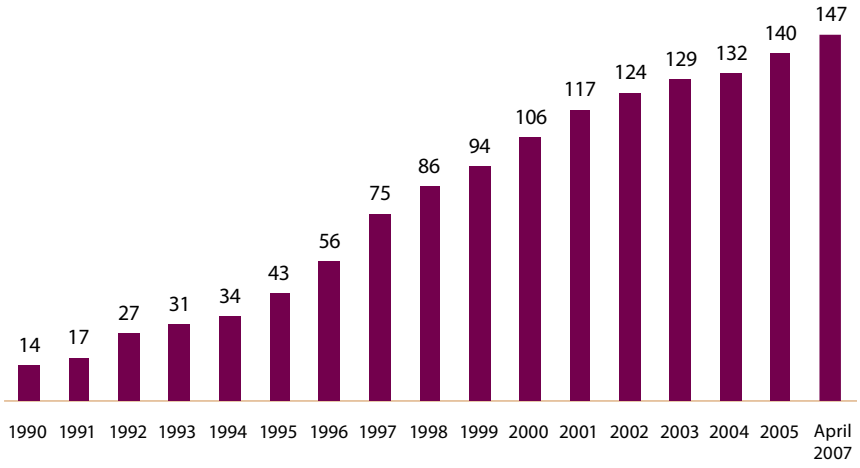
Another regulatory trend is "converged" regulation, covering the entire ICT sector (e.g., broadcasting, Internet and computing, as well as telecommunications). Converged regulators have been established in every region. This usually signifies the merger of existing regulators or establishing a new, consolidated regulator with an extended mandate to regulate both telecommunications and broadcasting. This shift is related to trends in unified licensing (Box 4.3) and regulatory forbearance.[13] For example, an EU directive established a legislative framework and structure for the national regulatory bodies of the Member States, with a deadline of July 2003. However, only few countries, including Denmark, Finland, Ireland, Sweden and the UK managed to re-structure before this date. The United Kingdom has merged the responsibilities of five independent regulatory bodies to create OFCOM, its national regulatory agency with responsibilities for the ICT sector.[14]

As noted above, a sound regulatory environment and stable institutions are the key factors driving ICT growth. The following country case studies focus on trends towards unified licensing (Nigeria) and on innovation in spectrum management (Guatemala).

4.5.1 Nigeria: Unified licenses for the future

At the turn of the century, Nigeria had one of the most limited telecommunication networks in Africa, with a teledensity of less than one. Mainlines were concentrated in the major cities, waiting times for lines were measured in years and quality was poor. The analogue mobile system was not available outside the main urban areas. In response to the growing need for telecommunications and a modern infrastructure, Nigeria launched the National Telecommunications Policy (NTP) in September 2000.

Figure 4.6: Number of economies with a national telecommunication regulatory agency, 1990-April 2007



Source: ITU World Telecommunication Regulatory Database.

Box 4.3: Licensing regimes

Licensing frameworks traditionally comprised a large number of different service and technology categories. Many countries used either individual licenses, class licenses or open entry to regulate telecommunications networks and services. Applicants had to apply for separate licenses in order to provide each service. Individual licenses can provide a higher degree of regulatory control over market entry, mainly in the case of targeted economic promotion policy or scarce resources (spectrum, numbering). Convergence transformed this categorization and regulators are optimizing licenses and simplifying licensing regimes. A growing number of regulators are adopting alternative approaches to rationalize the licensing regime,, including:

1. General License Categories and Technology Neutrality: the underlying licensing reform is to introduce technology-neutral licenses that combine converged services or broaden the types of services that fall within a single license ("class licenses").

In Malaysia, the licensing framework previously consisted of 31 service-based licenses. Its new framework consists of four general and technology-neutral licenses: Network Facilities Provider (NFP); Network Services Provider (NSP); Application Services Provider (ASP); and Content Application Services (CSP - a special subset of application services that includes television and radio broadcast services and Internet content services).

2. Unified Licensing: under this regime, licenses are amalgamated into a single license covering a wide range of services.

In Kenya, the new licensing regime announced in September 2004 adopts a unified and technology-neutral licensing framework that allows any form of communications infrastructure to be used for any type of communications service. This licensing regime is simpler than the previous service-specific licensing regime (consisting of 46 types of licenses grouped into nine categories). Kenya is introducing its new regime gradually and has established a transition period during which it will issue three types of technology-neutral licenses i.e., individual network operator (major) licenses, non-facility based service provider (minor) licenses, and frequency licenses, before moving to its full unified licensing regime.

3. De-licensing: Many countries have moved towards a general authorization regime, in which operators are free to provide services subject to regulatory obligations. Typically, the operator must notify the regulator before, or shortly after, initiating service. However, operators do not have to wait for approval before commencing service.

The member states of the EU are moving to a simple authorization regime using minimal regulatory intervention and requiring individual licenses only where strictly necessary (e.g., for the use of scarce resources such as radio frequencies and numbering). The regime covers authorization of all electronic communications networks and services, regardless of whether or not they are provided to the public.

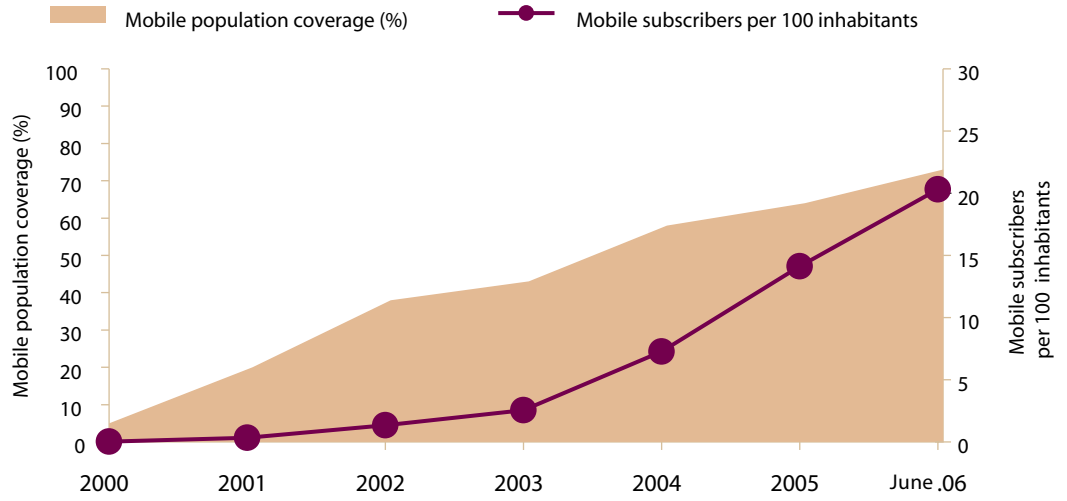
4. Eliminating License Requirements on New Converged Services: another way of addressing convergence is to eliminate filing requirements with the regulator on the basis that the services fall outside of the regulator's authority or because the regulator has decided to forbear from regulating a particular service.

The US followed this approach for ISPs offering email, Internet access and VoIP services. Services provided by ISPs are treated as unregulated "information services" to promote the development of the Internet.

5. Adherence to Regulatory Requirements and Obligations: as many regulatory functions were based on a license at inception, the move to forbear from licensing is viewed by some as eroding the regulator's authority over new entrants, leading to a license being issued, even when regulatory oversight is no longer required. Although a regulator may decide that certain categories of service or network providers are exempt from licensing requirements, regulators may still impose certain regulatory obligations on such providers (e.g., contributions towards universal service funds or compliance with emergency service requirements). For instance, although the FCC (the US regulator) has not implemented licensing, notification or registration requirements for ISPs, it has determined that certain VoIP providers must comply with emergency number (E911) requirements. This determination is part of a rule-making proceeding that was initiated by the FCC to determine whether VoIP services should be regulated and whether providers of such services should be subject to certain regulatory requirements.

Source: ITU/*info*Dev ICT Regulation Toolkit, available at www.ictregulationtoolkit.org/en/Section.2091.html.

Figure 4.7: Mobile coverage and penetration, Nigeria



Source: ITU World Telecommunication Indicators Database, adapted from Nigerian Communications Commission and MTN

The Government licensed a number of new service providers including:

- Auction of three mobile cellular licenses in 2001 to MTN, Econet[15] and the incumbent fixed line operator, NITEL;
- Issuing a Second National Operator license to Globacom in 2002 for all services including mobile (i.e. a fourth license);
- The award of over a dozen new local network operators licenses since 2000.

The results have been dramatic – teledensity has soared. New mobile subscriptions increased from 30'000 per month during 2001 to half a million per month in 2004, with 11 million mobile subscribers by March 2005. By June 2006 there were almost 26 million fixed and mobile subscribers for a teledensity of 22 subscribers per 100 inhabitants. The population coverage of mobile networks increased from around 5 per cent in 2000 to 75 per cent by June 2006 (Figure 4.7). Thousands of jobs have been created and access extended to many for the first time. Nigeria obtained a connection to the SAT3/WASC submarine fibre optic cable in 2002, significantly expanding its international communications capacity and global Internet bandwidth.

As a result of the liberalization, Nigeria now has one of the most competitive fixed and mobile markets in Africa. It has licensed over 20 private operators, accounting for 71 per cent of its 1.5 million fixed lines in operation at June 2006, far more than the incumbent. Nigeria has four mobile operators and the lowest industry concentration in Africa.[16]

This startling growth has not been without problems - mobile interconnection disputes have arisen and the privatization of the incumbent NITEL has also been subject to numerous setbacks.[17] ISPs have complained about restrictions on access to the SAT fibre cable and the high prices charged by NITEL.[18] The regulator, the NCC, has played a key role in overcoming these problems. For example, due to the lack of progress among the operators over mobile interconnection, NCC established rates to be followed by the mobile industry.[19] Nigeria became one of the first countries in Africa to adopt the unified licensing approach in February 2006. In future, NCC will issue unified licenses allowing operators to provide multiple services under the terms of a single license (eliminating the distinction between fixed and mobile services, which was causing problems due to the mobility functionality of fixed wireless networks). This will enable operators to deploy new infrastructure and services more rapidly.

4.5.2 Guatemala: Spectrum innovator

In 1996, Guatemala signed peace accords. That same year, it also introduced sector reforms with its new General Telecommunications Law[20] minimizing license conditions, eliminating investment requirements and ending price controls. A regulator was created, the Superintendent's Office of Telecommunications (SIT), as well as a fund for rural telecommunications. One of the most innovative outcomes of the General Telecommunications Law was a new spectrum regime.

Under the law, spectrum is assigned through "Frequency Usufruct Titles" (TUFs). The TUF is valid during 15 years, during which owners can lease, sell, subdivide or consolidate spectrum, without actually owning it. The TUFs are auctioned by the SIT. 4'000 TUFs have been issued (with about half through auction) and almost the entire spectrum is in use. The TUF is a certificate containing information about the spectrum pertaining to it:

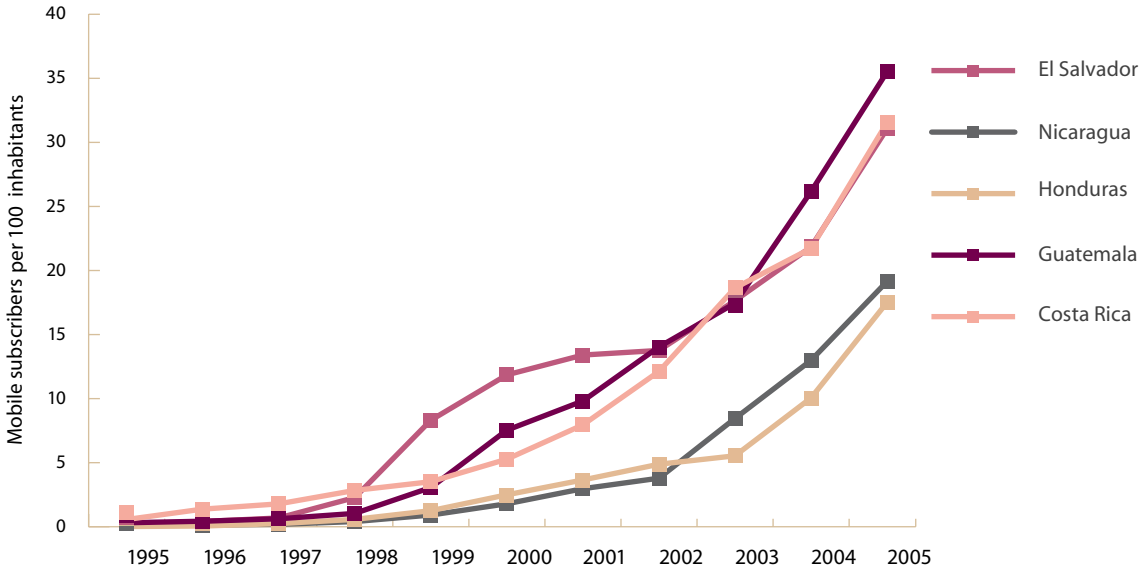
- range of frequencies;
- hours of operation;
- maximum power transmitted;
- maximum power emitted at the border of adjacent frequencies;
- geographic coverage;
- date of issue and expiry.

The back of the TUF is for endorsements, required whenever it is traded. The SIT maintains an inventory of assigned frequencies on its website.[21]

The country has also licensed several mobile operators. Guatemala's first mobile telephone operator, Comcel, started in 1990. It held a monopoly until 1999, when two additional operators (Telefónica of Spain and TELGUA, the incumbent fixed line operator) were licensed, following the telecom reforms of 1996. A fourth operator, BellSouth, began operations in 2001, but it was acquired by Telefónica in 2004. By 2006, there were three mobile companies operating. Two additional mobile licenses were issued in 2003, but have yet to begin operations.

Spectrum flexibility has lowered investment costs for mobile operators by making a large amount of spectrum available, lowering mobile interconnection charges and prices.[22] Guatemala has the lowest mobile tariffs in Latin America and the highest mobile penetration in Central America (Figure 4.8), mainly due to the liberal spectrum environment.[23] Spectrum trading is being widely adopted elsewhere and was the focus of a recent ITU workshop.[24]

Figure 4.8: Mobile subscribers per 100 inhabitants, Central America



Source: ITU World Telecommunication Indicators Database, adapted from regulatory and operator reports.

Box 4.4: The Government of India seeks to expand its USO fund to improve rural mobile infrastructure

In 2006, the Indian government extended financial support from the Universal Service Obligation (USO) Fund to mobile operators to create infrastructure in rural and remote areas, according to local press reports. The USO Fund, which previously provided subsidies only to basic telecoms operators for fixed-line services in rural areas, will now also cover mobile operators.

The USO Fund can be used for the creation of infrastructure such as towers, power supply and back-up, in rural and remote areas which are not covered by wireless signals. Telecommunications operators will utilize the infrastructure created with the support from USO Fund to extend mobile services in these areas and a maximum of three telecoms service providers will be able to share the new infrastructure. This will also be used for providing broadband services in villages. It is expected that approximately 10'000 wireless masts would be set up in different parts of the country. The scheme is aiming to increase the coverage of villages and other remote areas. With an estimated 670 million people living in low-income rural areas, around half India's population is poorly served by current fixed and mobile networks. Increasing rural teledensity levels is also a key to achieving the Department of Telecommunications' (DoT) target of 250 million subscribers in India by 2007.

Source: Global Insight, 17 October 2006.

4.6 Infrastructure development

Infrastructure is one of the key foundations for building an Information Society and bringing the benefits of ICTs to all. The WSIS called for mobilization by different stakeholders to establish better and more extensive infrastructure. Infrastructure is now provided by alternative sources - for instance, many local authorities around the world have begun financing or constructing Wi-Fi networks, while mesh networks and peer-to-peer network infrastructures foresee end-users as being infrastructure providers.

The facilitation of the implementation of WSIS Action Line C2 at the international level is led by ITU[25] and should provide guidance on relevant topics, such as policy harmonization, regulation, financing mechanisms and the use of innovative technologies. The multi-stakeholder nature of the WSIS implementation process is useful as a new model for addressing universal service provision (see Box 4.4).

The following country case studies, on Tunisia, Netherlands and Pakistan, illustrate different aspects of infrastructure investment.

4.6.1 Tunisia of Tomorrow

Tunisia was the country that originally proposed the holding of a World Summit on the Information Society and it hosted the second Phase of the Summit in November 2005. The Tunisian government views ICTs as a key way for Tunisia to face the challenges of the 21st century. President Ben Ali's campaign motto during the 2004 elections was *Tunisie de Demain* ("Tunisia of Tomorrow").[26] ICTs figured prominently in the President's Election Platform for 2004-2009 and constitute one of the pillars is the construction of a knowledge economy.

Tunisia was the first African and Arab nation to connect to the Internet backbone in 1991. Since then, international Internet bandwidth has grown from 19.2 kbit/s to 600 Mbit/s in 2005. Connections to two submarine fibre networks (SEA-ME-WE and Italy-Tunisia) guarantee ample bandwidth. It has the second-highest fixed line penetration and the highest mobile and PC penetration among North African countries. While fixed line growth has slowed, mobile has taken off rapidly, following the award of a second license in 2002. The mobile network covers virtually the entire population. Tunisia has also been trialing 3G mobile systems.

Table 4.2: ICT indicators for North Africa, 2005

ICT Indicator	*Algeria*	*Egypt*	*Morocco*	*Tunisia*
Main lines per 100 inhabitants	7.8	14.6	4.4	12.5
Mobile subscribers per 100 inhabitants	41.5	18	40.9	52.6
PCs per 100 inhabitants	2.4	2.5	2.6	5.7
Internet hosts per 1000 inhabitants	2.3	121.3	825.6	4.2
Price of a local fixed line call	$0.04	$0.02	$0.15	$0.02
GDP per capita (PPP, US$, 2005)	$6'770	$4'440	$4'360	$7'900
Internet users per 100 inhabitants	9.1	7	15.2	9.5
Literacy	69.8	55.6	50.7	74.3
DOI rank 2005/06 (181 economies)	91st	118th	108th	86th
GDP 2005 rank (181 economies)	83rd	91st	68th	87th

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

The Ministry of Communication Technologies is responsible for overall policy. The Tunisian Internet Agency (ATI) was established in March 1996 to promote use of the Internet in the country, while a regulator, the National Telecommunications Agency (INT) was established in 2001. Tunisia has liberalized its telecommunication sector through various reforms. Mobile competition was introduced in 2002, when a second license was issued to Orascom Telecom ("Tunisiana"). The duopoly expired in December 2004, but additional licenses have yet to be awarded. The incumbent operator was partially privatized in 2006 when a Dubai-led consortium paid US$ 2.25 billion for a 35 per cent stake. Tunisie Telecom is now migrating its fixed network to an IP network. Its investment plans called for capital expenditure of DT 1.5 billion (US$ 1.1 billion) between 2002-2006, 56 per cent more than the previous five-year period.[27] The operator introduced ADSL in 2003 and VoIP and is also installing Wi-Fi hotspots.

As a middle-income country, Tunisia faces the dual challenge of widening community and household access to ICTs. As noted, nearly all of the country has basic access to mobile telephony. The OECD basket of monthly mobile phone usage amounts to 4 per cent of average income; recharge cards are available for DT 5 (US$3.82) with a validity of three months. By mid-2006, mobile penetration was 64 subscribers per 100 inhabitants.

Various government initiatives seek to contribute to widen access to ICTs to every Tunisian citizen, including:

- **Publinets.** The Tunisian government launched a programme of public access Internet centers (Publinets) in October 1998. The maximum tariff is DT 2 (US$ 1.50) per hour, with large reductions for students, journalists and the handicapped. Publinets are run by entrepreneurs with financial assistance from the government. There are 250 Publinets nationwide, which also provide training.
- **Family PC.** This programme aims to make one million computers available by 2009. Arrangements have been made with suppliers for desktops or portable PCs at prices no greater than DT 700 and 1'200 (US$ 535 and 916) respectively, while local banks provide generous loans.

The Government is conscious of the importance of integrating national ICT initiatives and reforms into an overall strategy for digital opportunity. It recently adopted a new Orientation Law in the Digital Economy (no. 2007-13 of 19 Feb. 2007) on the establishment of the digital economy. This Law has been established following a dialogue between the Government and the private sector. The main objective of this Law is to foster Public-Private Partnerships in the ICT sector in order to contribute to enhancing export opportunities and speeding up the pace of job creation for higher-education graduates in this sector. Currently, Tunisia is elabourating an ICT strategy for 2007-2011[28] with support from the World Bank. Its strategy aims to achieve levels of ICT infrastructure equivalent to those of developed countries by 2011.

4.6.2 Netherlands: Broadband heaven

The Netherlands is fast developing its broadband infrastructure. By October 2006, broadband penetration had reached 29.8 subscribers per 100, equivalent to over half of all households.[29] As a member of the EU, the Netherlands adheres to regional ICT policy initiatives such as the eEurope Action Plans, which call for widespread broadband infrastructure.[30] Dutch ICT policy aims to be among the ICT leaders in Europe. Given the Netherlands' broadband penetration, it has been successful in meeting this goal.

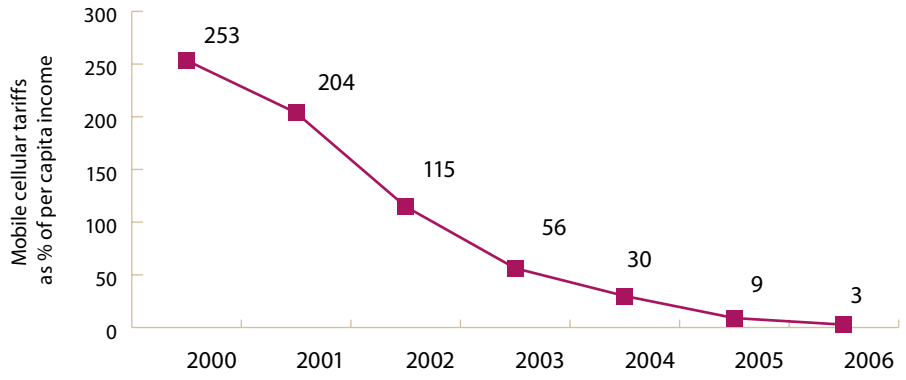
Geography plays a large part in explaining Dutch broadband success. The country is flat and urbanized, with a high population density. These factors make it easy to roll out ICT infrastructure. Almost all houses have a fixed line telephone connection and 97 per cent have a cable television connection. While geography has contributed to the Netherlands' good connectivity, policy has also played a large role. The incumbent operator, KPN, was privatized in 1994 and a telecom regulator, "Onafhankelijke Post en Telecommunicatie Authoriteit" (OPTA), was created in 1997.

In broadband policy, the Dutch have loosely followed the *investment ladder* theory[31], requiring the incumbent to open up its copper wire access network. Investment ladder theory suggests that competition increases, as newcomers grow in their ability to make investments. In the early stages of competition, where newcomers cannot yet make large levels of investment, resale can help to grow the market (including simple resale, bitstream access and unbundled local loop). The market moves up the investment ladder as newcomers invest more in their own technology. *Inter-modal* competition is beneficial in this, in addition to *intra-modal*. In the Netherlands, cable TV has proved an effective competitor to DSL through the availability of Internet access via cable modem. As a result, the incumbent had a broadband market share of less than 45 per cent in October 2006.

The competition has also lowered prices and improved quality. Broadband pricing has dropped dramatically. KPN charged some € 74 per Mbit/s in 2001 for DSL, but by 2006, this had fallen to € 8. Users in turn want faster connections. By the end of 2005, over half of the incumbent's broadband subscribers were already at speeds greater than 3 Mbit/s. KPN has plans to provide fibre optic connections to all neighborhoods (i.e., fibre to the curb) as part of its Next-Generation Network (NGN) strategy. Already, by the end of 2005, fewer than half of all calls were made over the traditional PSTN telephone network.

From the experience of the Netherlands, effective competition is critical to achieving a high level of broadband. Competition policies have made a crucial difference in raising broadband penetration. Further steps include the promotion of both intra-modal and inter-modal competition by requiring incumbent operators to provide wholesale access to their networks, while encouraging the build-out of alternative infrastructure.

Figure 4.9: Mobile tariffs as a proportion of per capita income, Pakistan, 2000-2006



Source: Wilson, Joseph (2007), "Digital Opportunities in Pakistan", available at: www.itu.int/osg/spu/digital-bridges/materials/wilson-paper.pdf.

4.6.3 Pakistan: Mobile-driven growth

In 2000, the Government of Pakistan established its first IT Policy. The vision was "to harness the potential of IT as a key contributor to the development of Pakistan".[32] It aimed to:

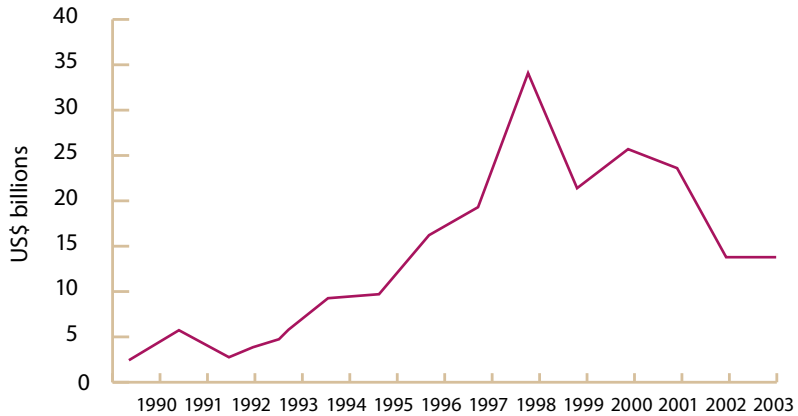
- Make the Government a facilitator and enabler to provide maximum opportunities to the private sector (local and foreign) to lead and invest in the development of IT in Pakistan.
- Develop an extensive pool of trained IT manpower to meet local and export requirements.
- Develop an enabling legislative and regulatory framework for IT-related issues.
- Revitalize, emphasize and support Pakistan's dormant manufacturing and Research and Development (R&D) potential.
- Establish an efficient and cost-effective infrastructure that provides equitable access to national and international networks and markets.

New regulations have been established to ensure the effective implementation of the IT Policy.

A liberalized environment and targeted policy incentives have boosted growth in the ICT sector of Pakistan. Cellular usage grew ten times over just five years to reach 2.5 million at the end of 2005. The number of mobile subscribers increased from 0.22 to 18 per 100 inhabitants from 2000-05, which means that virtually every household within reach of mobile signal has at least one mobile phone. The main factor driving this growth was the shift from Receiving Party Pays (RPP) to Calling Party Pays (CPP). Prepaid cards costing less than US $0.50 per month brought cell phones within the reach of ordinary people. Handset prices fell from over US$ 300 to under US$ 100. Moreover, cell phone users could keep their phone numbers even after their prepaid card expired, under the Mobile Number Portability Regulation 2005. These measures have all contributed to the greater affordability of mobile services (see Figure 4.9).

With policies ensuring that access to the Internet costs no more than a local phone call, Pakistan's government has installed Internet access in 1'700 locations, reaching some 90 per cent of the country's population. Household PC penetration grew from 0.03 to 35 per cent between 2000 and 2005. A national broadband policy was announced in 2004 to offer affordable, high-speed broadband services to corporate, commercial and residential areas. As the Government cannot bear the full cost of nationwide infrastructure, it has opened up the telecommunication market to foreign investment and competition. By opening the market, it is hoped that broadband access will become cheaper and more accessible.

Figure 4.10: Telecommunication Foreign Direct Investment in developing countries, 1990-2003



Source: World Bank.

Box 4.5 Greenfield investment

New projects boost investment and enable growth

One way in which foreign investment can be injected into the telecommunications sector is through licensing new networks. The biggest by value have tended to be new mobile cellular licenses with much of the foreign investment covering the cost of licenses. However, the once-exclusive fixed line markets are also now beginning to open up and there has been increasing investment in second or third fixed line operators, as well as "Second National Operator" licenses, which allow licensees to offer a full range of services including fixed, long distance and mobile.

According to data from the World Bank's Private Participation in Infrastructure (PPI) database, there were some 565 Greenfield transactions in the telecommunication sector of developing countries between 1990-2005. The total value of license fees was some US$ 33 billion (of which around one-third are accounted for by Brazil alone). The World Bank estimates that investment commitments for these new projects amounted to some US$ 205 billion.

The extent to which developed countries have reduced foreign investment in the telecommunication networks of developing countries is reflected in Greenfield transactions in 2005. All except one of the transactions involved investors from Africa or the Middle East. South-South flows are driving FDI in developing countries, where a growing number of, mostly early-liberalized economies, are building growth strategies based on regional or international expansion. The two transactions involving a developed country investor were Millicom's investment in Chad and the launch of a new mobile operator in Oman (where Denmark's TDC is a secondary member of a consortium led by Qatar Telecom).

Box Table 4.5: Selected greenfield telecommunication investments, 2005

Country	*Operator*	*Amount (US$ m)*	*Investors*
Afghanistan	Areeba Afghanistan	40	Fee paid by Investcom (Lebanon) for a mobile license.
Algeria	Consortium Algerien des Telecommunications	65	Orascom (Egypt) & Telecom Egypt. The consortium has committed to invest US$ 400 million.
Bangladesh	Warid Telecom	50	Fee paid by Warid Telecom (UAE) for a mobile license.
Chad	Millicom Tchad	Not available	A mobile license awarded to Millicom of Luxembourg; amount of license or planned investment not published.
Iran	Irancell	350	MTN (South Africa).
Maldives	Wataniya Telecom	1	Mobile license won by Wataniya (Kuwait). Wataniya's investment in Maldives stood at US$ 64 million.
Oman	Nawras Telecom	104	Q-Tel (Qatar) and TDC (Denmark).
Sierra Leone	Africell Sierra Leone	0.25	The fee paid by LINTEL (Lebanon) for a mobile license

Source: ITU, adapted from World Bank and various operator and regulator reports.

4.7 Attracting investment

Regulatory changes have to be coupled with appropriate incentives. The creation of an enabling environment is the foundation for a vibrant ICT sector and for maximizing the benefits of ICTs. The multiplier effect of investment incentives can help ensure a high return and contribute to the overall performance of the ICT sector. This section reviews national ICT strategies aimed at creating an enabling environment for investment.

4.7.1 Foreign Direct Investment (FDI)

As noted above, FDI has helped finance ICT infrastructure and develop telecommunication services in many countries since the 1990s. FDI has come into the telecom sector in two broad waves:

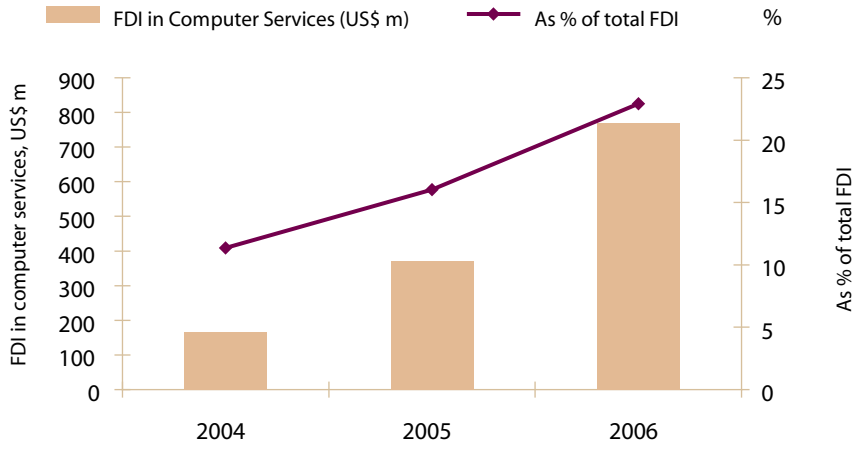
- the first, in the early 1990s, arose in response to numerous privatizations of incumbent operators around the world (Figure 4.10);
- the second, in the mid- to late-1990s, flooded into new mobile markets. FDI also provides an additional source of revenue in licensing fees (Box 4.5). Technology-intensive FDI can trigger productivity gains and improve business processes, with important spillover effects in better management practices and technology-intensive skills.[33]

Countries seeking to attract FDI must ensure that they have an adequate enabling environment (in political risk, taxation incentives, investment restrictions and regulatory environment). They can also allow high levels of foreign ownership/control and commit to regional and global trade agreements offering flexibility and security to investors. However, many countries retain foreign investment caps that can inhibit investment in the ICT sector. For example, companies were reluctant to invest in India's telecommunication sector until the government lifted the cap on foreign ownership in any operator from 49 per cent to 72 per cent.[34] China is raising foreign investment limits in its mobile and wireline markets to 49 per cent by the end of 2006 and 2007 respectively.

Commitments to trade agreements help provide security to investors by enshrining telecommunications liberalization in multilateral treaties. If a country violates its commitment, it can then be brought before the trade organization. Some 69 countries have offered commitments at the WTO negotiations on basic telecommunications which entered into force on 1 January, 1998.[35] Other countries can also benefit, by using the WTO commitments as a lever for pursuing liberalization in their telecommunication sectors.

According to the World Bank, FDI in telecommunications jumped from $2 billion in 1990 to $33 billion in 1998 (Figure 4.10) — but gradually fell to about $13 billion in 2002 and 2003.[36] While there

Figure 4.11: Foreign Direct Investment in India's computer services sector



Source: Reserve Bank of India.

are fewer opportunities today (given that many privatizations that have already occurred and fewer mobile licenses are being issued), there are still many opportunities in the broader ICT sector. Although data are scarce, investment is growing in terms of the number of transactions. However, values remain low, due to the underdeveloped state of Internet and computer services markets in most developing economies. Take African Lakes, the UK-based company that bought Africa Online in 1998. Although Africa Online operates in 8 countries and is the largest ISP in Africa outside of South Africa, African Lakes paid only US$ 4.4 million to acquire it.[37] Nonetheless, its value has grown massively, with Africa Online changing ownership nine years later for US$ 20 million in February 1997, when South Africa's Telkom bought it.[38]

The golden era of large foreign investment in major infrastructure providers may seem to be over, but there is scope for investment in downstream activities, such as call centers, software development and outsourcing. This is occurring is India, where the FDI inflows into India's computer services sector rose from US$ 166 million in 2004 to US$ 770 million in 2006, when computer services accounted for 23 per cent of total FDI to India (Figure 4.11). This rise in FDI to India's computer services sector has fueled rapidly-growing IT-enabled export services, from just US$ 753 million in 1996 to US$ 23.6 billion by 2006. Today, India is the third-largest exporter of computer and information services in the world.

4.7.2 Tax incentives[39]

In economies where the private sector is increasingly dominant as a result of privatization, one of the main areas where governments retain influence is the tax framework they offer to foreign investors to attract investment. A country's tax regime is a major part of its investment promotion strategy (which may also include steps to reduce bureaucracy, streamline customs and export procedures, and simplify permits and licensing procedures).

Asian governments were among the first to pioneer the use of fiscal and export incentives in reduced tax rates, waivers and exemptions to specific groups of investors to build comparative advantage.[40] Tax incentives are often offered to large Multi-National Corporations (MNCs) and listed companies, on a standardized or negotiated basis. Fiscal incentives are widely used in technology-intensive sectors with global production and supply chains dominated by MNCs. In many countries, government policy has sought to attract MNCs with their large resources of 'hot' capital with specific incentives.

Based on a review of the incentives offered by twenty developing countries, virtually all countries offered tax incentives (in reduced rates, exemptions, tax holidays or stability agreements) for investment in manufacturing, technology-intensive and export sectors (Table 4.3). Some countries target specific fields (e.g., Singapore's targeted incentives in the infocomm and biotechnology sectors). Survey evidence suggests that investors do take tax incentives into account in deciding where to invest[41], although critics argue that tax competition between neighboring countries has resulted in a "race to the bottom". Nevertheless, tax incentives to attract high-tech telecommunication investments are an important means of revitalizing a lackluster telecom sector.

4.8 Innovation-driven and human capacity-building strategies

Most recent growth in the ICT sector has involved targeted innovation and human capacity-building strategies. ICT skills are crucial to innovation. Likewise, ICT innovation plays an important role in raising productivity and competitiveness.[42] Markets for basic services in most developed economies are now relatively mature and close to saturation. For many developed economies, innovation in products and services will continue to be one of the main drivers of future growth in the ICT sector. The development of an adequate pool of highly-skilled labour is the foundation for the success of national innovation policies. An example of this strategy is the case of Singapore.

4.8.1 Singapore: Innovation, Integration and Internationalization

Singapore is seeking to establish high, but sustained ICT growth, based on people-centered and innovation-driven national policies. Market and regulatory reforms have catalyzed growth in the ICT sector over the last decade. Singapore was one the first countries to introduce a nationwide ICT strategy. The National Computerization

Table 4.3: Investment Tax Incentives in Selected Developing Countries

Country	*Investment Tax Credit (%)*	*Accelerated Depreciation (% per year)*	*Sectoral incentives*	*Export incentives*	*Regional incentives*	*Loss carry forward*	*Tax holidays (Years)*	*Corporation Tax rate (%)*
Botswana	None	Mining+ capital allowances	Yes	Duty exemptions	No	5	None	25
Brazil	None	Yes	Yes	Yes	Yes	4	15	34
Ecuador	In tourism	5-10	Yes	Yes	Yes	N/a	20	25+15
Ethiopia	N/a	Yes	Yes	Yes	Yes	3-5	1-5	35
Ghana	None	5-20	Yes	Yes	Yes (-25-50%)	5	5-10	30-32.5
Kenya	None	Yes	Limited	Yes	No	Unlimited	10	30-37.5
Korea	6-10	Yes	Yes	Yes	No	3	5	15-25
Lesotho	None	5-25	Yes	Yes	No	N/a	None	15-35
Mauritius	10% anti-pollution	Yes	Yes	Extensive	No	Unlimited	0-10	15-35
Mexico	19-25	Yes	Yes	Yes	Yes	4	None	34
Nepal	None	5-25	Yes	Yes	Yes	N/a	5-10	20-30
Nigeria	5-20	No	Yes	Yes	No	4	3-5	30
Peru	None	3-20	Yes	Yes	Yes	4	None	27
Philippines	75-100	No	Yes	Yes	No	N/a	4-5	32
Rwanda	None	5-50	Yes	Yes	Yes	5	None	30
Singapore	33.3/3-50	Yes	Yes	Yes	No	Unlimited	5-10	20
Sri Lanka	None	Yes	Yes	Yes	Yes	6	5	30
Tanzania	None	25-100	Yes	Yes	Yes	5	2-5	30
Uganda	None	5-20	Yes	Yes	Yes	Unlimited	10	30

Note: N/a: Not available.

Source: Biggs (2007), adapted from UNCTAD Investment Policy Review series.

Plan was adopted in 1980. As a result, over the next five years, all government offices were computerized and the ICT services industry grew tenfold. The National IT Plan (1986-1991) and IT2000 (1992-1999) provided the framework for enabling online services, e-commerce and e-industry. Infocomm21 (2000-2003) identified the ICT sector as a government priority and key sector for growth. The program aimed to boost the competitiveness of Singaporean firms and enhance quality of life through ICTs or "infocomm". In 2000, Singapore fully liberalized its telecommunication market, allowing competition in all markets and lifting all limits on direct and indirect foreign equity investment in Singaporean operators. The first e-Government Action Plan was also launched. The most recent national ICT strategy (2003-2006), Connected Singapore, focuses on enabling individuals, organizations and business to become more viable, efficient and innovative. In March

Table 4.4: The age divide in Singapore

AGE-DISAGGREGATED DOI	2005/06	15-29	45-59	60+
OPPORTUNITY	***1.00***	***1.00***	***1.00***	***1.00***
INFRASTRUCTURE	***0.71***	***0.76***	***0.54***	***0.42***
4. % households with a fixed-line telephone	0.98	0.98	0.98	0.98
5. % households with a computer	0.74	0.86	0.55	0.34
6. % households with Internet access at home	0.66	0.83	0.48	0.24
7. Mobile cellular subscribers per 100 inhabitants	0.98	0.87	0.61	0.38
8. Mobile Internet subscribers per 100 inhabitants	0.18	0.24	0.1	0.15
UTILIZATION	***0.45***	***0.65***	***0.49***	***0.49***
9. % individuals that used the Internet	0.49	0.83	0.48	0.24
10. Fixed broadband subscribers / total Internet subscribers	0.83	0.83	0.83	0.83
11. Mobile broadband subscribers / total mobile subscribers	0.04	0.28	0.16	0.39
DIGITAL OPPORTUNITY INDEX	**0.72**	**0.80**	**0.68**	**0.63**

Source: ITU/UNCTAD Digital Opportunity Platform, adapted from the Singapore Infocomm Development Agency (IDA).

2005, there were 35 Facilities-Based Operator (FBO) licensees that owned their own facilities and more than 700 Service-Based Operator (SBO) licensees that provided telecommunications services over third-party networks.[43]

Today, Singaporeans enjoy easy and widespread access to advanced telecommunication networks and services. In its vision iN2015 for An Intelligent Nation, Global City, Powered by Infocomm, the Government views infocomm as integral to enabling growth in the economic and social spheres. Highly-skilled human resources, R&D and innovation are the key pillars of Singapore's strategy for growth. The ambitious targets of in2015 include creating 80'000 additional jobs, with 90 per cent of all households using broadband and 100 per cent computer ownership in households with school-age children.[44]

Singapore was also the first country in the world to focus on computerized primary education. In 2002, there was a 2:1 pupil-computer ratio in all primary schools. The Ministry of Education has decided to move away from general purpose computer labs and to invest in the concept of classroom connectivity. Today, every classroom is connected to the Internet and the high-speed Singapore ONE backbone. Singapore already collects age-differentiated ICT data and this makes it possible to assess the age divide in Singapore, by calculating the DOI for different age groups (Table 4.4). Not surprisingly, the 15-29 age group does best, while the 60+ age group falls below the national average.

The vision of the Government of Singapore is to have "an infocomm-savvy workforce and globally competitive infocomm manpower to drive national economic competitiveness".[45] On the basis of digital opportunity among the young generation of tomorrow, Singapore's future seems bright and assured. The Government of Singapore has introduced a comprehensive plan, in2015, that seeks to address the age divide, among other issues.

4.9 Conclusions

Which strategies are likely to be the most successful in stimulating ICT growth? There are likely to be as many answers as there are economies, because ICT growth is specific to different national contexts, policy goals and market structures. Nevertheless, the review in this chapter shows that certain factors are common to most economies in growing their ICT sector; further, these factors need to be integrated and mainstreamed into national growth strategies. Market reforms (including liberalization, privatization and competition) have proven vital enablers of growth. Proactive regulation can increase productivity and spread the benefits of ICTs across different sectors. Developing extensive and adequate infrastructure capacity is a key to enhanced connectivity. Creating an enabling environment for investment is another driver. Last, but not least, a prosperous and inclusive Information Society could not be built without highly-skilled labour.

The case studies presented in this chapter show that success in ICTs is not the preserve of developed economies alone, but can serve to promote national socio-economic development at any stage of the development process, as part of an overall national growth strategy.

Notes for Chapter Four

1 See WSIS Geneva Plan of Action, para 5, available at: www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=2316|0.

2 For instance, in the European Union, the ICT Sector is growing faster than the general economy and contributed nearly 50 per cent of productivity growth between 2000 and 2004: see i2010 Second annual report (2006), available from: http://ec.europa.eu/information_society/newsroom/cf/itemdetail.cfm?item_id=3303.

3 For instance, France's early start with non-IP-based interactive media, such as the videotext-based minitel system, arguably slowed the pace at which it initially adopted the Internet.

4 See "Information Society and Information Policy", Chapter 2 of G.S. Oh (2005), "The Process of Korean Information Policy", Korea Information Strategy Development Institute.

5 See the review by the Overseas Development Institute (Chapman and Slaymaker, 2002), in the UNCTAD Information Economy Report 2006, available at: www.unctad.org/Templates/WebFlyer.asp?intItemID=3991&lang=1.

6 UNDP (2000), The Estonian Tiger Leap into the 21st Century, available from: www.esis.ee/ist2000/background/tiigri-hype/contents.html

7 UNPAN (2005), "Global E-government Readiness Report 2005: From E-government to E-inclusion", available from: www.unpan.org/egovernment5.asp

8 EU (2005), "Information Society Benchmarking Report", available from: http://europa.eu.int/information_society/eeurope/i2010/docs/benchmarking/051222%20Final%20Benchmarking%20Report.pdf

9 Statistics are from the ITU World Telecommunication Regulatory Database, available through the ICT Eye portal - see: www.itu.int/ITU-D/ICTEYE/Default.aspx.

10 For example, Albania has been attempting to privatize incumbent AlbTelecom since 2002, when it was announced that it would be partially privatized by the end of that year. The deadline passed and an agreement was eventually reached on the sale in 2005, but it was later cancelled. The government then announced that the sale would take place by the end of 2006, but that deadline has also passed (www.itu.int/ituweblogs/treg/Albtelecom+Privatisation+Process+To+Begin+By+End+2006.aspx). Likewise, efforts to privatize Nigeria's incumbent operator NITEL have been ongoing since 2001, see: www.state.gov/e/eb/ifd/2005/43036.htm

11 One exception was the 2006 sale of 50 per cent of Colombia's TELECOM to Telefónica of Spain. The funds will be used for a capital increase in TELECOM instead of accruing to the government: "Telefónica Takes Control of Colombia Telecom." April 7, 2006, Press Release.

12 One example is Ghana, where 30 per cent of the incumbent was sold in 1997 for US$ 38 million to a consortium headed by Telekom Malaysia. The government later cancelled the agreement in 2002 and was taken to court by Telekom Malaysia. The case was finally settled by international arbitration in 2005, with the Ghanaian government agreeing to pay US$ 52.2 million. Another example is Yemen where the license of the TeleYemen joint venture between Cable and Wireless of the UK and the Yemeni government came to an end in 2003. The Yemen government subsequently awarded a five-year contract to France Télécom to manage the company, but with no equity stake.

13 For more information on this subject, see ITU "Trends in Telecommunication Reform Report 2007: On the Road to NGN", available at: www.itu.int/pub/D-REG-TTR.9-2007.

14 For more information, OFCOM's website can be found at: www.ofcom.org.uk/.

15 Econet Nigeria's shareholding has been the subject of ongoing disputes. See: iafrica.com, "Econet Nigeria dispute nears end". February 8, 2005. Available at: http://business.iafrica.com/news/411769.htm. In 2006, MTC of Kuwait purchased 60 per cent of the company and rebranded it. See: Celtel. "Celtel International acquires controlling stake in Vmobile Nigeria", Press Release, May 31, 2006. Available at: www.mtctelecom.com/muse/obj/lang.default/portal.view/content/About%20us/Worldwide%20Presence/Nigeria

16 As measured by the Hirschmann-Herfindahl Index, which was 3'341 at December 2005, World Bank, "Information & Communications for Development 26: Policies and Trends". The Hirschmann-Herfindahl Index (HHI) is a common measure of industry concentration, computed by summing the square roots of the market shares of each company. An HHI of 10'000 = monopoly.

17 www.firstglobalselect.com/scripts/cgiip.exe/WService=globalone001/globalone/htm/news_article.r?vcnews-id=218814

18 www.cipaco.org/spip.php?article505

19 Nigerian Communications Commission, Determination of Interconnection Rate, June 21, 2006.

20 Guatemalan Republic (1996), General Telecommunications Law, available at: www.sit.gob.gt/docs/lgt.pdf

21 See: www.sit.gob.gt/regulaciondefrecuencia.html

22 After Paraguay, Guatemala has the largest amount of spectrum available for mobile operators in Latin America. See Hazlett, Thomas W. and Munoz, Roberto E., "Spectrum Allocation in Latin America: An Economic Analysis" (September 2006), George Mason Law & Economics Research Paper No. 06-44. Available at SSRN: http://ssrn.com/abstract=928521

23 "The empirical evidence gleaned across the four estimated equations is consistent with the hypothesis that spectrum reforms in Guatemala and El Salvador have resulted both in expanded deployment of radio spectrum and in less concentrated markets… Given that Guatemala and El Salvador have succeeded in having much more bandwidth deployed by operators than in the average Latin American regime (approximately 139 MHz to 90 MHz), competition has been enabled." Hazlett, Thomas W., Ibarguen, Giancarlo and Leighton, Wayne A., "Property Rights to Radio Spectrum in Guatemala and El Salvador: An Experiment in Liberalization" (10 March 2006). George Mason Law & Economics Research Paper No. 06-07. Available at SSRN: http://ssrn.com/abstract=889409

24 The ITU/Ugo Bordoni Foundation workshop "Market mechanisms for spectrum management" was held at ITU in Geneva, 22-23 January 2007. More information is available at: www.itu.int/osg/spu/stn/spectrum/index.html.

25 ITU was selected by WSIS as the facilitator for WSIS Action Line C2 (information and communication infrastructure), with assistance from the Association for Progressive Communications (APC) and NGO. For more detail about WSIS Action Line C2, and the third facilitation meeting due to taking place on 16 May 2007 in Geneva, see: www.itu.int/wsis/c2/index.html#16-May-2007.

26 "Le Programme Electoral du Président Zine El Abidine Ben Ali, 2004-2009", available from: www.benali.tn/francais/pdf/benali2004_fr.pdf

27 www.itu.int/ITU-D/imt-2000/documents/Tunis2005/Presentations/Day%201/Presentation_Houerbi.pdf

28 http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=64290415&theSitePK=40941&menuPK=228424&Projectid=P088929

29 See "12th EU Telecom Rules implementation report", available at: http://ec.europa.eu/information_society/newsroom/cf/document.cfm?action=display&doc_id=258.

30 See: http://europa.eu.int/information_society/eeurope/2005/index_en.htm

31 See: http://erg.eu.int/doc/publications/erg_05_23_broadbd_mrkt_comp_report_p.pdf

32 Wilson, J. (2007), "Digital opportunities in Pakistan", input for the DOF 2006, available from: www.itu.int/osg/spu/digitalbridges/materials/wilson-paper.pdf

33 See Machin and Van Reenen (1998), "Technology and Changes in Skill Structure: Evidence from Seven OECD Countries". Quarterly Journal of Economics 443: 195–226, WEF, Global Competitiveness Report 2006.

34 See: www.networkworld.com/news/2007/020707-verizon-enters-indias-long-distance.html

35 See: www.wto.org/english/news_e/pres97_e/data3.htm

36 wwwwds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2006/04/20/000012009_20060420105118/Rendered/PDF/359240PAPER0In101OFFICIAL0USE0ONLY1.pdf

37 See: www.nationaudio.com/News/EastAfrican/03122000/Features/Supplement4.htm

38 See: www.telkom.co.za/pls/portal/docs/page/contents/minisites/ir/sens/sensarticle_197.pdf

39 This section is based on the research and analysis in "ICT Tax incentives", Phillippa Biggs, ITU (forthcoming).

40 Lall, Sanjaya, "Competitiveness, FDI and Technological Activity in East Asia", 2003, Edward Elgar Publishing Ltd, UK.

41 Morrisset & Pirnia (2000), World Bank, Working Paper 2509, "How Tax Policy and Incentives Affect FDI", World Bank, Washington.

42 Lindbaek, J. (1997). "Emerging Economies: How Long Will The Low-Wage Advantage Last?", Background paper for a speech by IFC Executive Vice President, APPI Meeting, October 1997, Helsinki.

43 See: www.itu.int/osg/spu/ni/ubiquitous/Papers/UNSSingaporeCaseStudy.pdf

44 For more information on Singapore's iN2015 strategy, see: www.in2015.sg/.

45 See: www.ida.gov.sg/Manpower/20060414201723.aspx

chapter five

Challenges to building a safe and secure Information Society

5.1 Introduction: Building confidence and security in the use of ICTs

Over the past two decades, the Internet has transformed many aspects of modern life. Use of the Internet continues to grow, with the estimated number of Internet users exceeding one billion worldwide at the end of 2006 and an estimated 113 million websites.[1] People around the globe and from all walks of life have been hearing about the promised improvements the Internet will bring to their lives. While some of these promises have materialized, the full potential of the Internet has not yet been realized. One of the main reasons is that many users lack trust in the Internet for conducting transactions or storing sensitive information. An online survey conducted by ITU in 2006 found that almost two-thirds of respondents had refrained from certain activities online due to security concerns, while users' greatest fears were theft of personal information (e.g., identity theft, credit card fraud etc), computer viruses and spyware.[2] Building trust and confidence is one of the key enablers of future growth and use of the Internet.

The expansion of the Internet is opening up many new opportunities for criminals to exploit online vulnerabilities to commit cybercrime acts or even deliberately attack the critical infrastructures of nation states. Viruses, spyware, phishing, identity theft, zero-day exploits, Denial of Service (DoS) attacks, zombie botnets, and other vulnerabilities are endangering cyberspace and jeopardizing the very future of the Internet. With spam and other exploitation now accounting for up to 90 per cent of e-mail traffic over the Internet, we stand at a critical point in the further development of the Information Society. Unless there is progress in building confidence and security in the use of Information and Communication Technologies (ICTs), users' trust in the Internet may diminish and this could limit its growth and potential.

The term "cybersecurity" is used generically to cover the range of threats to the use of the Internet and ICTs more generally, but it is worth distinguishing three broad areas of concern:

- Threats to individual users posed, for instance, by viruses or identity theft, as well as annoyances such as spam, spyware or pop-ups;
- Threats to businesses, governments or other organizations: for instance, through exploitation of vulnerabilities in their data storage, industrial espionage, system downtime, etc. Corporate users may also have liability in the case of threats to their customers, partners or suppliers;
- Threats to critical public infrastructures, including electronic communication networks, financial systems, emergency services, navigation systems, electrical power grids, air traffic control, water control systems etc.

While these dependencies vary from nation to nation, nearly all nations need to defend and protect their critical network information infrastructures, as the risks are huge, especially in a world in which strife between nations could transmute into electronic warfare. Telecommunications is a critical national infrastructure[3], as vital as the power supply in ensuring the smooth functioning of society. Since the mid-1990s, the rapid growth of ICTs and societal inter-dependency have led to a shift in the perception of threats to cybersecurity. Since then, greater linkages have been made between cybersecurity and Critical Information Infrastructure Protection (CIIP) and, as a consequence, a number of countries have undertaken an assessment of the threats, vulnerabilities and instruments to address them.

With the growing importance of cybersecurity at the national level, cybersecurity has moved onto the international political agenda. During the WSIS, "Building confidence and security in the use of ICTs"[4] emerged as one of the key principles for building an inclusive Information Society. Both the *Tunis Commitment*[5] and *Tunis Agenda on the Information Society*[6] highlight the need to continue the fight against cybercrime and spam, while ensuring the protection of privacy and freedom of expression. In the WSIS outcome documents, Summit participants called for all stakeholders to cooperate to promote, develop and implement a global culture of cybersecurity.

We stand at a critical point in the further development of the Internet. As new technologies are adopted, it is crucial to understand the risks that accompany them in order to maximize the benefits. Growing security threats to security, at the level of the individual, the firm, government and critical infrastructures, make security everyone's responsibility.[7] It is now more important than ever to understand the issues and keep up-to-date on how these challenges are changing.

This Chapter examines the challenges faced in building a safe and secure Information Society.

It reviews the changing nature of cyber-threats and their impact to determine to what extent the future development of the Information Society is at risk. It considers what the different stakeholders can do to build a safer and more secure Information Society, in terms of potential policy responses. Cybersecurity issues are complex and constantly evolving: as a result, coordinated policy action at the international level is needed to address the challenges and the threats to cybersecurity that are emerging.

5.2 The changing cyber-threat environment

5.2.1 From nuisances to real threats

The reliability and robustness of information and communication networks against attack are critical in the future development of the Information Society. The Internet has become such vital part of our society and cultures that it is often difficult to imagine how we ever functioned without it. However, at the same time, the potential for electronic attacks against our networks is growing rapidly. As users demand software with more features and services, and as the underlying source code becomes ever more complex, new opportunities for exploitation continue to emerge. Security is key to users' trust in e-business, e-government and other online applications.

One of the more prominent risks to Internet security is spam, which has mutated from a general annoyance to a broader cybersecurity threat. Spam is now the primary mechanism for delivering viruses that can hijack millions of computers (through so-called "zombie botnets") or launching phishing attacks to capture private or corporate financial information. Phishing refers to spam sent with a fraudulent motive - for instance, to gather credit card or personal banking information. Spam also acts as a platform for many other types of scams. Countries now widely recognize that cybercrime[8] is the fastest-growing form of criminality, including both new criminal offences in relation to computers (such as spam, viruses and hacking) and existing crimes committed using digital or computer technology (such as fraud, harassment, etc.).[9] During the Tunis Phase of the WSIS, participants reaffirmed their commitment to deal effectively with the significant and growing problem posed by spam. However, one problem that all spam-fighters constantly face is that the criminal is always one step ahead.

An additional dimension to consider is the changes taking place in users' online behavior. New ways of using the Internet to communicate, often linked to social networking websites such as MySpace, Bebo, Facebook, etc., are also increasing online security risks, as is the widespread availability of much higher bandwidth connections. The data shared on these sites can make users prey to online attacks. A name, address and birth date, let alone a social security number, provides more than enough ammunition for criminals to hack into financial records and compromise a user's personal information. Fraud, identity theft, computer spyware and viruses (with or without negligent user behavior) can flourish on social networking sites. A recent survey by European Schoolnet[10] indicated that 57 per cent of young people make their online social network profiles public and disclose personal information. Almost a third of youngsters surveyed indicated that they did not know how to choose whether their information should remain public or private on these sites, suggesting greater awareness is urgently needed. Social networking illustrates key trends in the Internet today, with a move away from the centre of the network towards the edges, less centralized control, more user-centric activities and greater user-generated content.

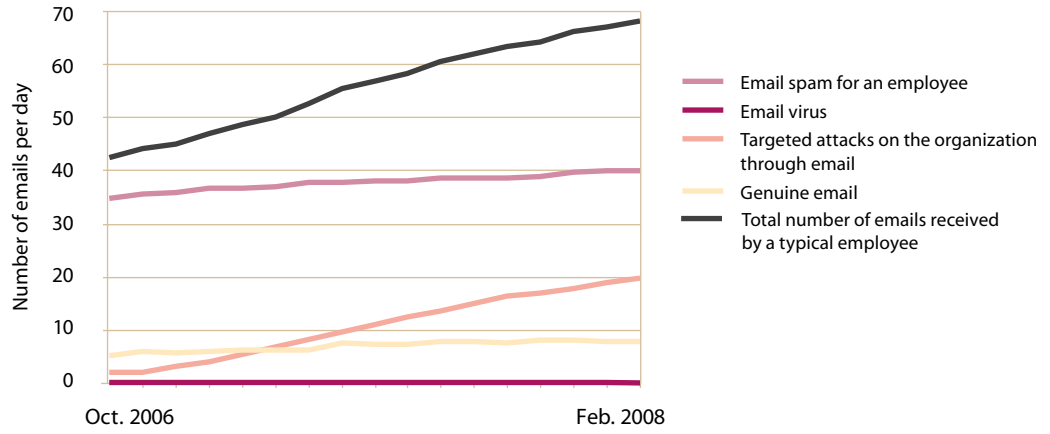
5.2.2 Spam and how the threat from spam is changing in nature

Spam is now worse than ever before.[11] Despite a recent optimistic 'state-of-spam' report by the United States' Federal Trade Commission in December 2006[12] suggesting that spam volumes might have leveled off, in early 2007, it appears that more spam is being sent and received than ever before. Spam now poses a security problem on a colossal scale: some nine out of ten e-mails are considered as spam[13] and both the volume and proportion are increasing steadily (Figure 5.1). Spam has been experienced by nearly everyone who has ventured online. Spam has now reached such a massive volume that experts are warning that spam and related threats could paralyze the Internet. It represents a huge burden on the Internet, clogging critical communication channels and slowing down Internet traffic, especially in developing countries where the capacity of links to the international Internet backbone may be limited.

Spam comprises unsolicited, unwanted and harmful electronic messages[14]: generally, but not exclusively, delivered by e-mail (spam can also

Figure 5.1: Forecast evolution of the changing nature of threats in cyberspace

Based on a typical user



Source: ITU, adapted from MessageLabs.

arrive over mobile phones, instant messaging or IP telephony services, etc). E-mail is considered a business-critical application for many organizations[15], as well as a form of legal documentation in many countries. How do so many spammers succeed in attracting victims and why do people believe the promises offered by spam e-mails? Are people really willing to part with their bank details or invest money in companies that they have never heard of? The answers can be found in the economics driving spam. The cost of sending e-mails is still very low, and if a million scam e-mails can be sent as easily as a single one, there is a likelihood of at least one positive response which will allow the criminal to make a profit. Spam can also be used for indirect profits - for instance, by hyping shares.

Spam - in all its forms - is a drain on resources, time and money. It imposes heavy direct and indirect costs on users, businesses and governments. The direct costs include spam-filtering software, hiring Information Technology (IT) engineers to deal with the problem and the purchase of additional equipment, bandwidth and storage capabilities. More broadly, spam slows messaging services, takes time to deal with (for instance, checking for false positive emails that are detected by a spam filter), reduces employee productivity and increases business costs. In Brazil, 62 per cent of Internet users spend at least five minutes a day dealing with spam, nearly a quarter (23 per cent) spend ten minutes a day and 2 per cent spend more than half an hour a day dealing with spam.[16] According to business surveys, the main justifications for investments in anti-spam initiatives are to compensate for reduced productivity and lost revenues, as well as to reduce the strain on the network and IT resources. Companies may be unwilling, however, to disclose the true costs of spam due to competitive pressures to preserve their reputation. The evidence suggests that costs are heavy, especially for Multi-National Corporations (MNCs) with worldwide operations using e-mail in multiple languages.

The nature of spam is also changing. The e-mail scams asking people to act as intermediaries and move large sums of money through bank accounts are still in circulation, but no longer make up the majority of spam received. More personalized e-mail spam is increasingly common. Pop-ups masked as legitimate warnings from the e-mail software in use on the computer are increasing, as these are currently not picked up by the most commonly-used spam filters. Such pop-ups may state: "Warning: hidden files might have been installed on your computer from the websites you have visited". The person behind this scam wants you to click to accept and download a "safe" program to eliminate the supposed files from your personal computer.

Image spam, or emails sent with embedded images, is a new kind of spam, which is increasing rapidly.[17] By using embedded images instead of text, messages are able to avoid detection by anti-spam filters that rely on the analysis of textual spam content, giving spammers a better chance of having their messages read. A small .gif-file (not

Box 5.1: Threats in cyberspace
Why they deserve increased attention

There are several reasons why cybersecurity is growing in importance to countries and stakeholders around the world, including:

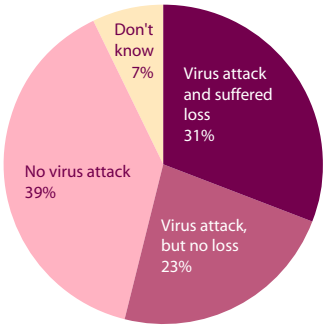
- Inherited architecture: the Internet began as a closed network with a limited number of known users with access, so user authentication was not an issue. The design philosophy of the Internet is now several "generations" behind the latest technological changes (consider, for example, the issue with inherited architecture posed by the 'millennium bug').
- Constant evolution in protocols and technology: the US National Institute of Standards and Technology (NIST)[19] has played a key role in establishing some of the protocols and algorithms used to secure Internet transactions through the use of hash functions. However, in the constant tug-of-war of human ingenuity, many encryption algorithms are eventually compromised. As an example of this, NIST launched an open, blind competition to come up with a fresh algorithm for hash functions in January 2007.
- Evolution of the network: telecommunication networks are evolving towards Next-Generation Networks (NGNs) with decentralized intelligence at the edges of the network and separation of the control layer from the transport layer. The capacity and speed of networks are also increasing. In the absence of specific measures to address network security, the decentralization of intelligence to the edges of the network may make the network more vulnerable.
- Convergence: the combination of different ICTs in converged devices with multiple functions offers opportunities for 'cross-infection', with the problems of one technology feeding into other ICTs. The power and reach of a computer virus would multiply, if it could be transmitted through Internet Protocol television (IPTV) as well as e-mail, to make it much more devastating.
- Size and scale effects: the growth in the size of the network means that chain-reaction network effects are also growing, at an increasing pace.
- Anonymity: the lack of user authentication on the Internet means that it is easy to be anonymous and/or provide false identity information to misbehave online, visit suspicious sites or commit cyber-related crimes without any fear of reprisal ("the easier it is to be bad, the worse people are[20]"). Conversely, anonymity may be one way in which users feel protected, in not giving away information and guarding against attack.
- Internationalization: the availability of the Internet in nearly every country in the world means that the legal framework may have difficulty keeping pace with technological developments: a chain is only as strong as its weakest link. A hacker operating from an unidentified country could use computers in, say, Latvia and the US to attack a Korean government site. Such international attacks are very difficult to guard against.
- Growing dependency on ICTs: modern lifestyles are increasingly dependent on ICTs in work and at play, as well as the storage and transmission of electronic data, for everything from bank accounts to assets to health records. In some countries, the Internet has become such vital part of society that it may be difficult to remember how they functioned without it. Loss of such information could have profound consequences. Very few organizations have the threat-analysis capabilities and strategies in place to address network threats.[21]

Source: ITU.

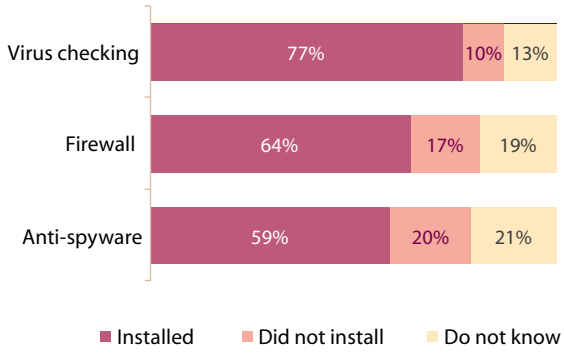
visible in the e-mail received due to its small size) enables the sender of the spam e-mail to know when and if the e-mail message is opened and detect links in pages and e-mails that are opened after the specific spam message. As a result, your personal information could suddenly be in the hands of the spammer. The person or organization behind this e-mail may also want confirmation that the e-mail address is active, so it can be sold to other spammers.

Figure 5.2: Viruses - How worried are you?

Proportion of home users in Singapore that had experienced a virus attack, 2006



Proportions of home internet users that had installed anti-virus software, 2006



Note: The base sample comprised home internet users aged 15-59 who had used the Internet in the preceding 12 months.

Source: Singapore Infocomm Development Authority (IDA), Household Survey, at: www.ida.gov.sg.

Spammers are constantly developing new techniques either in response to, or in advance of, anti-spam software solutions.[18] Variations of spam are developing on different platforms such as spim (spam through instant messaging) and spit (spam associated with Internet telephony). The common thread linking these different platforms is that they have minimal or no marginal costs to sending messages in bulk. Spam is developing from a problem mainly affecting e-mail to attacks on instant messaging, Short Message Service (SMS) text-messaging, blog comments, chat forums, news groups, online games and wikis, with ever-greater costs to users.

Cases of what is called "pump-and-dump" spam and related scams are also increasing: the criminal buys cheap shares in a small company, and creates an interest in the company by sending out spam messages. As a result, the value of the shares rise and the spammer can sell the shares they have acquired at a profit. If undertaken through a real stock exchange, this is an illegal activity with serious consequences; however, in the online world, it is likely that the spammer can get away scot-free without any penalty. The rise of spam still seems to continue unabated and is mutating into more sophisticated threats, often with organized criminal intent. Box 5.1 lists some of the threats in cyberspace and why these deserve increased attention by all stakeholders.

5.2.3 Constantly evolving cyber-threats

We are witnessing a shift in the nature of cyber-security threats with attacks becoming more targeted and sophisticated, using increasingly innovative intrusion methods. Spam is the main vehicle for delivering viruses hijacking millions of computers or launching phishing attacks to capture private financial information. While users are familiar with the time and effort needed to delete spam from e-mail inboxes, the new and emerging threats that spam carries are still quite unknown to the average user. This section reviews some of the more common cyber-threats, their growth and development.

Some users may be sadly all too familiar with the danger posed by viruses and worms to PCs, hard drives and/or files. Viruses and worms can be amusing, annoying or downright dangerous. With connection to the Internet, their transmission by e-mail can multiply their impact many times through a chain reaction branching process. Contrary to previous large-scale virus attacks, where the idea was to attack as many computers as possible, virus attacks are becoming more focused and now rarely occur in a single, large outbreak, to avoid detection.

In Singapore in 2006, over half of all home Internet users experienced a virus attack, with nearly a third of all users incurring a loss as a result. A further fifth of all users had experienced a virus attack, but had not incurred any losses (Figure 5.2). In Brazil, over half of all firms with access to the Internet experienced a virus attack in 2006 (Figure 5.3, left). Viruses were most widely guarded against, with over three-quarters of home users using software to check for viruses (a similar proportion of nearly 70 per cent of household users installing anti-virus software was observed in Brazil, far in excess of the 20 per cent using firewalls or anti-spyware protection). Alarmingly, a fifth of all Singaporean home Internet users did not know about firewalls or anti-spyware. Among all those who had used a home computer but had not installed anti-virus software, 41 per cent were unaware of any need to protect against viruses, while 28 per cent cited the cost of software as being prohibitive. This suggests that consumer awareness is an important issue, with affordable protection the next biggest factor.

Spam often acts as a platform for other scams, with malicious e-mails able recruit your PC to play a role in the activities of a botnet. Botnets are networks of compromised personal computers that can retrieve information such as passwords, credit card numbers, and other personal data stored in the web-browser's auto-fill databases. Botnets are increasingly threatening the smooth functioning of the Internet. Vint Cerf, one of the original developers of TCP/IP, recently stated that up to a quarter of Internet-connected computers are virus-infected components in botnet networks of PCs under the control of hackers, comparing the spread of botnets to a disease that has reached "pandemic" proportions.[19] Large numbers of computers connected in botnets are needed to manage spam campaigns and denial of service attacks. At the 2007 World Economic Forum in Davos, Switzerland, experts in the area mentioned that, at one point, a botnet used about 15 per cent of Yahoo's search capacity.[20] There is also a trend towards smaller botnets, which are much more difficult to detect. In today's business and consumer computing paradigm, the botnet is an emerging tool for various malicious activities. Businesses and consumers are struggling with the best means of protection, and the benefits with implementing different proposed options.[21]

Traditional hacking, or unauthorized access to networked computers, has changed significantly in character over the past few years. Hackers are

Box 5.2: What is malware and what can it do to your PC?

Until recently, designing malware (malicious software) was a competitive form of expression for computer-savvy teenagers. Now, malware techniques are being adopted by organized crime as a goldmine. Malware is very powerful, with low costs and huge returns on investment. Malware, as we know it today, can easily and unknowingly be downloaded by e-mail or Internet websites. This malicious code (which is increasingly targeting mobile phones and portable devices as well as PCs) can install key-stroke logging programs and other software to steal personal information stored on, entered into, or received by these devices. This information, including passwords and other sensitive personal data, is then used in criminal activities, which are increasingly creative and difficult to detect.

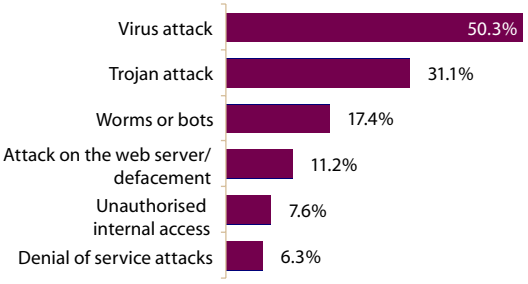
According to SophosLabs, the top five economies hosting web-based malware in 2006 were: the United States, People's Republic of China, Russian Federation, the Netherlands and Ukraine. "The US remains a hot spot for online criminal activity and despite authorities' continued efforts to clamp down on cybercrime, as too many US-hosted websites still have lax security measures in place", according to SophosLabs. "Given the effectiveness of web-based attacks, web-hosting companies in the United States and elsewhere need to step up their policing of published content and ensure that malicious code is quickly removed, before innocent users get hit." Sophos estimates that it sees approximately 5'000 new malicious URLs every day hosting malicious software or "drive-by" downloads of unwanted content.

While policy-makers around the world remain perplexed by this new type of criminal activity, the criminal gangs behind these frauds and scams are getting away with millions of dollars and euros. The stakeholders involved urgently need a better understanding of the impact of malware and how it is used. Only with full awareness of the risks involved can stakeholders take informed decisions on what action needs to be taken. The malware problem is not diminishing, but is constantly changing in character and addressing malware is no easy task, as cyberspace is an increasingly complex place.

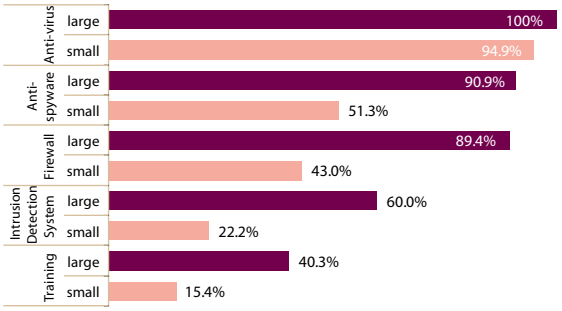
Source: For more information, see MessageLabs and Sophos websites.

Figure 5.3: Cyber attacks on firms in Brazil and action taken

Proportion of firms with Internet access in Brazil that had experienced different forms of cyber attack, 2006



Security measures to promote cybersecurity adopted by firms in Brazil with Internet access, 2006



Note: *'Small' firms comprise businesses of 10-19 employees; 'large' firms include businesses of 1'000+ employees.*

Source: Brazilian Survey on the Use of ICTs, 2005, available from ANATEL, the Brazilian regulator.

developing malicious code more quickly and are becoming more technically sophisticated in the way they circumvent network controls such as anti-virus software and firewalls. Their attacks are more targeted, affecting specific industries, organizations, groups, and people. As an example, denial of service attacks can seek to overwhelm a specific firm's e-mail systems with spam to force the company's system to collapse. Criminals have used attacks like this to blackmail firms into paying them to suspend the attack. Whereas the chance for infamy may have once motivated them, today's hackers often seek financial gain or revenge. Hackers are evolving into well-paid professionals, who can be hired to launch targeted attacks or sell people's private information. According to VeriSign, a US company with specific responsibility for the .com registrar, espionage is likely to prove one of the largest threats to networks in 2007, especially from insiders and direct competitors.[22] MessageLabs, a provider of integrated messaging and web security services, estimates that a key factor in the success of targeted attacks is the distribution of spyware and adware, which has grown into a multi-billion dollar industry and fuelled an increase in the number of botnets.[23]

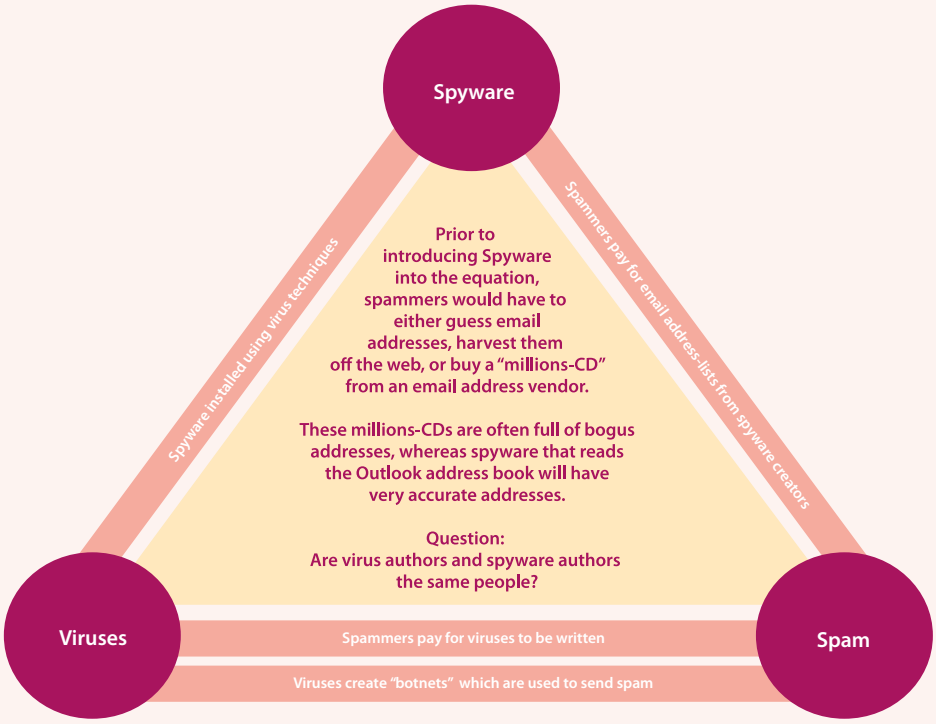
During 2006, there was a steady increase in the number of trojan spy programs designed to steal user data from players in online games and the evolution of trojans encrypting user data using professional encryption algorithms.[24] A trojan horse is a program that appears to have some useful or benign purpose, but really masks some hidden malicious code. Trojan horse programs can hijack a computer without the user's knowledge. In the worst-case scenario, e-mail-hosted spyware can monitor all transactions over the computer, view data stored on the "clipboard" or automatically saved passwords for computers, banks or credit cards, so criminals can take control of these and empty the bank account. Millions of connected computers worldwide are infected with trojan horse programs connecting them to botnets without the users' knowledge. In Brazil, nearly a third of all firms with Internet access had been subjected to a trojan attack in 2005 (Figure 5.2, left). Recently, media articles reported the case of a Russian criminal gang attacking a large Swedish bank using this approach. A trojan horse program, readily sold over the Internet, was used to extract more than USD 1 million from 250 customers of a Scandinavian financial institution.[25] The bank customers' details were stolen and used when they downloaded an attachment from an e-mail that appeared to have been sent from their bank.

Phishing[26] attacks, or false and misleading emails/ websites designed to persuade people to part with personal information and/or money, are also growing threats. An e-mail campaign, or single e-mail sent to many users, directs users to

Box 5.3: The cybercrime ecosystem – spyware, viruses and spam

The financially-motivated, multi-player cybercrime ecosystem is fuelling a rapidly-growing crime wave. Businesses and consumers are suffering financial losses, identity theft and other damages as a result of phishing using botnets and other kinds of threats involving spam, viruses, and spyware.

Box Figure 5.3: The cybercrime ecosystem



It might be described as a "vicious triangle": spammers pay for e-mail addresses and viruses from spyware creators. These viruses are in turn used to create botnets, which are then used to send spam. At the same time, spyware is installed onto "zombified" computers using viruses. Prior to spyware, spammers had to guess e-mail addresses, harvest them off the web or buy a "millions-CD" from e-mail address vendors. Millions-CDs used to be full of computer-generated bogus addresses, whereas spyware reading e-mail address now provides very accurate addresses. Spyware is evolving to become more targeted. Cyber-criminals can now harvest huge amounts of information on user communities. With the information gathered through spyware, it is possible to conduct spear-phishing attacks and gather further confidential business information. Criminals may potentially have access to more knowledge on home users' everyday Internet use than many well-resourced governments. Compromised computers can be used to track user behaviour, record passwords, conduct online purchases and other activities. Any number of applications can be installed on the same computer, each application potentially bundled with different forms of parasitic software so that, over time, the computer becomes overwhelmed by Internet baggage and its performance is severely affected.

Source: MessageLabs presentation; at: www.itu.int/osg/spu/presentations/2006/sunner-lap-cnsa-dec-2006.pdf, available April 2007.

a specific phishing or fraudulent website (multiple campaigns may point to the same web site). In January 2007, for the first time ever, e-mails containing phishing attacks outnumbered e-mails infected with viruses and trojan horse programs.[27] According to security-mail services vendor MessageLabs[28], in January 2007, one in every 93 e-mails (just over 1 per cent) contained some form of phishing attack, compared to one in 120 e-mails (0.8 per cent) that were infected with viruses. Security vendor Sophos[29] confirmed that it had seen more phishing than malicious-software activity/e-mails containing malicious attachments in January 2007. Botnets have been identified as a leading cause for phishing as a very serious form of spam.

Previously, viruses caused massive disruption and users were aware of online assaults. Now, however, targets of phishing attacks may have no knowledge that they have become victims. A carefully targeted phishing attack may go unnoticed for a long time during which the information-gathering continues.

5.2.4 Identity theft and the Internet

In today's business and consumer computing space, a financially-motivated, multi-player cybercrime ecosystem is fueling a rapidly-growing crime wave (Box 5.3). As a result of phishing, businesses and consumers are subject to potential financial losses, identity theft and other damages. The existence of, and interactions within, the botnet ecosystem makes phishing possible, along with its ensuing damage - in particular, the theft of personal or business critical information.

Identity theft is not new. By gaining access to people's personal data and impersonating them, a criminal can pursue a crime in near-anonymity. In the 21st century, with increasing reliance on electronic data and online identification, identity theft has never been easier. Law enforcement experts are concerned that online anonymity is making it more difficult to catch cyber-criminals. Anonymous use of mobile phones is still possible in some countries, using pre-paid cards. Anonymous access to the Internet is offered by service providers, Internet cafés and many wireless hotspots. A degree of anonymity is also facilitated by the use of dynamic rather than static Internet addressing, where addresses are allocated to users for the duration of a session, rather than on a permanent basis.

The Internet has opened the door to countless forms of dishonest but relatively harmless activities, but real criminals looked upon the Internet's shroud of anonymity and saw even greater opportunities. Until now, these criminals have been able to make the Internet a playground for their kind of people, including hackers, spammers and organized criminals. Stories of trojan horse programs stealing passwords, worms burrowing into people's hard drives, and spyware tracking an Internet user's every move barely raise eyebrows anymore. Not only do we accept them, we almost expect them. So, what can be done?

5.3 Towards an International Roadmap for Cybersecurity

5.3.1 Taking Action Against Spam and Related Threats

Spam is a public policy issue that is challenging governments, Internet Service Providers (ISPs), network operators, commercial e-mailers and consumers to work together in new ways, with each stakeholder group playing its part, to solve a problem that threatens the interests of all. But what has been happening in the area of fighting spam and related threats? On the current state of the battle against spam, Neil Schwartzman, Chair of the Canadian Coalition Against Unsolicited Commercial E-mail (CAUCE),[30] recently stated that "the development of spam-fighting is allowing computer-aware criminals to take the upper hand in the fight against what has now evolved into a completely technologically and organizationally merged threat to public safety. If we do not change our strategic approach immediately, the battle, indeed, even the war, may be all but lost".[31] The criminals always seem to be one step ahead in the fight against spam. However, user authentication could dramatically help in reducing spam, as it would require the e-mail sender to verify to the receiver that they are who they claim to be (the current Simple Mail Transfer Protocol (SMTP) "regulating" e-mails is relatively weak).

Work on identity management for activities on the Internet could therefore represent a step in the right direction. The ITU Telecommunication Standardization Sector (ITU-T) has recently established a Focus Group dedicated to identity management (IdM).[32] Its objective is to facilitate the development of a generic identity management framework through the participation of telecommunication and ICT experts. The use of multiple usernames and passwords offers great opportunities for hacking, identity theft and other forms of cybercrime, and is causing substantial financial losses. The ITU initiative on identity management aims to address this problem with a technology-neutral and platform-independent solution.

In today's interconnected networks, threats can originate anywhere, and therefore national, regional and international cooperation and action is needed to address cybersecurity-related threats. At the Tunis Phase of the WSIS[33], participants reaffirmed their commitment to deal effectively with the significant and growing problem posed by

spam. Numerous organizations, businesses, and partnerships worldwide are engaged in this fight; however, spam traffic volumes continue to grow. Consultations have taken place in many different forums over the past few years[34] and the need for a multi-pronged approach to fight spam and related threats has been widely agreed upon. However, prevention, consumer awareness, technical tools such as filtering techniques and national legislation are of only limited use in the absence of a comprehensive international framework.

Limited awareness of the numerous initiatives underway is a significant challenge in promoting international cooperation on countering spam. In December 2006, a meeting on the "Countering Spam Cooperation Agenda"[35] was held in conjunction with ITU WORLD TELECOM 2006[36] in Hong Kong (China). Organizations shared insights into the activities they are undertaking and explained what role their organization is playing in the fight against spam, to give policy-makers ideas for what an international framework countering spam could look like. In countries where legislation for cybersecurity and spam has been enacted and law enforcement procedures have been put in place, prosecutions, fines and prison sentences now apply for spam, creating a deterrent effect. Attitudes are also changing, as more people fall victim to the theft of personal information, identity and assets. The impact of cybercrime-related legislation and the critical role of law enforcement in preventing all different kinds of attacks in cyberspace should not be underestimated.

Overall, however, the anti-spam laws enacted to date around the world have been largely unsuccessful in eradicating spam.[37] In almost every instance, anti-spam statutes have focused on sanctioning spammers for their bad acts. An increasing number of countries and other jurisdictions have created such laws or applied to existing laws on data protection, consumer protection, and protection against fraud to fighting spam. Yet, in many cases, these laws have missed their target entirely, with no perceptible impact on actual spammers. Even worse, some laws have had negative side-effects in higher transaction costs, administrative costs, and restraints on legitimate senders of e-mail.[38] The persistence of the problem of spam has led policy-makers, technologists, academics and many others to come up with a wide range of possible strategies to end it. The least intrusive approach, most consistent with the end-to-end principle of network design, is to leave protection to end-users, through simple technologies, such as spam filters on e-mail clients. While this might be an option for developed countries, the lack of resources in developing economies would not support this kind of approach. An alternative mechanism, which has yet to be carried out in practice on a larger scale, involves enforceable codes of conduct. [39]

Enforceable Codes of Conduct – an alternative approach

Current anti-spam laws exist in around a quarter of countries worldwide[40], but have so far proven relatively ineffective. Enforceable codes of conduct could be used as part of a multi-pronged fight against spam to complement the relevant laws in place. Currently most anti-spam laws are directed at the spammers, not the ISPs that carry spam. On a practical basis, such laws require considerable investigative and enforcement resources – which can be problematic especially for developing countries. Even in developed countries, law enforcement agencies usually have higher priority issues to handle. To date, those promoting legal remedies for the fight against spam have tended to neglect investigation, enforcement powers or resources. And although most spammers and their clients can eventually be found, each investigation can be so time-intensive and costly that the costs often outweigh the benefits. For example, the United States Federal Trade Commission had only brought approximately 70 cases against spammers to court up to the end of 2006.

For developing countries with limited resources for such work, anti-spam laws may be rendered nearly meaningless due to the enforcement challenge. As spam is increasingly used to support fraudulent and criminal activities, different innovative approaches in the fight against spam could prove fruitful. National laws have been designed to address some of the related threats (described earlier in this Chapter), but no law can be , if it is not properly enforced. The move to enforceable codes of conduct offers an alternative approach that would need to be industry-driven. The private sector should first be given the opportunity to develop such codes of conduct. At the same time, it may be beneficial for governments to enforce these codes to ensure that all ISPs operate under the same rules. The ISPs that do not abide by these rules could be held accountable. Examples of such codes of conducts can be found through the Messaging Anti Abuse Working Group (MAAWG), albeit non-enforceable ones.[41] Australia and Italy, among other countries, have also carried out work on developing codes of conduct. Enforceable

codes of conduct could level the playing field in the fight against spam and related threats.

Winning the battle on increasingly sophisticated attacks

In January 2007, in a positive step forward for prosecutors in the fight against cybercrime, the first person was convicted in the United States for running a phishing scheme[42] under the US 2003 CAN-SPAM Act[43] (the federal anti-spam law). The sentence for this crime was set to 101 years in prison. The United States' anti-spam law forbids e-mail marketers from sending false or misleading messages and requires them to provide a way for people to opt out of future mailings. The man had compromised ISP accounts to send e-mails purporting to be from the company's billing department. The e-mails instructed customers to update their billing information on one of several web pages or lose their Internet service.

It is no surprise that phishing[44] succeeds in tricking its victims, as it is able to prey on both the ignorance of many users and their fears (e.g., by claiming that their account information has been compromised and the data should be resubmitted). Increasingly sophisticated, context-aware phishing is making scams more credible, and more successful.[45] To manage such security risks, organizations must examine network vulnerabilities and keep users informed. The Anti-Phishing Working Group (APWG) has been established as an industry association to track and report phishing attacks.[46]

Laws alone though will not make information and communication networks more secure. The problem of computer-related crime can only be solved when makers of computer equipment and technology build more secure systems and when the owners, operators and users on these systems operate in a more secure and responsible manner. The following section looks more closely at some of the other related measures that are being undertaken to build confidence and security in the use of ICTs and promote a global culture of cybersecurity.

5.3.2 Moving forward on a possible Roadmap for Cybersecurity

Today's ICT infrastructure makes it possible to perform illegal activities from almost anywhere in the world, at any time. Attacks are also crossing borders in complex and sometimes surprising ways. It is difficult for any single national or international approach to create trust in so many different infrastructure systems[47]: therefore, a coordinated and multi-layered approach is needed to protect critical network and information infrastructures.

A good way to create trust in global ICT networks is not to rely on a single line of defense, but instead on a set of overlapping defenses comprising national and international strategies, public and private efforts and multilateral and bilateral cooperation.[48] These defenses can help create trust, by giving users confidence that when an attack breaches one or more defenses, other means of protection will step into the gap and contain the attack, preventing the attackers from striking again. However, decision-makers are approaching this challenge from different angles. Depending on their priorities, national agencies and other stakeholders have tried to shape policies through at least four different perspectives:

- Addressing cybersecurity as a technical and operational network or IT issue;
- Looking at cybersecurity as an economic issue (e.g., maintaining business economic advantage, threat to business continuity);
- Focusing on cybersecurity as a legislation and enforcement issue (e.g., cybercrime);
- Concentrating on cybersecurity as a national security issue (e.g., CIIP and possible threats from other states).

An international roadmap for cybersecurity must address all these different perspectives. Through the WSIS process, a practical themed approach has been suggested to facilitate discussions and cooperative measures among governments, the private sector and other stakeholders. This approach includes looking at: information-sharing of national and regional approaches, good practices and guidelines; developing watch, warning and incident response capabilities; technical standards and industry solutions; harmonizing national legal approaches and international legal coordination; and privacy, data and consumer protection.[49] A roadmap, with all these different elements, would serve to engage the relevant actors in what are often seen as siloed communities (stakeholder groups that may not otherwise talk with each other), in order to enhance the opportunity for multi-stakeholder collaboration and partnerships in these domains.

5.3.3 Roles of the different stakeholders in cybersecurity

In a world of intertwined global networks, there is a need for coordinated and sustained approaches to protecting critical network and information infrastructures. Both critical network infrastructures and the attacks that threaten them take a wide range of forms which also cross borders in complex ways. Software written in India controls emergency gas leak repairs in the United Kingdom; an e-mail from Kenya might cross the Atlantic in route to Canada; and a hacker operating from an unidentified country might use computers in Russia and Brazil to attack an Israeli government site. No single national or international approach can create trust in so many different infrastructure systems.[50] All stakeholders have a role to play in the Information Society - and this also applies to cyber-related threats and security issues.

The role of governments

Ultimately, it is the responsibility of each government to ensure that its citizens are protected and, by doing so, to contribute to building a global culture of cybersecurity. Government strategy on information and network security has a major impact on the country's competitiveness. The state has a vital role in the coordination and implementation of national cybersecurity strategy. Currently, countries differ in their readiness to deal with cybersecurity policy issues and to develop a cybersecurity/CIIP strategy. Some countries have developed a comprehensive national strategy, while others are only just beginning to consider the issue.

As threats to cybersecurity are constantly evolving, cybersecurity policy must be flexible and adaptive. As there are many different stakeholders involved, the government needs to determine the roles of institutions and their related responsibilities to ensure cybersecurity at the national level. Typically, implementation of a national strategy requires coordination across many authorities, organizations and different government departments. Each government must determine the level of cybersecurity risk that it is willing to accept and expose its citizens and businesses to. As the different government stakeholders bring different perspectives to the problem, one of the first tasks is to evaluate national vulnerabilities and map these against the roles and responsibilities of the different government agencies. Some states have created a dedicated central organization to deal with the coordination for cybersecurity and CIIP-related issues across government agencies, such as Japan's National Information Security Centre (NISC).

Another important task for governments is the creation of new, or adaptation of existing, legislation to criminalize the misuse of ICTs. At the judicial level, governments need to enforce existing national legislation to curb abuses and protect consumers' rights. In its executive role, the government, with other stakeholders, is responsible for raising awareness on the threats involved, often through public education initiatives. Information on security risks and responses must also be shared with small firms, individual users, and other stakeholders.

To secure infrastructures effectively, national strategies must be matched with an international approach. The creation of frameworks for cooperation across jurisdictions, with the sharing of skills, knowledge, and experience, is vital for a secure online environment. The Council of Europe (CoE) Convention of Cybercrime[51] is one such framework in the area of international cybercrime legislation. The CoE Convention requires signatory parties "to co-operate to the widest extent possible" (Article 23), "to provide for the possibility for extradition for serious offences under Articles 2 to 11" (Article 24), "to provide mutual assistance to the widest extent possible" (Article 25), and "to set up a 24/7 Network" (Article 35),[52] to foster cooperation and collaboration. As mentioned earlier, legislation also requires effective enforcement. Besides direct bilateral cooperation between states, Interpol[53] has undertaken a number of activities to provide a unique range of essential services for the law enforcement community to optimize the impact of international effort to fight cyber-related crime.

The role of businesses and the private sector

As ICT infrastructure is often owned and operated by the private sector, their involvement in promoting a national and global culture of cybersecurity is vital. As hackers become more sophisticated, the time between discovering a vulnerability and developing the malicious code to exploit the weakness is shrinking. Early warning and rapid response is key to protecting business-critical assets. In many countries, the private sector is the first to assess and respond to the rapid technological changes and threats taking place. Large firms are generally more likely to take action than

small firms, as they tend to have greater resources at their disposal and may run greater risk with size (depending on the industry) (Figure 5.3, right). Industry also plays a critical role in agreeing on security standards in industry forums or standards development organizations.[54] Since effective cybersecurity requires an in-depth understanding of all aspects of information and communication networks, the private sector's expertise is crucial in the design of national cybersecurity strategies.

The role of users

The open nature of the Internet and the need for implementing security measures at the edges of the network (on individual computers and devices) make education of end-users is vital. Much remains in the hands of the users themselves, their activities and awareness of security, and how vulnerable they are to different threats.

Unfortunately, users are often unaware of the different threats and dangers in cyberspace and how to protect themselves. Communication systems are increasingly complex and individuals are asked to maintain and trust systems they do not fully understand. Users' lack of unawareness of the risks involved is one of the main reasons why critical infrastructures are increasingly vulnerable to attack (Box 5.3). As mentioned earlier, a large number of PCs are infected with viruses often unwittingly installed by the users themselves. As a result, there are now hundreds of thousands of PCs on broadband networks that have become part of zombie botnets controlled by criminal gangs, used to send spam or launch denial of service attacks. Due to the interconnectivity of modern ICTs, genuine security can only be promoted when users are aware of the existing dangers and threats. It is the responsibility of each user to become aware of the threats, as well as the opportunities, of the Internet. Governments and businesses must help users obtain information on how best to protect themselves.

5.3.4 Information-sharing - a common need

Sharing of information has been a key focus for both governments and private sector players over the past few years.[55] Governments, businesses and non-profit organizations are sharing information on security threats and best practice responses. To protect information infrastructure and fight cybercrime, countries must have systems in place for evaluating threats and preventing, responding to and recovering from cyber incidents. Networked Computer Emergency Response Team (CERT) centres are being established around the world to research modern techniques of cyber-intrusion and network security, security alerts, etc. and provide guidance and support.

Another approach adopted by some governments is the support of privately-funded information-sharing agencies. These agencies address everything, from overall network concerns to meeting sector-specific needs. One example is the United Kingdom's work on establishing Warning, Advice and Reporting Points (WARPs)[56] to establish an interdisciplinary network for the sharing of critical security information. In other countries, industry-specific information-sharing and analysis centres serve a similar purpose.

At the regional level, in 2005, the European Commission established the European Network and Information Security Agency (ENISA)[57] to coordinate national efforts on cybersecurity and to serve as an advisory unit to the Commission on information- and network security-related matters. International bodies including the OECD, ITU, APEC, the EU[58] and private sector and not-for-profit organizations are also working together to fight cybercrime.

5.3.5 Cybersecurity and developing economies and countries in transition

A globally interconnected information network makes it clear that cybersecurity cannot be effectively addressed by individual nations or even groups of industrialized countries as it requires a combined effort by government, industry, law enforcement, and citizens of all countries worldwide. Developing countries face unique challenges in developing security policies and approaches appropriate to their circumstances. In developing countries, ICTs also bring new challenges that need to be addressed in order to conduct electronic transactions securely and maintain the integrity of information systems and resources. Ensuring that developing nations reap the full benefits of the Internet to foster economic, political and social development involves assisting these countries (which make up the majority of the countries around the world) to address the challenges related to cybersecurity. As security is an important component of the policy framework for the Internet, developing countries need to: ensure that their laws cover cybercrime, develop

partnerships between government and the private sector to address cybersecurity, improve the sharing of information and raise security awareness among all users.[59]

Some important first steps in providing cybersecurity-related assistance to developing countries and countries in transition include awareness-raising, providing platforms for information-sharing and overall capacity-building in specific areas related to cybersecurity; setting up the necessary building blocks for a national strategy on cybersecurity; establishing a legal foundation and encouraging regulatory development; technical expertise in incident response, watch, warning, recovery, etc. In addition to these, the benefits of partnerships between industry and government in this area need to be explored in order to promote a culture of security involving all stakeholders.

Assistance on laws and legislation and enforcement

The overall development of cybersecurity strategies, information-sharing and outreach to the public is often encouraged when advising developing and emerging economies for enhancing national cybersecurity efforts. There are, however, many resources where developing countries can get immediate assistance in this area:

- To obtain support and assistance with drafting cybercrime statutes, examples of multilateral contacts that can be consulted include the Asia Pacific Economic Cooperation (APEC), the Organization of American States (OAS), the Council of Europe and ITU, as well as individual countries. Private critiques of draft cybercrime statutes can also be obtained from different stakeholders.
- For awareness-building (including for policy-makers), multilateral organizations such as APEC, Interpol, ITU, OAS and OECD, as well as individual states, can again provide good contacts.
- To obtain training for law enforcement in cybercrime, cyber-forensics and how to set up a cyber-investigation unit, interested parties can consult APEC, OAS, the G8 (to a limited extent) and Interpol, among other multilateral groups.
- In addition, developing countries themselves have valuable information to share with each other. The development banks (both global and regional institutions) and the private sector are expanding their activities in this area. There is also growing interest in routine formal training of law enforcement by companies, groups of companies, national trade associations, as well as interest by the private sector in talking to national policy-makers. It is important to remember that in cyberspace, any nation is only as secure as the least secure country.

5.4 WSIS Action Line C5: Building confidence and security in the use of ICTs

Fresh thinking and innovative solutions, together with solid commitment by governments and all stakeholders, are now needed to move forward to ensure global cybersecurity. The WSIS outcome documents[60] emphasize that building confidence and security in the use of ICTs is a vital foundation in building a safe and secure Information Society. The ITU has been appointed as the sole facilitator for WSIS Action Line C5, to assist stakeholders in building confidence and security in the use of ICTs. In this role, ITU is responsible for assisting stakeholders in the implementation process, at national, regional and international levels.

5.4.1 Action Line C5 Facilitation and Partnerships for Global Cybersecurity

The first Action Line C5 meeting was held in Geneva 15-16 May 2006, in conjunction with World Information Society Day on 17 May 2006. This meeting was dedicated to Promoting Global Cybersecurity. Three main focus areas were endorsed as the basis for future work programmes[61]:

- **Focus Area 1 -** National Strategies: The development of a generic model framework or toolkit that national policy-makers can use to develop and implement a national cybersecurity or CIIP programme.
- **Focus Area 2 -** Legal Frameworks: Capacity-building in the harmonization of cybercrime legislation, the Council of Europe's Convention on Cybercrime, and enforcement.
- **Focus Area 3 -** Watch, Warning and Incident Response: Information-sharing of best practices on developing watch, warning and incident response capabilities.

To stress the importance of the multi-stakeholder implementation, ITU has launched the Partnerships for Global Cybersecurity (PGC) initiative.[62] PGC is an open, multi-stakeholder platform that seeks to advise and share information with, and between, governments and other stakeholders on the different dimensions of building confidence and security in the use of ICTs. It aims to promote the use of ICTs to achieve the internationally-agreed development goals and to facilitate the implementation of WSIS Action Line C5, as well as providing a forum for policy dialogue and action.

The upcoming meeting for C5 facilitation in Geneva, Switzerland, on 14-15 May 2007[63], will assess the progress of worldwide initiatives to promote cybersecurity and seek ways to move forward in the five main themes[64] of: (1) information-sharing of national approaches, good practices and guidelines; (2) developing watch, warning and incident response capabilities; (3) technical standards and industry solutions; (4) harmonizing national legal approaches and international legal coordination; and (5) privacy, data and consumer protection. Specific attention will be given to activities in the Action Line C5 focus areas, as mentioned above.

ITU has also launched the Cybersecurity Gateway[65] as an easy-to-use online information resource on cybersecurity activities and initiatives worldwide. This gateway provides access to a vast number of resources. Organizations are invited to join in partnership with the ITU and other stakeholders to build confidence and security in the use of ICTs.

Specifically in the area of spam, the StopSpamAlliance[66] has been launched as a joint initiative to gather information and resources on countering spam. This initiative has been jointly launched by APEC, OECD, ITU, the European Union's Contact Network of Spam Authorities (CNSA), the London Action Plan, and the Seoul-Melbourne Anti-Spam group. The StopSpamAlliance.org website contains an overview on these organizations' activities in countering spam and related threats. In line with the *Tunis Agenda for the Information Society*[67], the StopSpamAlliance web pages link to initiatives in anti-spam legislation and enforcement activities, consumer and business education, best practices and international cooperation.

5.5 Conclusion –Towards a safer Information Society

Due to society's greater dependency on ICTs, the challenges related to creating a safe and secure networked environment are very real. ICTs are now indispensable in all areas of life: individuals, institutions, governments and firms around the world are investing in technologies, introducing security management procedures and launching campaigns to enhance network and information security. There are today more than four billion users of ICTs around the world, with increasingly powerful devices in terms of data storage, processing power and transmission capabilities. Technologies are also converging. Mobile phones are now becoming computers in their own right, offering greater opportunities for 'cross-infection' and damage.

5.5.1 Is the Information Society really at risk?

As the speed and connectivity of the devices used to commit cybercrime increase, the network itself has become vulnerable. The availability of information, the speed of information exchange and with the relative anonymity of online transactions complicates security vastly. The Information Society and business, based increasingly upon the digital economy, are in growing jeopardy. A growing number of security breaches have already incurred substantial financial losses and undermined user confidence.

Today, the Internet is largely anonymous - some argue that this core value of anonymity is one reason why the Internet has flourished. However, as cyber-threats become more disruptive and pose a serious menace, some wonder whether the Internet can remain anonymous, as we try to build a safe and secure Information Society? They claim that the drawbacks and negative aspects of anonymity are starting to outweigh the advantages. There are compelling reasons to authenticate and validate user names and addresses (e.g., for servers, domains, etc.) and to establish a more secure structure for the Internet. In contrast, proponents of anonymity for the Internet are quick to point out the virtues of anonymity in freedom of expression and the risks and costs of introducing strict identification and authentication in the networks.

5.5.2 How can we build a safe and secure Information Society?

For a normal citizen today, it is already difficult to keep personal computers secure from spam, spyware, viruses, phishing, let alone protect the personal data stored on the computer and other devices. Living in the digital world in 2015, users will be surrounded by pervasive devices, embedded sensors and systems, all connected to an IP-based network. Trust, privacy, and security are vital to the further development of the Information Society. Cybersecurity is a major consideration for the development of NGN[68], which will require increased international cooperation as well as the involvement of governments working on harmonized legislation and mutual enforcement.

An "updated" Internet (Web 2.0) could offer new and improved services with better security against viruses, worms, denial-of-service attacks and zombie computers. Other services requiring high levels of reliability (such as medical monitoring) and services that cannot tolerate network delays (such as voice and video-streaming) would be better supported in this new environment. However, the constant ebb and flow of technological change means that we cannot just rely on technological solutions: new issues are bound to surface. To provide these advanced services, both the architecture of the Internet and the business models through which the services are delivered, need to change.[69]

The benefits of the Information Society as a whole are at stake, if networks are insecure. As no single country or entity can create trust, confidence and security in the use of ICTs, international action is needed to address cybercrime. The protection of critical information infrastructures needs a joint effort by governments, industry, law enforcement and citizens worldwide. Time will tell if governments, businesses and citizens are willing to undertake this challenge. Encouraging each participant in the Information Society to become aware of the risks involved and assume responsibility for the security of information systems is one of the main challenges going forward. Building confidence and security in the use of ICTs requires a coordinated and focused effort from all stakeholders in the Information Society.

Annex to Chapter Five

Glossary

Adware – Advertising-supported software, or adware refers to any software package which automatically plays, displays, or downloads advertising material to a computer after the software is installed on it or while the application is being used.

Botnets/Bots – Botnets are networks of compromised personal computers that can retrieve information such as passwords, credit card numbers, and other personal data stored in the web-browser's auto-fill databases. The program is similar to worms in their propagation methods, but allows attackers to communicate with and control access to compromised machines. A Bot is a computer that has been broken into (compromised) and misappropriated by a criminal (2007 United States Contribution to ITU-D Study Group 1/Q22).

Blog – blog is short for "Web log"

Denial of Service (DoS) attack – Denial of Service is an attack on a computer or network meant to deny legitimate users access either to that computer or network. When the attack comes from multiple sources it is known as a Distributed Denial of Service (DDoS).

Malware – Malware is a general term for software code or program inserted into an information system in order to cause harm to that system or other systems, or to subvert them for use other than that intended by their owners. Malware is a tool which facilitates a range of crimes. Compromised computers, like the malware installed on them, can become both components of the cyber attack system and the targets of attack.

Phishing – Phishing is a fraudulent attempt to trick an individual into revealing sensitive information such as bank account numbers, national insurance identification numbers, or user names and passwords. Spam is a primary vehicle for Phishing. An example would be an email that purports to be from one's bank but directing an individual to an illegitimate web site for the purposes of stealing that person's credentials.

Spam – Spam has multiple definitions that vary from one administration to another. For example, in some jurisdictions, it is unwanted, fraudulent email while in others it is simply unwanted email. An email message is determined to be spam either by a recipient, or his or her agent.

Spyware – Spyware refers to a broad category of malicious software designed to intercept or take partial control of a computer's operation without the informed consent of that machine's owner or legitimate user. While the term taken literally suggests software that surreptitiously monitors the user, it has come to refer more broadly to software that subverts the computer's operation for the benefit of a third party.

Trojan horse – A trojan horse is a program that appears to have some useful or benign purpose, but really masks some hidden malicious code.

Url - A url is a universal resource locator. It is the address on the network of a given web page.

Viruses – A virus is a computer program that can copy itself and infect a computer without permission or knowledge of the user.

Worms – A worms is a computer programe capable of self-propagation, sending copies of itself from computer to computer, through the exploitation of existing vulnerabilities or configuration flaws.

Notes for Chapter Five

1 Netcraft (www.netcraft.com) runs a monthly survey of websites. In April 2007, it registered some 113,658,468 sites, an increase of 3.2 million sites from the previous month's survey. Of these sites , around 50 million were "active" at the time of the survey. For more information, see: http://news.netcraft.com/archives/2007/04/02/april_2007_web_server_survey.html.

2 ITU Trust and Awareness Survey, March-May 2006; www.itu.int/newsarchive/press_releases/2006/09.html.

3 Melani security resources; www.melani.admin.ch/index.html?lang=en.

4 Information on WSIS Action Line C5 - Building confidence and security in the use of ICTs; www.itu.int/wsis/implementation/c5/ and www.itu.int/pgc/.

5 WSIS Tunis Commitment; www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=2266|0.

6 WSIS Tunis Agenda on the Information Society www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=2267|0.

7 Michigan Online Security Training resources; www.michigan.gov/cybersecurity/0,1607,7-217--108238--,00.html.

8 Different terms are used in countries around to globe for criminal activity over the Internet, but cybercrime is the most widely used (cf. Council of Europe Cybercrime Convention).

9 Report by London's Metropolitan Police Service, 2007; www.mpa.gov.uk/committees/mpa/2007/070125/10.htm#fn001.

10 European Schoolnet coordinates the European Safer Internet network, Insafe (www.saferinternet.org), which aims to empower citizens to use the Internet. The results of the survey can be found here: www.saferinternet.org/ww/en/pub/insafe/news/insafe_survey.htm, December 2006.

11 Red Tape article on "Spam is back and worse than ever", 19 January 2007; http://redtape.msnbc.com/2007/01/spam_is_back_an.html.

12 United States' Federal Trade Commission; www.ftc.gov/.

13 Article in The Sydney Morning Herald, "2006: The year we were spammed a lot", 16 December 2006; www.smh.com.au/news/security/2006-the-year-we-were-spammed-a-lot/2006/12/18/1166290467781.html.

14 Spam as per the Anti-Spam Toolkit www.oecd.org/dataoecd/63/28/36494147.pdf.

15 Gartner Inc.; http://mediaproducts.gartner.com/webletter/blackspider/issue1/article3.html, 2004.

16 Brazilian survey on the Use of ICTs in Brazil, 2005, available from the Brazilian regulator, ANATEL.

17 Secure Computing; www.securecomputing.com/image_spam_WP.cfm and SPU Newslog; www.itu.int/newslog/.

18 Often, image spam is created using animated GIFs to bypass spam filters. Layering multiple images loaded one on top of another adds disturbances or "noise", which can complicate the message and make every message unique.

19 Interview for the WEF at Davos, 2007, available from: www.weforum.org/.

20 Article in The Register, "Botnet 'pandemic' threatens to strangle the net", 26 January 2007; www.theregister.co.uk/2007/01/26/botnet_threat/.

21 Paper on "Botnet threats and solutions – Phishing"; http://antiphishing.org/sponsors_technical_papers/trendMicro_Phishing.pdf, available April 2007.

22 VeriSign, "A Holistic Approach to Security", 2006, www.verisign.com/static/037640.pdf.

23 MessageLabs press release, 2006: the Year Spam Raised the game and Threats Got Personal, 13 December 2006.

24 Kaspersky Security Bulletin 2006, "Malware Evolution"; www.viruslist.com/en/analysis?pubid=204791924,.

25 Article in The New York Times, "Online Nordic Banking Theft Stirs Talk of Russian Hacker" by Andrew E. Kremer, 25 January 2007; www.nytimes.com/2007/01/25/technology/25hack.html?ex=1327381200&en=5699048fce2742b2&ei=5090&partner=rssuserland&emc=rss.

26 Phishing Guide from the United Kingdom's National Infrastructure Security Co-ordination Centre (NISCC); www.cpni.gov.uk/docs/phishing_guide.pdf.

27 CNET News article, "Phishing overtakes viruses and Trojans by Tom Espiner; "http://news.com.com/Phishing+overtakes+viruses+and+Trojans/2100-7349_3-6154716.html, January 2007.

28 MessageLabs resources; www.messagelabs.com/.

29 Sophos resources; www.sophos.com/.

30 Website for the Canadian CAUCE; www.cauce.ca/ and for links to all CAUCE globally; www.cauce.org.

31 Article in Spam Fighter blog, "Trench Warfare in the Age of Laser-Guided Missile .html", 26 December 2007 ; http://spamfighter666.blogspot.com/2006/12/trench-warfare-in-age-of-laser-guided.html.

32 The scope of the ITU-T Focus Group is Identity Management (IdM) for telecommunications/ICT in general; and specifically to facilitate and advance the development of a generic IdM framework and means of discovery of autonomous distributed identities and identity federations and implementations. IdM Focus Group website at: www.itu.int/ITU-T/studygroups/com17/fgidm/index.html, available April 2007.

33 WSIS main website; www.itu.int/wsis/.

34 ITU WSIS Thematic Meeting on Countering Spam, 2004, www.itu.int/osg/spu/spam/meeting7-9-04/index.html, ITU WSIS Thematic Meeting on Cybersecurity, 2005, www.itu.int/osg/spu/cybersecurity/2005/index.phtml, First Meeting for WSIS Action Line C5, 2006, www.itu.int/osg/spu/cybersecurity/2006/index.phtml, available April 2007.

35 StopSpam Alliance resources; www.stopspamalliance.org, available April 2007.

36 ITU Telecom World resources; www.itu.int/WORLD2006/forum/index.html, available April 2007.

37 WSIS Thematic Meeting on Countering Spam, July 2004, ITU Discussion Paper by Matthew Prince, "How to Craft an Effective Anti-Spam Law"; www.itu.int/osg/spu/spam/contributions/Background%20Paper_How%20to%20craft%20and%20effective%20anti-spam%20law.pdf, available April 2007.

38 Trends in Telecommunication Reform 2006 , Stemming the International Tide of Spam; www.itu.int/ITU-D/treg/publications/Chap%207_Trends_2006_E.pdf.

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42 Article in Mercury News; www.mercurynews.com/mld/mercurynews/news/breaking_news/16482522.htm,.

43 Controlling the Assault of Non-Solicited Pornography and Marketing Act of 2003 (CAN-SPAM Act); http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=108_cong_public_laws&docid=f:publ187.108.pdf.

44 Phishing Guide from the United Kingdom's National Infrastructure Security Co-ordination Centre (NISCC); www.cpni.gov.uk/docs/phishing_guide.pdf, available April 2007.

45 Study on "Designing Ethical Phishing Experiments: A study of (ROT13) rOn", 2006, www2006.org/programme/files/pdf/3533.pdf, available April 2007.

46 Phishing Attack Trends Report, November 2006; http://antiphishing.org/reports/apwg_report_november_2006.pdf

47 ITU Background Paper on "International Coordination to Increase the Security of Critical Network Infrastructures", 2002; www.itu.int/osg/spu/ni/security/docs/cni.04.pdf, available April 2007.

48 ITU Background Paper on "International Coordination to Increase the Security of Critical Network Infrastructures", 2002; www.itu.int/osg/spu/ni/security/docs/cni.04.pdf, available April 2007.

49 See more details on the different themes in the Cybersecurity Gateway; www.itu.int/cybersecurity/.

50 ITU Background Paper on "International Coordination to Increase the Security of Critical Network Infrastructures", 2002; www.itu.int/osg/spu/ni/security/docs/cni.04.pdf.

51 Council of Europe (CoE) Convention on Cybercrime; www.coe.int/economiccrime.

52 Council of Europe (CoE) Convention on Cybercrime; www.coe.int/economiccrime.

53 Interpol resources; www.interpol.int/Public/TechnologyCrime/default.asp.

54 ITU-T Study Group 17 is the main ITU Study Group on telecommunication security and related standards activities; www.itu.int/ITU-T/studygroups/com17/index.asp.

55 Information on the benefits of information sharing; www.itu.int/cybersecurity/info_sharing.html,.

56 Warning, Advice and Reporting Points (WARPs) resources; www.warp.gov.uk/.

57 European Network and Information Security Agency (ENISA) resources; www.enisa.europa.eu/.

58 Information from the ENISA website on security-related activities taking place in the European Union; www.enisa.europa.eu/pages/01_01.htm.

59 ITU WSIS Thematic Meeting on Cybersecurity, Chairman's Report, 2005; www.itu.int/osg/spu/cybersecurity/chairmansreport.pdf.

60 WSIS outcome documents; www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=2316|0.

61 2006 Chairman's report available at www.itu.int/osg/spu/cybersecurity/2006/chairmansreport.pdf.

62 Partnerships for Global Cybersecurity and WSIS Action Line C5 Facilitation; www.itu.int/pgc/.

63 Partnerships for Global Cybersecurity and the second meeting for WSIS Action Line C5 Facilitation; www.itu.int/pgc.

64 WSIS Thematic Meeting on Cybersecurity 2005 resources; www.itu.int/osg/spu/cybersecurity/2005/ .

65 ITU Cybersecurity Gateway; www.itu.int/cybersecurity/.

66 The StopSpamAlliance initiative; www.StopSpamAlliance.org.

67 Tunis Agenda for the Information Society; www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=2316|0,.

68 ITU resources related to Next Generation Networks (NGNs); www.itu.int/ngn/.

69 Washington Post article, "Hold Off On Net Neutrality" by David Farber and Michael Katz, 19 January 2007; www.washingtonpost.com/wp-dyn/content/article/2007/01/18/AR2007011801508.html.

chapter six

Implementing WSIS Outcomes

6.1 Halfway towards the WSIS goals

The year 2007 marks the second full year of implementation, following the successful conclusion of the Tunis Phase of the World Summit on the Information Society (WSIS), which took place in Tunis on 16-18 November 2005. More significantly, it represents a midway point between the formal adoption by the UN General Assembly of the WSIS as a Summit in two phases under the patronage of the UN Secretary-General in December 2001, and the anticipated review of the WSIS outcomes due to take place in 2015.[1] This Chapter evaluates what has been achieved thus far in the WSIS process and what remains to be done.

6.1.1 A comprehensive implementation plan

The WSIS is unique among UN Summits in that it was conceived as a Summit in two phases. Governments and participants agreed on a set of principles for the Summit outcomes in the first Phase (see the *Geneva Plan of Action*) and later developed a strategy for implementation (in the *Tunis Agenda for the Information Society*). Difficult issues, on which agreement could not be reached during the first Phase—principally Internet Governance and the financing of ICT for development—were addressed in the second Phase, *inter alia*, through the creation of the Internet Governance Forum[2] and voluntary Digital Solidarity Fund.[3]

Due to the far-reaching nature of the Information Society, a comprehensive implementation plan is beyond the remit of any single UN agency. The resulting implementation plan, the *Tunis Agenda for the Information Society*, operates on three levels:

- **National implementation** (Para 100 of the *Tunis Agenda*) is to be established through national implementation mechanisms, with individual governments taking the lead.[4] As part of its work in facilitating WSIS implementation, ITU has carried out a survey of national implementation and this information will be made available to all stakeholders.[5] A good example, in this respect, would be the initiative taken by the Government of Egypt, where the Ministry of Communications and Information Technology (MCIT) published in December 2006 a "Golden Book", summarizing its WSIS-related activities (some 127 in total).[6]
- **Regional implementation** (Para 101) involves the UN Regional Commissions and intergovernmental organizations, based on a multi-stakeholder approach. For example, the Economic Commission for Latin America and the Caribbean (ECLAC) has developed eLAC2007, a regional plan of action for the Information Society (Figure 6.1). Furthermore, in conjunction with Institute of Connectivity of the Americas (ICA) and the Canadian International Development Research Centre (IDRC), ECLAC has established an Observatory for the Information Society in Latin America and the Caribbean (OSILAC) to centralize work on Information Society indicators.[7]
- **International implementation** (Para 102) has three main components:
  - **Inter-agency coordination** within the UN system (Para 103-4), which is coordinated by the newly-established UN Group on the Information Society (UNGIS). UNGIS was formally established in April 2006 by the UN Chief Executive's Board and held its first meeting in ITU on 14 July 2006. UNGIS will be chaired on a rotating basis by ITU, UNESCO and UNDP.[8]
  - **The multi-stakeholder implementation process** (Para 108-110), which is described in more detail in Section 6.1.2 below.
  - **Follow-up** (Para 105), which is coordinated by the UN Economic and Social Council (ECOSOC) through the Commission on Science and Technology for Development (CSTD). The Commission, which was established in 1992 and enlarged in 2006, comprises 43 Member States representative of all UN regions. The tenth session of the CSTD will be held in Geneva, 21-25 May 2007, under the theme "Promoting the building of a people-centred, inclusive and development-oriented Information Society". The CSTD is tasked with assisting ECOSOC in overseeing UN system-wide follow-up to the WSIS.[9]

6.1.2 WSIS stocktaking

The *Tunis Agenda* requested that the ITU continue to maintain and update the stocktaking database of WSIS-related activities. The stocktaking portal (www.itu.int/wsis/stocktaking) is structured around the eleven WSIS action lines and contains over 3'300 WSIS-related activities submitted by

Figure 6.1: Regional Plan for the Information Society in Latin America and the Caribbean (eLAC2007)

Note: *The plan was approved at the Regional Latin American & Caribbean Preparatory Ministerial Conference for the WSIS, 10 June 2005, in Rio de Janeiro, Brazil.*

Source: UN Economic Commission for Latin America and the Caribbean at: www.eclac.cl/socinfo/elac/default.asp?idioma=IN

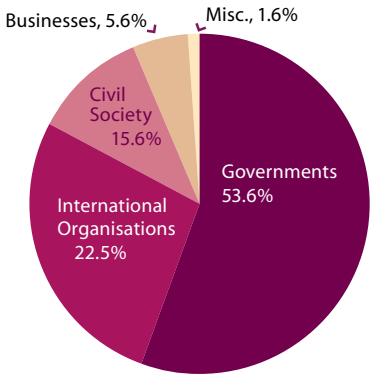
stakeholders. In early 2007, Member States and WSIS stakeholders were invited to submit fresh activities and update existing activities.[10] A selection of activities is described later in this chapter.

The stocktaking database has been improved by regular updates and password-protected access, with the addition of extra search terms at the request of stakeholders. It has also been integrated into the ITU's "ICT Eye" portal for market, regulatory and statistical information, so data on WSIS-related activities can assessed in the context of other country-specific information.[11]

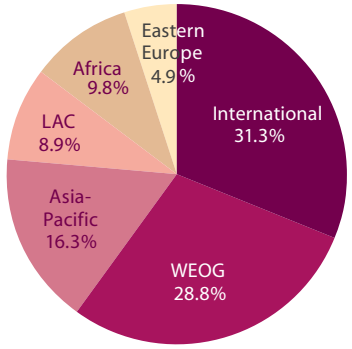
A breakdown of entries in the WSIS stocktaking database is presented in Figure 6.2. As expected, governments have provided the majority of activities in the database, followed by international organizations. Activities of an international nature and activities in the Western Europe and Other Group (WEOG) dominate the database. The WSIS stocktaking is a basic resource for exploring the ICT success stories featured in this chapter and throughout this report.[12]

Figure 6.2: WSIS stocktaking activities

Breakdown of entries by submitting entity



Breakdown of entries by UN region



Note: *WEOG = Western Europe and other group (also includes North America, Australia and New Zealand). LAC = Latin America and the Caribbean.*

Source: WSIS Stocktaking Database, www.itu.int/wsis/stocktaking.

6.1.3 Multi-stakeholder implementation

One of the main characteristics of the WSIS process is the commitment to multi-stakeholder participation. Although this concept is by no means new, it has permeated the WSIS process to a greater extent than in any previous UN Summit and is the cornerstone of WSIS implementation.

Multi-stakeholder implementation unites the efforts of governments, private sector entities and civil society, as well as international organizations. It is described in more detail in Paras 108-110 of the *Tunis Agenda*, as well as in its Annex, which proposes moderators/facilitators for the eleven WSIS Action Lines. ITU, UNESCO and UNDP were invited to play the leading facilitating roles in the WSIS implementation process. In order to put the multi-stakeholder process into motion, the three agencies convened a meeting of moderators/facilitators on 24 February 2006, in Geneva.[13] It was agreed that, each year, a cluster of Action Line facilitation meetings would be held on 17 May, which has been designated by the UN (in response to the request from WSIS) as World Information Society Day, in addition to World Telecommunication Day (Box 6.1). A summary of the meetings to be held in the 2007 WSIS cluster can be found at: www.itu.int/wsis/implementation.

The next three sections present an overview of WSIS implementation, covering the three clusters of the Digital Opportunity Index (DOI), namely: promoting digital opportunity, upgrading infrastructure and increasing utilization.

6.2 Digital Opportunity

6.2.1 Accessibility

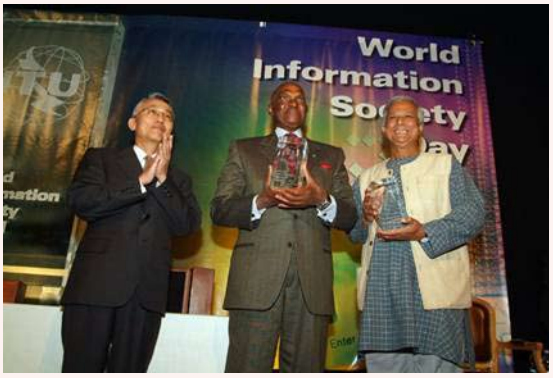
For developing countries, one of the most promising ways of increasing access to ICTs is through communal access, such as public access points or telecentres. For youth, they also offer exposure to and training in the ICT skills that are essential in a modern economy. Different approaches have been followed to strengthen the work of telecentres (Box 6.2). Telecentres are usually most effective when they are combined with existing social centres, such as town halls, meeting points, religious centres or youth clubs or other public facilities such as post offices or schools. Despite their promise, telecentres may have to overcome significant obstacles to gain acceptance, including local resistance, poverty, illiteracy and a lack of local content.

Initiatives to promote telecentres have been launched in different countries (see, for instance,

Box 6.1: World Information Society Day Awards

One outcome of WSIS was the launch by ITU of the World Information Society Day awards on 17 May 2006.The award recognizes individuals or institutions that have made a significant contribution to building the Information Society in either:

- Social accomplishment;
- Mobilization of public opinion; or
- Key technical innovation.



The inaugural ITU World Information Society Day award-winners, H.E. Abdoulaye Wade (centre) and Prof. Mohammed Yunus (right) are honored by the former ITU Secretary-General, Yoshio Utsumi (left).

The inaugural awards were made to HE Abdoulaye Wade, President of Senegal and Prof. Mohammed Yunus, Managing Director of Grameen Bank Bangladesh, in recognition of their personal contributions to building the Information Society. Later in 2006, Prof. Yunus and Grameen Bank jointly received the Nobel Peace Prize, honouring their "efforts to create economic and social development from below".

Source: ITU (at www.itu.int/wisd) and the Nobel Foundation (at http://nobelprize.org/).

Image Source: ITU

the example of **Senegal** highlighted in Box 6.3). In Asia, in **China**, the 'Poverty Alleviation through Science and Technology in China' initiative was launched as early as 2001.[14] By 2004, telecentres had been established in five regions and village staff was trained in Beijing in equipment and management. In **Myanmar**, Myanmar Info-Tech initiated a programme of Public Access Centres (PACs) in 2006 to be established throughout the States and Divisions of the Union of Myanmar for easy and affordable Internet access by students, firms and local organizations. **New Zealand** also has a 'Connecting Communities' strategy to promote partnerships between local government and the private sector in connecting up local communities.

In Latin America, the Program Acessa São Paulo (PASP) has set up 123 Infocentros since 2000 in São Paulo, **Brazil**, with a total capacity of 1.75 million visits per year to address digital exclusion and give community Internet access to low-income groups. Communities can define their own priorities, including how the equipment donated by government is to be used. In **Colombia**, three telecentres have been set up to support indigenous rights, with funding from the Canadian International Development Research Centre (IDRC). These telecentres — combining an Internet café with a library and meeting place — are housed at the Association of Indigenous Governing Councils of North Cauca and are helping to raise awareness of the rights of indigenous Indians and denounce human rights abuses.

In Africa, the **Appui au Desenclavement Numerique** (ADEN[15]) is aiming to democratize the use of ICTs by establishing 60 public Internet access points, to be managed by associations, local authorities or educational institutions. ADEN will also conduct train-the-trainer courses in network administration and management of public Internet access points. To date, ADEN has been active in Angola, Burkina Faso, Burundi, Cameroon, Central African Republic, Congo (D.R.), Guinea, Mozambique, Nigeria, Senegal and Tanzania. **Ghana**'s eCARE programme (e-commerce and renewable energy) will establish three telecentres in rural areas in Accra, Eastern and Volta regions, offering training, follow-up financial support, discounted airtime and equipment to recruited entrepreneurs.

A number of initiatives are broadening access to information even further, for example, by using radio to disseminate information obtained from the Internet more widely. In the developing world, radio sets are relatively cheap, and

Box 6.2: Supporting the work of telecentres

Telecentres offer access to ICTs at reduced cost, by pooling resources and expertise to make ICTs affordable to communities where personal ICT ownership is limited.

Initiatives to strengthen telecentres include:

- Government programmes and public statements of support, as happened, for example, for PubliNets in **Tunisia** (see Section 4.6.1) and **Egypt**'s plan to establish 300 publicly accessible telecentres covering all 26 Governorates;
- studies on telecentres (e.g., Roman & Colle, 2002) and online support networks for sharing experiences;[16]
- technical solutions in software and connectivity; and
- initiatives to extend ICT skills into the broader community.

In Kerala, **India**, the 'Akshaya Project' was launched in November 2002 to bridge the digital divide and boost Kerala's standing as India's foremost knowledge society. Akshaya has three focus areas – to promote access to ICTs, to develop IT skills by all sections of society and to develop local language content on relevant topics. Akshaya is one of the most ambitious ICT programmes ever attempted in a developing country, aiming to build a network of 6'000 information centres, generate 50'000 job opportunities and attract investment of Rs.500 Crore (around US$ 120m) over three years. It has been successfully implemented in Malappurram.

UNESCO has established a Community Multimedia Centre (CMC) initiative to promote community empowerment and contribute to bridging the digital divide. One feature of UNESCO's approach is the linkage established between the Internet, as a source of information, and local community radio for dissemination.

Telecentre.org is a universal access network launched during the Tunis Phase of the WSIS that unites telecentre managers in an online network. It supports the work of telecentre staff with training, marketing and technology. In **Uganda**, an NGO promoting the integration of ICTs into Uganda's development efforts, UgaBYTES, offers technical solutions for telecentres - in 2002, it introduced the Telecentre Manager software, allowing managers to track user activities by automatically-generated registration and user reports. The software was offered free, along with training.

Taking a different approach, Indonesia's "Digital Scout programme" seeks to broaden ICT skills through ICT-savvy youth visiting remote areas to educate locals about the uses and benefits of ICTs. The programme asks participants to consider which applications and training are most appropriate for given communities, rather than applying blanket solutions to unique problems. (This is similar in concept to **New Zealand's** "Technical Angel" project - see Box 6.6).

Source: WSIS Stocktaking Database at: www.itu.int/wsis/stocktaking.

the service is popular and accessible, especially where illiteracy is high. Radio broadcasts of weather forecasts for fishermen in **India**, crop prices for farmers in Africa or calls for political rallies help inform people who would otherwise be unaware. In **Nepal**, Radio Sagarmatha took an innovative approach to introducing the Internet to its listeners. Since March 2000, it has broadcast a three-part programme: firstly, "browsing on the radio" discusses websites of interest. The second part explains technical Internet jargon, with questions and requests. Finally, an Internet user is interviewed for tips on how to use information from the Internet. The programme is overwhelmingly popular, revealing a thirst for Internet in Nepal and the radio was inundated with so many requests, that the programme was doubled in length.

6.2.2 Affordability

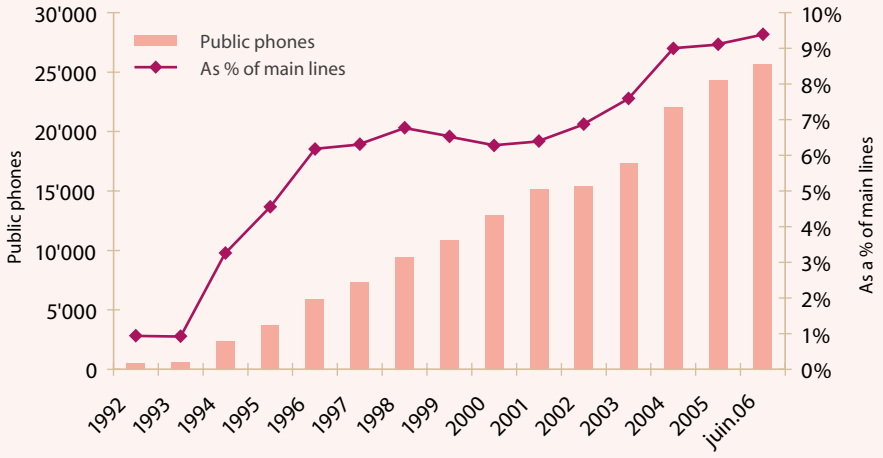
Following market liberalization and the trend toward privatization (Figure 4.5)[16], the ability of governments to influence market prices directly has diminished. Instead, governments are increasingly relying on regulatory agencies to monitor and regulate the price of telecom services (one example given in Chapter three is Telecom Lesotho's application to the Lesotho Telecom Authority for approval of its proposed tariffs for ADSL service).

Ensuring that telecommunication services remain affordable (relative to local income) therefore mainly depends on regulatory control of prices (interconnection and wholesale, as well as retail).

Box 6.3: Senegal's success in promoting telecentres to meet its WSIS commitments

As discussed in Chapter three, the Government of Senegal is seeking to boost access to ICTs (Box 3.2). One way in which it hopes to achieve this is through public telephone centres or "téléboutiques". Senegal was one of the first countries in Africa to liberalize resale of telephone service through public centres and the results have been impressive. From just over 500 telecentres in 1992, there were 24'284 telecentres by the end of 2005, accounting for nearly one in ten fixed lines (Box Figure 6.3). Apart from providing a valuable service to people without a mobile phone or families without a fixed line, these telecentres provide direct employment for some 32'000 people. The popularity of telecentres has continued, despite the rising ownership of mobile phones. Consumers use both mobile and payphones, with mobile users receiving calls on their handsets, but making calls from telecentres, where tariffs are lower.

Box Figure 6.3: Telecentres in Senegal, 1992 - 2006



Note: *Public phones include telecentres, public cabins and "phonepoints".*

Source: Adapted from ARTP.

Efforts are underway to move from voice-oriented telecentres to multimedia community access points offering Internet access. Although there are 24'000 telecentres, there are only around 800 public locations that provide Internet access. There is a UNESCO project to create around 20 community multimedia centres[19] and a project with the US government to leverage the network of telecentres to create services to benefit SMEs. Senegal is also hooking up schools to the Internet. A NEPAD e-School project aims to provide secondary and primary schools with Internet access. The Government issued a sector note on telecommunications in January 2005, which aims to connect 9'500 villages by 2008 and all 14'200 villages by 2010. At the end of 2005, only 1'713 villages were connected to the fixed line phone network. There is a pilot project testing how fixed wireless technology (e.g., WiMAX) can help accomplish this goal.

Senegal has been a strong international voice for reducing the digital divide. It has been charged by NEPAD with coordinating ICT projects within Africa. Senegal's President Wade conceived the idea of the Digital Solidarity Fund which was adopted by the WSIS and established in March 2005. This achievement was recognized when President Wade was awarded one of the two inaugural awards for World Information Society Day by ITU on 17 May 2006 (Box 6.1). Senegal has also been an active member of the UN ICT Task Force and G8's Digital Opportunity Task Force.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

In some countries, initiatives to promote affordability have focused on subsidies to specific groups or programmes to recycle and rehabilitate used equipment.

The Government of **Hungary** launched an early initiative of this sort in 2001, when it set up a public-private consortium (involving Compaq, Matáv and Postabank) to provide PCs and Internet

to 1'400 underprivileged families at a discounted rate. Families could pay for the PC in monthly instalments of USD 25 over three years. **Singapore** offers specific subsidies for computer purchases by families with children of school age. As part of its IN2015 Vision, Singapore believes that interesting schoolchildren in IT at an early age is vital to developing the skilled workforce that will help maintain its competitive standing in the global economy. The Government offers subsidized computers to low-income families with schoolchildren – the statistics show that this programme has had some impact, as computer ownership by families with young children is higher (see Section 4.8.1).

New Zealand has launched a Computers In Homes (CIH) programme with the 2020 Communications Trust to provide over 100'000 New Zealand families who are socially and economically disadvantaged with a recycled computer, an Internet connection, training and technical support and to enable them to become active participants in the online world. Parallel projects target different groups: illiterate adults, refugees and their families, students and ethnic groups, with Computer Use Manuals available in English, Maori, Samoan and Tongan. The majority of Pacific families benefiting from CIH are Samoan, who enjoy emailing distant family and friends, as it is cheaper than telephoning and can be done at any time of day or night.

6.3 Infrastructure

Infrastructure is the basic building block of connectivity and ICT skills and applications are built on the foundation of accessible infrastructure. With privatization, state plans for the deployment of infrastructure have been superseded in many countries by private operators responding to commercial incentives, but many governments maintain national ICT strategies in recognition

Box 6.4: Multilingualism – or lack of it – in accessing the Internet

The Internet offers huge opportunities not only to access information, but also to create and publish content, provided: (a) you have access to an Internet connection you can afford (b) you have a basic knowledge of how to navigate online (c) you are literate and (d) your language(s) is represented on the Internet. For certain sections of society, any one of these four barriers can prove insurmountable. The last barrier is especially significant, however, for languages supported by small populations or which are spoken by ethnic minorities. Online representation is politically sensitive and can reinforce the domination of certain languages, notably Mandarin Chinese, English, Russian or Spanish.

In Thailand, Internet penetration has not yet reached critical mass. The main barrier facing most Internet users is not access or affordability, but lack of Thai content. To promote Thai content, companies such as Microsoft, Terra Lycos and M-Web have incorporated Thai into their programme and portal designs. M-Web bought the popular Thai portal, Sanook.com, and is incorporating Thai content into its websites and browser software.

To commemorate the 1'600th anniversary of the Armenian alphabet, UNESCO and the Matenadaran Institute launched the B@bel Initiative in 2004 to enhance access to online information in Armenian for three million inhabitants in Armenia and four million Armenians living abroad. The project will develop a Unicode-compatible font to standardize the range of Armenian fonts. Different fonts use non-standard encoding and make printing, publishing and digital design difficult and data transfer (including e-mail) unreliable. Many fonts are limited and cannot recreate the rich styles of traditional manuscripts. This initiative will promote content creation in Armenian and help preserve Armenian culture.

Nepal faces similar challenges, with the Nepali Devanagari language used by some institutions, while others use fonts such as Preeti, Kantipur and Fontasy Himali. Lack of a standard font has inhibited software creation (such as a dictionary or Nepali spell-checker) and made data transfer difficult. Since 2004, UNESCO has supported efforts by Madan Puraskar Pustakalaya, a local NGO, to standardize the Devanagari font, promote computing in the Nepali language and maintain archives in the mother tongue. There are also initiatives to establish portals and discussion forums in local languages.

In Ethiopia, the CyberEthiopia initiative for digital inclusion seeks to foster dialogue, collaboration and knowledge-sharing among Ethiopians (in Ethiopia and abroad) by offering local content and e-forums in minority languages, with a wealth of online resources.

Source: WSIS Stocktaking Database at: www.itu.int/wsis/stocktaking.

that the nationwide development of ICTs needs a coordinated approach (see Chapter four). For many developing countries, ICT strategies are included as a cross-cutting theme in their Poverty Reduction and Growth Strategy (PRGS) framework. ITU was nominated by the WSIS as the focal point for the Action Line (C2) on information and communications infrastructure.

A major initiative on infrastructure in Africa is being undertaken by the **European Union**. The START project (EuroAfrica ICT Initiative) brings together the European Commission with partners, including Sigma Consultants, Meraka Institute of the CSIR (South Africa) and the Panos Institute of West Africa, to develop appropriate ICT solutions for Africa. Overall, the EU plans to double the level of its aid budget between 2005 and 2010.[17]

6.3.1 Fixed lines

The privatization of state-owned operators (as illustrated in Figure 4.5) has meant that government targets for roll-out of fixed lines are no longer appropriate, since fixed line markets are increasingly responding to market incentives. As discussed in Chapter three, many people are now 'cutting the cord' and using a mobile phone as their main, and often only, phone. Despite this, fixed line connectivity still has a role to play, especially for Internet access. In urban areas, fixed line connectivity is generally not a question of supply, but a problem of perceived need and affordability. In rural areas, the problem is supply and extending infrastructure to remote areas with low population densities, where the returns may not justify the investment.

Many countries have instituted Rural Telecommunication Development Funds (Box 6.5), including **Egypt**, **Nepal** and **Uganda**. The Government of **Nigeria** has set up a National Rural Telephony Programme (NRTP) to establish effective and affordable telecoms throughout Nigeria, with a backbone ICT deployment. In **Azerbaijan**, the Rural Area Telecommunications Programme is a joint project designed to provide affordable telephone and high-speed Internet service to people in rural areas. It is an Azerbaijani-American joint venture with Caspian American Telecommunications (CAT). **Lao PDR** has also set up a project to provide basic telecom infrastructure to rural areas. Some 2'500 connection points were established over five years to connect three-quarters of all rural districts to the telecom network. Local administration and small firms have been provided with phone lines, fax, email and Internet, while the public has access through public call offices.

6.3.2 Mobile communications

As shown in Chapter three, cellular mobile communications are increasingly important for access to ICTs, especially for developing countries. Growth in mobile telephony offers the most immediate way of bridging the digital divide. The mobile sector is also notable for a high level of private sector ownership (see, for example, Table 3.2, which summarizes key pan-African mobile strategic investors).

The **World Bank** has promoted the development of mobile communications within its overall InfoDev programme for a considerable time now. Its Private Sector Support Division work with operators and service providers in many countries to extend access to voice and data communications in under-served areas, mainly through mobile and/or fixed line services.

6.3.3 Broadband

As Chapter three suggested, broadband represents the likely future face of the Internet and broadband services are now available in more than 170 economies worldwide.

In **Japan**, the Government launched the "Asia Broadband Programme" in 2002 to bridge the digital divide and promote the social, economical, cultural development of Asia. The programme aims to make Asia a global information hub by 2010 by extending infrastructure, improving technical and human capacity and enriching digital content. The program has established partnerships in ten Asian countries to build network infrastructure and enable people to access broadband platforms at affordable prices. The programme is now also focusing on the development of mobile broadband, with a focus on improved security and other features.[18]

In Europe, the Ministry of Transport and Communications of **Bulgaria** (MTC) launched the iBulgaria initiative for broadband in 2004. The first phase of the initiative focused on stimulating new services, applications and content in online public services and e-business, in recognition of the leading role of the private sector. The second phase is now underway, to promote broadband infrastruc-

Box 6.5: Rural Telecommunication Development Funds (RTDFs)

While public telecommunication operators were state-owned (often an extension of the government ministry), they were generally able to operate cross-subsidies and subsidize services to rural areas that were often unprofitable from higher-margin services offered to urban areas, from business revenues or from more expensive international calls. Competition and privatization have obliged operators to rebalance their tariffs to reflect underlying costs, thereby reducing or eliminating cross subsidies, while in some countries, private operators have 'cherry-picked' more lucrative business and urban sectors.

In response to this, governments have sought to establish Rural Telecommunication Development Funds (RTDFs) or Universal Service Funds as an alternative to cross subsidization. Often financed through levies as a small percentage of revenues and operator contributions, RTDFs have had some success in extending rural connectivity. They have also been used by regulators as a mechanism to level the playing-field between incumbents and new entrants (by setting contributions at different levels – e.g., as in the Czech Republic or Malaysia). However, they have sometimes become a target for political meddling or corruption. For this reason, a recent trend has been to seek alternative, more transparent, mechanisms for achieving universal service objectives, such as the reverse cost auction system used in Chile, with support from the World Bank.

Source: ITU.

ture and security through basic state procurement. The Ministry of Transport of the Republic of **Latvia** has launched an ambitious broadband project for rural areas, which seeks to build a broadband network out to 90 per cent of Latvian territory by 2012, with funding assistance from the European Rural Development Fund (ERDF).

In Africa, **Ethiopia** is establishing a national wide-area network to link Federal government with 600 local 'woreda', schools, hospitals and agricultural research centres. The economy is mostly agrarian, but the Government believes a national strategy backed by technology can improve public services and create new opportunities. ETC was enlisted to build a core multi-service network, with the tender awarded to Cisco. A fibre-optic network has been built around Addis Ababa to carry mobile and fixed-line analogue voice traffic, Internet and multimedia services. High-speed fixed and microwave links extend the network to remote areas.

In Latin America, **Colombia**, the Ministry of Communications has launched its Social Telecommunication Programme using telecentres to honor the government's commitments at the WSIS. The "Broadband Connectivity for Public Institutions" project will ensure broadband Internet access to public institutions. The Project has three elements: infrastructure, contents and training. By September 2007, it is intended that broadband connectivity will have been established to 9'151 public institutions, 7'813 public schools, 202 hospitals, 1'048 mayoralties, 31 military bases and 57 agricultural centres.

6.3.4 Wireless communications

Wireless technologies offer easy-to-install, low-cost solutions compared to conventional fixed line infrastructure. The WSIS recognized the promise of these technologies in rolling out infrastructure to more people more rapidly, at lower cost. The flexibility and ease of installation of Wi-Fi and satellite communications mean that networks can be built by local communities, in line with their needs.

The **E-Link Americas** project uses satellite and wireless technologies to deliver affordable Internet access to districts, schools, hospitals and telecentres in rural areas of Latin America and the Caribbean. E-Link's high-speed Internet services are based on VSAT terminals connected to a satellite gateway in Canada using the Ku band, with access points extended using Wi-Fi. Local Service Partners act on behalf of E-Link Americas in Chile, Colombia, Ecuador, El Salvador, Honduras, Guatemala, Nicaragua and Peru.

In Asia-Pacific, **UN ESCAP** has a Programme to develop satellite communications for connectivity to ensure affordable access for underserved communities. The Programme promotes public-private partnerships as a way of encouraging space agencies and others to move forward from prototypes and pilot projects to operational products and services. In **Malaysia**, the Government has launched an initiative to connect remote villages to the Internet using computers, telephones and VSATs. One of the beneficiaries was the 12 communities that comprise Bario in a remote area of Sarawak.[19] Administered

by a public-private partnership, e-Bario demonstrates how ICTs can be used to help marginalized communities in Malaysia develop socially, culturally and economically.

6.4 Utilization

As Chapter two emphasized, the digital divide is no longer about basic connectivity, but increasingly about utilization and how people are using ICTs. New skills are needed to take full advantage of ICTs and participate in the digital world. A range of programmes and grassroots projects have been launched around the world to promote education, telemedicine and e-commerce using ICTs, as discussed in the sections below.

6.4.1 Education

Training in skills is vital in order to be able to take full advantage of ICTs. Many countries are focusing on education as a means of unlocking the promise and potential capabilities of children as future workers. Many countries initiated ICT projects in schools early, to bring the Internet to the next generation. Many countries have also adopted programmes to train the teachers in recognition of their skill needs and the fact that, by training up a single teacher, many more pupils can be reached (Box 6.6).

As early as 1995, the Government of the **Republic of Korea** determined that all schools should have Internet access. By 2001, all schools were equipped with a local area network, computer lab and access to the government backbone network. Connection speeds of 256 kbit/s were free, with discounts for higher speeds. Today, all schools have a 2 Mbit/s connection and multimedia equipment. The Rep. of Korea is reaping the rewards of its early initiative, with one of the highest Utilization scores in the DOI (see Section 4.2.1).

In Asia, **Thailand**'s SchoolNet project connected 5,000 schools to the Internet by the end of 2002, including all secondary and 1'500 primary

Box 6.6: Teaching the Teachers

The capabilities of teachers determine the success of their students. In some countries with skills shortages, programmes are underway to ensure that teachers are fully in command of their subject (although ICT is arguably one of the few subjects where some pupils may be ahead of their teachers!).

ITU has established an Internet Training Centres Initiative for Developing Countries (ITCI-DC). Designed to help people develop IT skills, ITCI uses a "train-the-trainer" methodology to spread ICT skills and awareness. ITU then transfers the Internet/IP related training programmes developed to training or educational institutions in each country. The multi-million dollar three-year project brings together public and private actors, NGOs and local businesses to increase the number of ICT skilled workers and help governments and local firms create incentives to avoid the "brain drain" that stifles ICT modernization in many developing countries.

In **Rwanda**, the Kigali Institute of Education (KIE) has established a network of Regional Distance Learning Centers and provides technical assistance for training their staff. KIE staff have developed training materials using ICT-based pedagogical modules. ICT staff are also trained in information management systems and web design. In Uganda, the Uganda Curriculum Development Centre, Makerere Institute of Computer Science and UNESCO designed an "ICTs for African Educators" CD-ROM. The multimedia CD-ROM familiarizes teachers and students in computer-assisted learning techniques to create an interactive learning environment.

In **Asia**, UNESCO has established an "ICT Portal for Teachers" with funding from the Japanese Government to train teachers in computer literacy and educational software for teaching and learning. The Portal seeks to help teachers integrate ICTs into their classroom activities, with up-to-date sources. It is hoped that the portal will enrich the school environment with quality multimedia materials and better-resourced teachers.

At Wellington Girls' College in **New Zealand**, the technical learning needs of the school started to outstrip the ICT skills of staff. Sponsored by the Ministry of Education, under its "Technical Angels" programme, students are given training in ICT so they can mentor and support college staff in ICT. Each Tech Angel mentors two teachers, teaching topics ranging from general computer use to scanning, movie-editing and burning CDs.

Source: WSIS Stocktaking Database at: www.itu.int/wsis/stocktaking.

Box 6.7: Initiatives in higher education and research

Universities and research institutions played a leading role in developing the Internet, which started as a military network but was quickly adopted for data exchange and research (in most developed countries, the majority of firms were relative latecomers to the Internet). In developing economies, higher research institutions were also among the first to be connected - for example, the University of Tunis claims to have established the first Internet connection in Africa (see Section 4.6.1).

Various initiatives seek to ensure that the Internet continues to serve higher education institutions in research and long-distance learning. Since 2003, the **Virtual University of Tunis**, in partnership with the Higher Institute of Technological Studies has provided long-distance courses using multimedia technologies. The programme aims to widen access to higher education, improve quality and educate the future workforce. Malaysia has established a Multimedia University (MMU) in its Multimedia Super Corridor. MMU focuses solely on high-tech subjects, such as software development, digital media and IT engineering.

The **Asia Pacific Initiative** (API) for research was launched in 2003 at the World Summit on Sustainable Development to promote collabourative research, online learning and capacity-building. The API is a knowledge-sharing initiative that harnesses creative power through new technologies. It created a new Media Studio for online multimedia broadcasting at the UN University, which functions as a networked organization with partner universities, research institutes, NGOs and businesses in Asia. Further pilot experiments are underway in IP/Internet broadcasting, video-on-demand, e-learning and interactive communications.

In **Brazil**, a pilot project in Rio de Janeiro aims to extend high–speed academic networks to provide connectivity to community centres in the slums, using Wi-Fi links. This project is being implemented in partnership with the Federal University of Rio de Janeiro, the Ministry of Science and Technology of the State of Rio de Janeiro and two local NGOs (Vivario and CDI). It aims to show how high-speed networks can be used with wireless technologies to serve low-income communities in urban areas.

Source: WSIS Stocktaking Database at: www.itu.int/wsis/stocktaking.

schools (Thailand's universities were already connected to the Internet). The Telephone Organization of Thailand (TOT) provides free Internet access and schools only have to pay the cost of a local phone connection. **Malaysia**'s Smart Schools programme teaches students about ICTs. The Malaysian Government allocates an average 20 per cent of its annual budget to education and is seeking to make all schools "smart" by 2010. The Mobile Internet Unit (MIU) uses "smart" buses to visit rural schools, leaving behind PCs, training materials, and where possible, an Internet connection.

The Ministry of Education of **Turkey** has launched the School Connectivity project to provide Internet access to computer labouratories in 42,500 primary and secondary schools, often in rural districts. This initiative has opened up computer labs to local communities after school-hours, so local people can use broadband.

In Latin America, **Colombia**'s Computers for Schools programme had provided 19'223 refurbished computers from firms to 2'17 schools by 2003, benefiting some 750'000 youth. The programme aims to become long-term. In **Chile**, the "Wireless IP Multimedia Diffusion Project" has connected 60 secondary schools using Wi-Fi, with the help of the National Universities Network. It provides educational materials to complement students' schoolwork.

In Africa, **Ethiopia** has launched its 'Schoolnet' programme, with a nationwide network that will connect up over 450 secondary schools. The 'Schoolnet' project already delivers educational content to schools from the Ethiopian Media Agency, using terrestrial and satellite networks and will broadcast TV-based educational content. More schools are coming online at a steady pace. The **Cape Verde** government launched the Projecto de Consolidação e Modernização da Educação e Formação (PROMEF), with funding from the World Bank. PROMEF sought to analyze how ICTs can be used to improve education and training systems in Cape Verde. It also created databases with budgetary, staff, scholarship and student information.

Box 6.8: Geographical Mapping of Malaria in Africa

Sub-Saharan Africa has the highest incidence of disease in the world and malaria is one of the main causes. Over 90 per cent of malarial deaths occur in sub-Saharan Africa. Detailed mapping of malaria incidence had never been carried out in Africa, making malaria control difficult. The **MARA** programme is run by the South African Medical Research Council as a database project that has compiled over 10'000 data points from the literature and country visits. It has produced the first collection of disease estimates and the first map of malaria distribution. It uses Geographical Information Systems (GIS) and spatial statistics to show the density and seasonality of malarial infections. Over 3'000 maps of malaria models have been sent to malaria control programmes, departments of health and research institutions in endemic African countries. All maps and reports in English and French are available from the website or by CD. This collaboration could serve as a model for disease information systems in developing countries.

Source: WSIS Stocktaking Database at: www.itu.int/wsis/stocktaking.

6.4.2 Telemedicine

Applications of ICTs in health (telemedicine or e-health) are evolving fast in: raising awareness and basic knowledge of health and hygiene; improving preventive care; improving the efficiency of Health Management Information Systems; and for long-distance diagnosis, investigation, online consultation and even operations over the Internet. ICTs and telemedicine solutions can play an important role in improving healthcare in developing countries, where people may have to travel long distances to receive medical attention.

This year sees the culmination of the seven-year USD 200 million Health Internetwork project of the **World Health Organization** (WHO) to provide access to high-quality, timely health information for medical professionals, researchers and policy-makers in developing countries using the Internet. One of the major initiatives of the UN Millennium Action Plan, this public-private partnership has focused on:

- Content creation: WHO teams have completed country assessment studies to work with local partners to create local Internet portals of health information;

Box 6.9: ICTs in the fight against HIV/AIDS

A range of initiatives are underway using different communication technologies to combat the spread of AIDS/HIV.

The high-speed capabilities of more recent ICTs should not detract from the power of radio to reach huge audiences in developing countries, especially where literacy rates are low. In **Ethiopia**, the radio series "Journey of Life" used real-life characters with whom the audience could identify to encourage people to protect themselves against HIV/AIDS. It showed how easy it is to become infected with HIV to educate listeners on precautions. In **Senegal**, Radio Oxyjeune broadcasts music and chat in the capital, Dakar, and hosts live phone-in shows in national and local languages to reach as wide an audience as possible. It tackles subjects such as HIV/AIDS and women's rights. Anonymous interviews with HIV-positive individuals have helped promote safe behavior. Organizers believe that personal stories are most effective in the fight against AIDS.

The **Staying Alive** campaign is a movement for AIDS awareness and prevention. Its Internet site promotes AIDS awareness, while a multimedia campaign is launched every year on World AIDS Day (1st December). Its campaigns involve celebrities, public announcements and on-air or online products for distribution for TV/radio partners (such as documentaries, concert events, news items and discussion programmes).

In **India**, Population Services International (PSI) has run a telephone helpline for HIV/AIDS prevention since 2002 in Mumbai as a low-cost, anonymous and confidential communication channel. Counsellors provide information, support and referrals. A helpline is helpful, as the idea of talking to a doctor about sexual health issues can be culturally difficult.

Source: WSIS Stocktaking Database at: www.itu.int/wsis/stocktaking.

Box 6.10: Information over Technology in e-Agriculture

A recent survey conducted by the UN Food and Agriculture Organization (FAO) found that nearly half of all stakeholders working in agriculture who replied to the survey identified e-agriculture with improvements in processes such as information dissemination, access and exchange, communication and participation. In contrast, only a third highlighted the importance of technical hardware and technological tools, such as mobile phones, computers and the Internet.

The results of the survey suggest that initiatives in Africa to promote agriculture through new and improved types of information-sharing are on the right track. African companies are experimenting with new information services to eliminate intermediaries, improve productivity and get a better deal for African farmers. TradeNet, a software company **Ghana**, has unveiled a simplified form of eBay over mobile phones for agricultural products across more than ten countries in **West Africa**. Buyers and sellers post information as to what they are after and their contact details, which are then circulated to 'matched' subscribers using SMS text messages in several languages. Interested parties can then contact others directly to do a deal. Similar projects are underway for daily price information for fruit and vegetable exports in **Burkina Faso**, **Mali** and **Senegal**. Such initiatives can improve the flow of business information and help reduce costs and boost profits.

The **Ministry of Agriculture of Malaysia** has launched Taninet or "Your friendly agricultural website", equipped with articles, a bulletin board, query and FAQ services and an event directory on agricultural topics. It has databases with up-to-date information on agricultural products and expert references. TaniNet also provides e-commerce services to fund its existence.

In India, the Murugappa Group has set up telecentres and an online portal to access market data without intermediaries or middlemen. Sugarcane farmers in Tamil Nadu, coffee planters in Coorg and soy farmers in Madhya Pradesh are using the site to sell their products at better prices. Farmers can browse the news and weather reports and use banking, micro-credit and micro-finance facilities. They can examine offers from other farming companies for fertilizers, farm tools and seeds etc. This model restores ownership of the supply chain to the farmers in an equitable manner, to the benefit of the farmers.

Source: WSIS Stocktaking Database at: www.itu.int/wsis/stocktaking.

- Connectivity: the project has sought to establish over 10'000 Internet sites, maintained by the WHO, NGOs and local partners;
- Capacity-building: WHO teams have provided hands-on training in how to manage portals and computer systems.

The Health Internetwork portal provides access to a vast library of the latest information on public health, with over 1'000 scientific publications, statistical data and vital information for research, health policy and health service delivery. It also offers applications such as epidemiological tools and mapping systems to chart the spread of disease, as well as distance learning courses. Pilot projects have been launched in eight countries in Africa, Central Asia and Eastern Europe.

In **Malaysia**, e-Farmasi is a medical database jointly developed by the Ministry of Health and Pharmaceutical Society, with information on pharmacies, illnesses and medicines (over 27'000 products, side-effects, directions for use etc.) It helps pharmacists manage their pharmacy and maintain patient medication records. The public can ask questions and buy medicines over the website. The site also offers a diagnostic guide, with health advice and guidance. Medicines can be searched by ingredient or brand-name. **Egypt** has gone one step further and launched an online market place for its pharmacies to coordinate their internal purchases of medicine at cheaper prices (CiraNet.com). Similar health information portals exist in **Hungary** (MEDINFO), **Russian Federation** ("Healthy Russia 2020") and **Nepal** (the NGO HealthNet).

In the **United States**, the medical services company, Medem Inc, launched the iHealthRecord Initiative in 2005 as an online health information resource (www.ihealthrecord.org). The system allows patients to access, update and share their medical records with doctors over the Internet. Vital medical information is not always available to emergency workers, leading to complications, constraints or delays. It is hoped that the system will reduce risks of mistakes (such as prescription errors), streamline documentation and reduce the need for visits. The service is free to patients who

access it directly. Doctors, hospitals and medical groups pay for the system at around $US25 per month per patient.

In **Mozambique**, ITU has helped the government to establish a network between the central hospitals of the capital city, Maputo, and Beira. The network allows doctors to confer and share medical records to ensure that patients in their respective cities get the best possible care. Medics in Beira now have instant access to radiologists in the capital, which has significantly improved patient care. Similar telemedicine projects with which ITU is involved are currently underway in **Senegal**, **Uganda** and **Ukraine**.

6.4.3 Building technical capabilities for economic development

ICTs are an engine for economic growth in their own right. Economic poverty is directly related to information poverty, in people's ability to use ICTs to get a better deal for their products or improve production processes more efficiently. In many applications in developing countries, the power of information is emphasized in making markets function more efficiently, addressing market failures, removing intermediaries and empowering farmers (Box 6.10). ICT skills are also important, however, in training the workforce in new technologies and improving productivity.

Since its launch in October 1997, the **Cisco Networking Academy** has spread to more than 150 countries and taught over 1.6 million students, who have enrolled in more than 10'000 Academies in high schools, technical schools, colleges, universities and community organizations. The Academy has helped in technical training for more than 5'000 ICT technicians in 32 countries, of which a quarter were women. The Programme is a comprehensive e-learning program, delivering web-based content, online assessment, student performance tracking, hands-on-labs, training and support, and preparation for industry standard certifications.

In Asia, UNDP's Asia-Pacific Development Information Programme is establishing **ICT Business Development Centres** in countries such as Vietnam[20] to support Asian cooperatives and their umbrella organizations to use ICTs. It further aims to install national and regional cooperative networks. These are local telecentres providing Internet access, training and business information for SMEs. The **Digital Freedom Initiative** started out in the US and Senegal in March 2003 and is being extended to by Peru, Indonesia and Jordan. It places volunteers in businesses and community centres to provide SMEs with the necessary ICT skills and knowledge to compete more efficiently in the global economy.

6.4.4 Youth

The WSIS Declaration of Principles recognized that young people are the future workforce and the leading creators and earliest adoptors of ICTs (para 11). The 2007 World Information Society Day, to be celebrated on 17 May, has this year the theme of "Connecting the Young".[21]

The *Voices of Youth*, an initiative of **UNICEF**, started as a way for young to send messages to world leaders at the World Summit for Social Development, held in Copenhagen in the spring of 1995. Today, it is a vibrant online meeting place (www.unicef.org/voy) where young people from around the world explore, speak out and take action on global problems. The portal provides multiple resources: interactive educational games and training, discussion boards in English, French and Spanish but also brain teasers and lots of information on children's rights.

UNESCO has launched *World Heritage in Young Hands* as a flagship projects for youth from over 130 countries. This Project gives young people a chance to voice their concerns on preservation and promotion of cultural and natural heritage sites from local to global levels and to become directly involved in related projects. The overriding aim of the project is to mobilize young people to contribute to world heritage preservation in many different ways: for instance, by establishing an online learning community (http://whc.unesco.org/education/sindex.htm).

In the **Republic of Nauru**, UNDP has launched a targeted project order to maximize the use digital and satellite-based radio communication resources to serve the education and development needs of students and young people. This project aims to combine existing satellite communication networks at the University of the South Pacific (a regional leader in distance education via radio waves), so students and the general public can receive educational materials as well as broader community development information.

6.5 Conclusions

At the WSIS, governments made a strong commitment to building a people-centred, inclusive and development-oriented Information Society for all, where people can access and use information. During the Tunis Phase, stakeholders stressed their ongoing commitment to remain fully engaged to ensure the implementation of the WSIS *Plan of Action*. This Chapter has highlighted some of the activities and initiatives that are underway around the world to make the WSIS vision a reality. From this review, it is evident that not only has WSIS succeeded in raising the profile of ICTs and their role in the Information Society of tomorrow, but it has also established an agenda and a framework for coordination, especially through multi-stakeholder partnership. Significant progress has been achieved in building a richer and more inclusive Information Society in which everyone can participate. Although the WSIS set 2015 as the date for the formal review of implementation, the review of projects and activities underway around the world presented here shows that WSIS implementation is on track.

Notes for Chapter Six

1 For reference, the UN General Assembly (UNGA) adopted the WSIS as a Summit in two phases in Resolution 56/183, available at: www.itu.int/wsis/docs/background/resolutions/56_183_unga_2002.pdf, on 21 December 2001. In the Tunis Agenda for the Information Society, one of the four WSIS outcome documents, the UNGA is called upon to make an overall review of the implementation of WSIS outcomes in 2015 (para 111). For more information about WSIS and its implementation, see www.itu.int/wsis.

2 For more information on the Internet Governance Forum, see: www.intgovforum.org/. The first meeting of the IGF was held in Athens, 30 October – 2 November 2006.

3 For more information about the voluntary Digital Solidarity Fund, see: www.dsf-fsn.org/. The fund is financed according to the "1 per cent of digital solidarity" principle, whereby some 1 per cent of the costs of ICT procurement projects are donated to the fund.

4 For more information on national implementation, see the WSIS stocktaking website at www.itu.int/wsis/implementation and also the World Information Society Day site at: www.itu.int/wisd/2007/index.html.

5 For more information on national implementation, see the website at: www.itu.int/wisd/2007/wsis-implementation/.

6 For more information on the Egyptian " Golden Book" , see: www.mcit.gov.eg/ar/brochures_ar/Golden%20Book%20Final2007211155321.pdf. The individual projects are also entered and can be searched in the ITU-hosted WSIS stocktaking database, at www.itu.int/wsis/stocktaking.

7 For more information on OSILAC see: www.eclac.cl/socinfo/osilac/default.asp?idioma=IN and on eLAC2007 see: www.eclac.cl/socinfo/elac/default.asp?idioma=IN.

8 For more information on UNGIS, see: www.ungis.org/.

9 For more information on UN CSTD, and the report of the SG on WSIS implementation, see: www.unctad.org/Templates/Meeting.asp?intItemID=4066&lang=1.

10 The circular letter on WSIS stocktaking is available at: www.itu.int/wsis/stocktaking/docs/dm_1002-wsis_stocktaking-e%20_3_.pdf.

11 For information on the ICT Eye database, please see: www.itu.int/ITU-D/icteye/Default.aspx.

12 A more complete selection of ICT success stories can be found at: www.itu.int/osg/spu/wsis-themes/ict_stories/index.phtml.

13 For more information on the meeting of action line facilitators/moderators, see: www.itu.int/wsis/implementation/consultations.html#first.

14 Launched by The Chinese Ministry of Science and Technology, China International Center for Economic & Technological Exchange (CICETE) and China Rural Technology Development Center (CRTDC), with support from UNDP.

15 Literally "fostering digital solidarity": see: www.africaden.net/.

16 See "Trends in Telecommunication Reform 2007" for the latest summary statistics of proportion of privatized operators throughout the world.

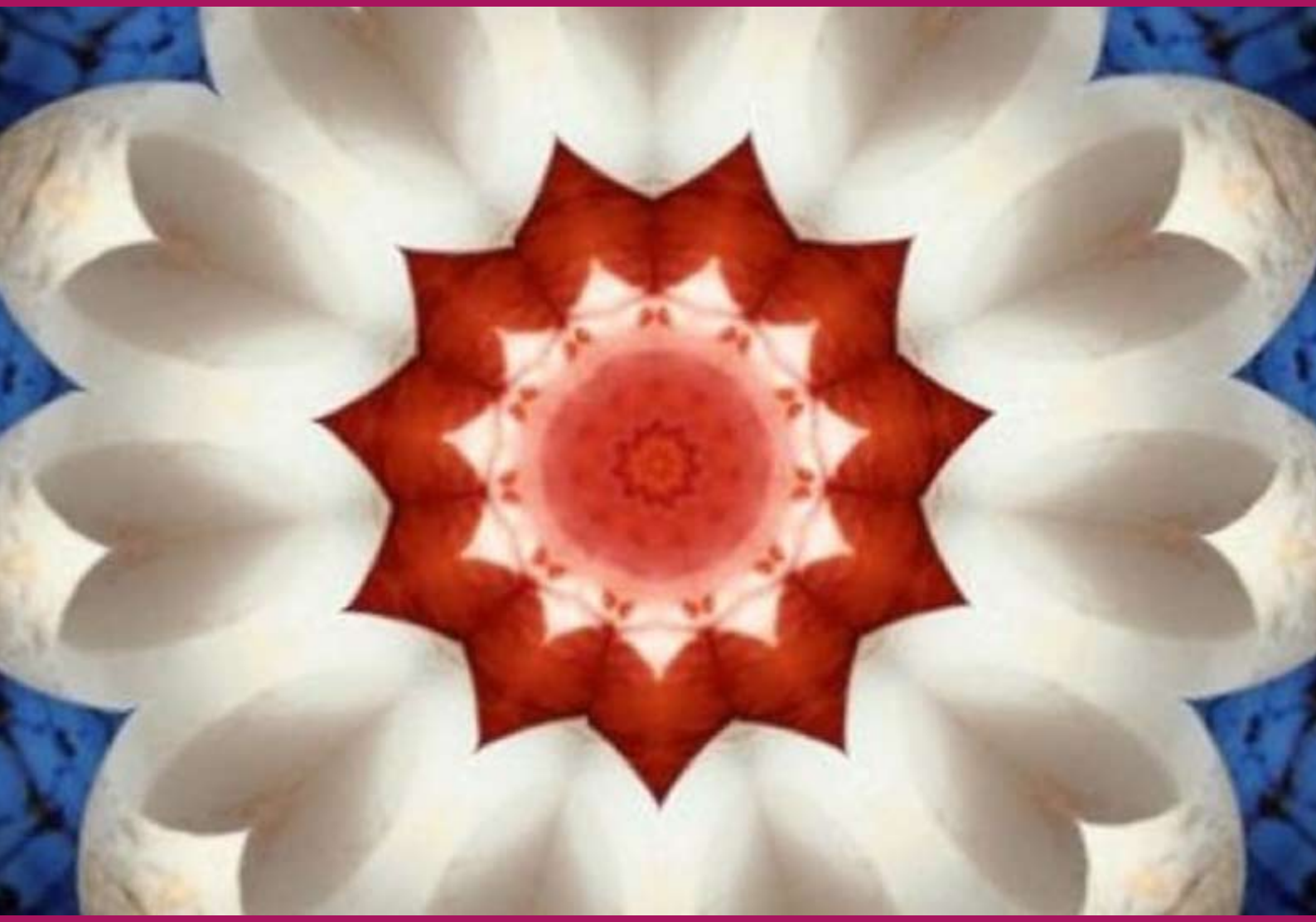
17 See "Financing ICT for Development: The EU approach", available at: www.iicd.org/iicd/articles/EU-Financing-ICT4D-(English).pdf/.

18 For more information, see: www.dosite.jp/e/ja/aisa/index_asia.html.

19 For more information on e-Bario, see: www.unimas.my/ebario/Main_index.htm.

20 www.apdip.net/projects/ictrnd/2004/L04-vn/

21 For more information, see: www.itu.int/wisd/2007/index.html.



chapter seven

The ICT Opportunity Index (ICT-OI)*

** Chapter 7 is based on an extract from ITU's publication "Measuring the Information Society 2007", which was published in February 2007. Please note that the ICT Opportunity Index is an ITU index that was developed concurrently with the Digital Opportunity Platform.*

The world is increasingly being characterized as a global Information Society, where the importance of extending access to Information and Communication Technologies (ICT) is considered vital for social development and economic growth. Attainment of internationally agreed developmental goals, including those of the Millennium Development Goals (MDGs), through access to ICT has been well documented. Several studies have been able to show the positive micro- and macro-economic impact that investment in ICT has, particularly through externalities generated by the productivity effects that the appropriate use of Information and Communication Technology has on the economy.

ICT policy and strategy play a key role in creating the right environment to foster the spread and use of ICT. Information and data on ICT developments and progress are an important pillar to evidence-based policy making and to decision makers for appropriate policy choices. They help to identify targets, and to track and benchmark progress.

Reliable, available and comparable data help decision makers to steer the path for achieving goals and targets from a global perspective. ITU has established itself as the main source of global telecommunication and ICT statistics. Based on its extensive experience in data collection - carried out through close cooperation with member states – ITU developed the ICT Opportunity Index (ICT-OI). The ICT-OI represents an important contribution to the measurement of the Information Society.

The ICT-OI, which was acknowledged by the World Summit on the Information Society (WSIS), is a useful statistical tool to compare ICT developments in different countries and regions over time. Ten widely available and reliable indicators and a sound methodology allow the ICT-OI to combine multiple factors into a single overall value. A composite index such as the ICT-OI is particularly useful for comparisons over a set period of time and between countries of similar income levels, or with similar social, regional or geographic characteristics; it provides useful insights to policy makers and analysts. Since the ICT-OI is composed of a number of indicators that are grouped into four sub-indices, it is further possible to recognize weaknesses and strengths in different areas and to tackle these accordingly.

Reducing multiple effects and developments into one single number makes indices a very simple and user-friendly tool, and consequently very popular, at least in terms of acknowledgement and media-attention. It also puts the spotlight not only on the importance of ICT – and the digital divide – but also on the importance of indicators – and the statistical divide. The only criterion not to include a country in the ICT-OI is the lack of country data for several of the indicators used to calculate the ICT-OI. Consequently, the index will help to highlight the need to collect more basic ICT data for those countries that would like to be included.

While the advantages of a single index are undeniable, there are limitations of presenting a large amount of information narrowed into a composite, single index value. Estimated values and a limited number of indicators are further shortcomings. Thus, while indices provide a useful tool for comparisons, they should be used judiciously, in terms of drawing overly simplistic conclusions. It should also be noted that the main objective of the ICT-OI is to track the digital divide and to help particularly developing countries measure their progress (or shortcomings). To be able to include a large number of economies, the index is limited in terms of the indicators that it is composed of. For this reason, the exact position and ranking of high-income/highly developed economies, should not be overrated. Rather, their inclusion in the index is to benchmark the rest of the world and to help identify targets. More precise and qualitative indicators, that are currently not available for most developing countries, would be needed to produce analytically useful tools for high-income/highly developed economies.

7.1 BACKGROUND OF THE ICT OPPORTUNITY INDEX[1]

The ICT Opportunity Index is the result of the merger of two well-known projects, ITU's Digital Access Index (DAI)[2] and Orbicom's Digital Divide Index. Both, the ITU's Digital Access Index and Orbicom's Digital Divide Index were published in 2003. Merging the two indices was a direct response to the increasing need for international cooperation and the World Summit on the Information Society's call for multi-stakeholder partnerships to create digital opportunities. Although the two indices rely on different methodologies, they also share a number of important characteristics. These similarities not only allowed for the merger, but also – in the interest of cooperation and to avoid duplication – made the existence of two separate indices and projects difficult to justify: Both, the ITU and the Orbicom Index are global in nature or "digitally inclusive" by maximizing the number of countries covered. They measure access to and use of ICT for the large majority of the world's economies. Both indices are quantitative in nature and share a large number of

indicators. The main source of data is ITU's World Telecommunication/ICT Indicators Database.

The ICT Opportunity Index was first published in November 2005, in time for the second phase of the World Summit on the Information Society.[3] It covered a total of 139 economies and tracked developments from 1995 to 2003. As the earlier Digital Divide Index, it was based on the infostate conceptual framework that allows linkages of ICT to economic development through the country's productive capacity and use of ICT.

Today's ICT Opportunity Index, which is produced by ITU, is largely based on ITU data and Orbicom's conceptual framework to measure the digital divide.[4] Although the index no longer refers to the *infostate* (instead, this is referred to now simply as *ICT Opportunity*), the conceptual framework remains the same. (See the following section for more details on the index methodology).

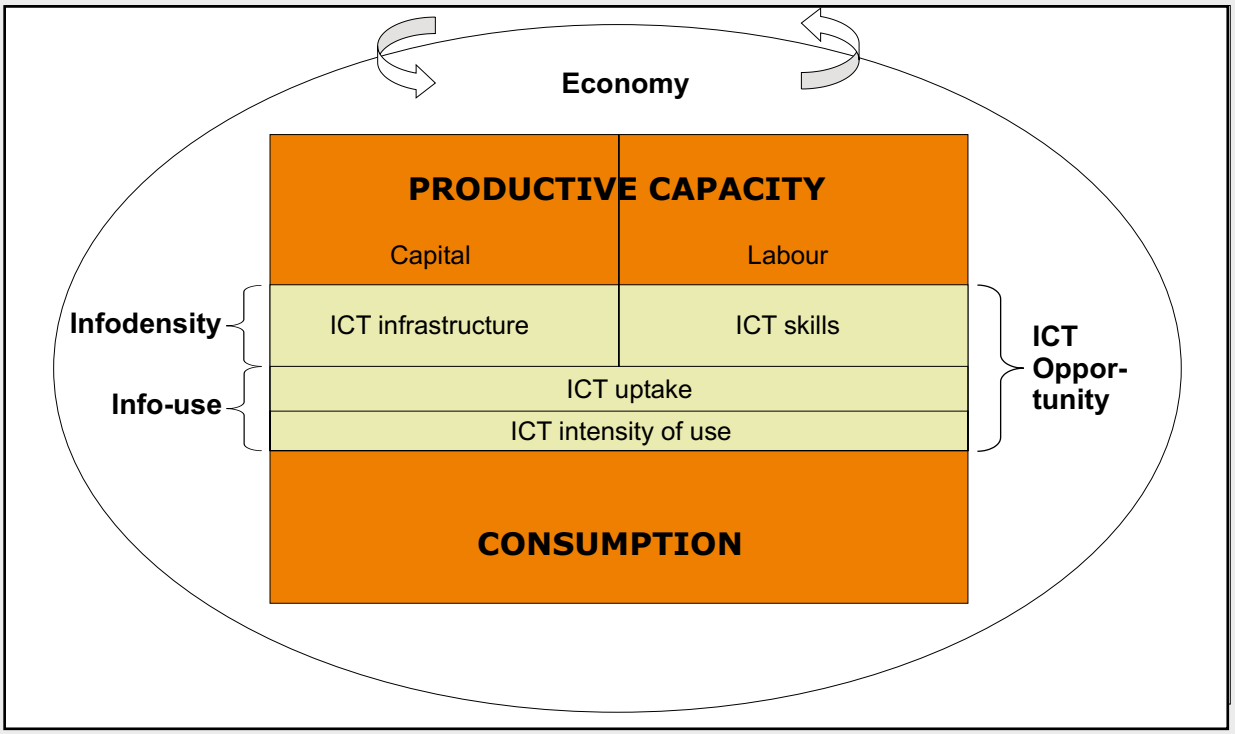
ITU has developed the ICT Opportunity Index so as to measure access to and usage of ICT by individuals and households in its inclusive sense. The fundamental principle has been to interpret the notion of ICT access and usage within the context of a global Information Society, thus recognizing ICT opportunities as an important part of social development.

7.2. ICT OPPORTUNITY INDEX

7.2.1 Conceptual framework of the ICT Opportunity Index

The conceptual framework of the ICT Opportunity Index has been adopted from Orbicom's Digital Divide Index presented in the "*From the Digital Divide to Digital Opportunities: Measuring Infostates for Development"* publication. The framework, which is closely linked to economic theory, is based on a dual nature of ICT: ICT are a productive asset, as well as a consumable. "*In that setting the conceptual framework developed the notions of a country's infodensity and info-use. Infodensity refers to the slice of a country's overall capital and labour stocks, which are ICT capital and ICT labour stocks and indicative of productive capacity. Info-use refers to the consumption flows of ICT. Technically, it is possible to aggregate the two and arrive at the degree of a country's ICT-ization, or infostate.*"[5]

Figure 7.1: The ICT-OI conceptual framework, which is set within the socio-economic, geopolitical and cultural environment of every economy



Source: ITU adapted from Orbicom.

This conceptual framework is particularly useful by including the underlying variables that specify the notion of ICT Opportunity. ICT Opportunities depend on the degree of **infodensity** and **info-use** (See Figure 7.1).

Infodensity symbolizes the productive capabilities and capacity of the economy in terms of **ICT labour** stocks and **ICT capital**. The quality and the quantity of these two inputs are fundamental factors for growth and for economic development. ICT capital is made up of Information and Communication Technology network infrastructure, as well as ICT networks machinery and equipment. ICT labour is the total stock of ICT skills of an economy's labour force. As for all other (non-ICT) forms of labour and capital, the total output will be an increasing function of these ICT stocks.

Info-use refers to an economy's ICT consumption (or use) within a given period. Since ICT goods are a necessary prerequisite for the use of ICT services, a distinction is made between **ICT uptake** and **ICT intensity** of use.

It should be noted that both, infodensity and info-use can keep growing and expanding since there is no upper limit for ICT capital or labour, and with new ICT being introduced over time. This also implies that there is no upper limit in terms of ICT Opportunities.

7.2.2 Applying the conceptual model: the indicators

To be able to carry out measurements, the most suitable indicators have to be identified to fill the conceptual framework and its building blocks. The choice of indicators is mainly driven by the availability and quality of data as well as an indicator's ability to reflect the purpose behind the conceptual framework. The inclusion of too many variables raises issues of definitions, overlapping coverage and the statistical notion of auto correlation where the variables themselves may be inter-dependent. There are a number of limitations so that the empirical application of the model will always be imperfect. The choice of indicators will depend not only on data availability and quality but also closely take into consideration knowledge of telecommunication sector dynamics.

The building blocks of the model are infodensity and info-use, and their components ICT capital (network infrastructure), ICT skills, ICT uptake and ICT intensity of use .

While the conceptual framework of the ICT Opportunity Index has not changed, the list of indicators has been modified. The new list of indicators chosen to construct the 2007 ICT-OI is reflected in Table 7.1.

It should be noted that the indicators chosen to measure ICT Opportunity include all four ICT-related indicators identified to track the Millennium Development Goals.[6] Additionally, six out of the eight ICT-related ICT Opportunity Index indicators are part of the core list of indicators identified by the *Partnership on Measuring ICT for Development.*[7] Eight out of the ten indicators are part of the ITU's World Telecommunication Indicators Database. ITU has many years of experience in the area of ICT statistics and a long history of close cooperation with national official data providers, including (particularly in earlier years) telecommunication operators, Ministries and regulatory authorities. Continuous work in this area, including in the area of benchmarking, confirms ITU's role as the main source of internationally comparable ICT statistics.

Infodensity

ICT capital is made up not only of telecommunication and Information and Communication Technology (ICT) network infrastructure, but also of ICT machinery and equipment (cables, routers etc). Only very limited internationally comparable data are available for ICT machinery and equipment so that the measurement of ICT capital will be limited to measuring network infrastructure, for which reliable data are widely available. The extent of **network** and infrastructure development was captured through penetration rates of fixed telephone lines, mobile cellular subscribers and international internet bandwidth. Both, fixed telephone lines and mobile subscribers, are widely recognized as key indicators to measure the basis of a country's telecommunication/ICT infrastructure. While penetration rates reflect the state of ICT access, increasingly availability of international internet bandwidth spurred by falling prices in fibre has enabled subscribers the opportunity to use communications more effectively in a globalized world. The bandwidth indicator also involves investment in infrastructure and facilities that enable rapid and efficient transmission of voice and data across the globe. Compared to the 2005 ICT Opportunity Index, a number of indicators were dropped from the networks list. These include "internet hosts per 100 inhabitants" and "digital telephone lines/main telephone lines". Information for the first indicator has shown to be less than reliable in terms of country-level data.[8] Regarding the percentage of digital telephone lines, ITU data show that by 2005,

the large majority of countries reported more than 90 percent of digitalized telephone lines, making this indicator somewhat obsolete. The indicator for "cable TV subscriptions" was dropped since cable TV is more popular in some regions than in others and limited to only some countries.

As ICT diffusion and uptake are clearly impacted by social and educational factors, enrolment rates in the primary, secondary, and tertiary sectors were taken as an inclusive reflection of wider productive and social opportunities to penetration. Together, educational enrolment and literacy figures represent the best available indicators to reflect the extent to which knowledge-based inputs enhance awareness to ICT goods and services which in turn, impact on access and usage. The information, sourced from UNESCO, provides enrolment in primary, secondary and tertiary segments of the educational system. Although ICT skills would be a good indicator to use in this model, measurement work in this area is still at a very nascent state and limited to a few countries. For this reason, skills are approximated with generic education indicators. It can also be assumed that ICT skills are closely linked to overall skills, although differences certainly exist between countries. Since higher educational levels are associated with more advanced skills and at the same time may be a better proxy for ICT skills, secondary education is weighed more than primary education and tertiary education is weighed more than secondary education. No modification have been made to the skills indicators since the 2005 ICT-OI.

Info-use

In order to capture ICT uptake (usage and consumption related parameters of ICT goods and services), three widely available and popular ITU indicators were used: internet users and computers per 100 inhabitants, and the proportion of households with a TV. While the latter indicator is not very significant for developed countries, where penetration rates have achieved close to one hundred percent in most cases, it remains an important indicator for developing countries. Ideally, other indicators on the use of ICT by households could have been included. However, since only a limited number of countries collect ICT household data, these limitations had to be taken into consideration.

With the recognition that the index has to be reflective in its developmental focus, the bias towards focusing variables on access to the internet was avoided by including indicators such as the percentage of households with a TV as these, too, form an important component of ICT goods. On the other hand, the ICT-OI includes the number of broadband subscribers (per 100 population) as one of the indicators, despite the fact that not all countries in the world have commercialized broadband services. The uptake of broadband is relevant since it is closely associated with intensity of use. The choice also reflects the importance that is attributed to the spread of broadband technologies, particularly since many applications (e-education, e-health, e-government) deemed useful in the area of ICT for development, have been linked to the uptake of broadband.[9]

While two indicators were included to measure ICT intensity (total broadband internet subscribers per 100 inhabitants, and international outgoing telephone traffic (minutes) per capita), these indicators are limited and can only provide a partial picture of the intensity of ICT use mainly due to data limitations.

7.2.3 Quality of data

A major criterion for the choice of the indicators that the ICT Opportunity Index is based on, is the availability and quality of data. The ICT Opportunity Index is based on a total of 10'980 data points: five years (2001-2005), 183 countries, and ten indicators. While the majority of data is made available directly by countries, there are some data quality and availability issues. Some data, for example the number of computers or the amount of international bandwidth, are not officially collected by all countries; in other cases, the latest (2005) data are not available. Finally, data for some economies are not available from the official country source. These difficulties have generally been overcome by using reliable secondary source data, by estimating the latest data based on past years' values, trends and growth rates, and by using national data when internationally comparable data are not available. Since the availability of data was one of the criteria in the choice of indicators, estimation of missing cells was kept to a minimum.

It should also be noted that all national country contacts were requested to verify and confirm, correct and/or provide their country-specific data used to compute the ICT Opportunity Index. Close to 50 percent of countries responded to this questionnaire.[10]

Some basic rules were applied to estimate missing data values within the different indicator categories (networks, skills, uptake, and intensity). Within the network category, only a fraction of data points for main telephone lines and mobile cellular subscribers were missing. Almost all countries track these indicators and provide data to ITU. Countries with

Table 7.1: ICT Opportunity Index: a total of 10 indicators

	Indicator used
Info Density	
Networks	a) Main telephone lines per 100 inhabitants b) Mobile cellular subscribers per 100 inhabitants c) International internet bandwidth (kbps per inhabitant)
Skills	a) Adult literacy rates b) Gross enrolment rates - primary - secondary - tertiary (*Source:* UNESCO)
Info use	
Uptake	a) Internet users per 100 inhabitants b) Proportion of households with a TV c) Computers per 100 inhabitants
Intensity	a) Total broadband internet subscribers per 100 inhabitants b) International outgoing telephone traffic (minutes) per capita

Source: ITU.

three or more missing data points (out of the five) in any of these two indicators (main telephone lines and mobile cellular subscribers) were not included in the 2007 ICT-OI. Bandwidth data were available for almost all countries for at least some years. If only 2005 data were missing, the 2004 values were used. Bandwidth data lacked completely only for a minority of countries. In this case, internet user data were compared to other countries and estimates made based on countries with the same level of internet use penetration rates.

Within the skills category, which is based on UNESCO's figures, missing data were estimated using growth rates of the latest two available years. In-between year data were estimated based on a simple average of the first and latest available year data.

The uptake category of the ICT Opportunity Index is composed of three indicators: internet users per 100 inhabitants, computers per 100 inhabitants, and proportion of households with a TV. The first two indicators are part of the group of indicators that are being tracked to measure the progress made towards the Millennium Development Goals (MDGs). Since there are data gaps for these indicators at the country level, ITU estimates a substantive number of these data, particularly the number of computers. ITU estimates the number of computers using industry sales data, shipment data and based on the number of internet users. Data for the number of internet users are provided by approximately 60 percent of countries. For most developed and larger developing nations, internet user data are based on methodologically sound user surveys conducted by national statistical agencies or industry associations. These data are either directly provided to the ITU by the country concerned or the ITU does the necessary research to obtain the data. For countries where internet user surveys are not available, the ITU calculates estimates based on average multipliers for the number of users per subscriber. These multipliers depend on the development status of a country, since a developing country, where more people use public internet access than home internet access, will have more internet users for each internet subscribers than a highly developed country.

While data on the percentage of households with a TV are provided by only a limited number of country contacts, an effort was made to find alternative national and regional sources so as to find data for at least one year (for 2001 to 2005) per country. It should be noted that, as opposed to some other indicators, such as the number of mobile cellular or broadband subscribers,

the change in the percentage of households with a TV is much more gradual. In other words, data from countries that track this indicator on a yearly basis show that penetration rates vary only slightly over years, and that the trend is towards a growing number of households with televisions. This also implies that "older" (for example year 2000) data are still relatively useful to make 2001-2005 estimates. When no data were available at all, estimates were made based on comparable economies, taking into consideration a number of factors: the reference economy would have a similar population base, a similar income level (GDP per capita), as well as similar internet user, mobile cellular subscriber, and fixed line penetration levels.

Two indicators, the number of broadband internet subscribers per 100 inhabitants, and international outgoing telephone traffic per capita, were used for the intensity category. Since broadband is a relatively new technology and has received a large amount of attention (largely because of its ability to deliver quality internet access and deliver innovative applications), ITU has made substantial efforts to collect this data. Even if countries do not provide the broadband data through the ITU questionnaire, there are relatively reliable ways to find out whether or not a country has commercialized broadband services. For example, ITU checks the main telecommunication operators' web sites to see if broadband services are advertised. If this is not the case, (and unless the ITU country contact has provided the data), it may be assumed that broadband services are not commercially available. Online research is carried out to confirm this assumption. By the end of 2005, ITU estimates that still about one quarter of all economies do not have commercial broadband services. If broadband services are available, but some years are missing, these are estimated, based on previous years' growth rates, as well as simple averages, for estimations of in-between year data.

Some data are available for most countries in terms of international outgoing telephone traffic. Forecast methods were used to estimate missing values based on average growth rates. For economies with no data at all, estimates were made based on comparable economies, taking into consideration the population size, income level, as well as the total number of telephone subscribers (fixed and mobile).

7.2.4 Reference year and reference country

To effectively monitor the digital divide, a reference year and a reference country must be identified. As the reference country, the average of all countries is used in each component of the ICT Opportunity Index. The reference year for the 2007 ICT Opportunity Index is the year 2001, for which the largest number of data cells are filled/available. This allows for optimal measurements. The reference year provides an important benchmark to quantify and monitor trends in ICT Opportunity across countries and over time in a systematic manner. It is also important to monitor the digital divide.

The reference country (average) has a value of 100 for the reference year throughout the exercise – for each indicator, component and the overall ICT Opportunity level. The sub-indices for all other countries assume their corresponding values. However, the reference country's score is not static but moving over time. Consistent with the framework's terms of reference, two-fold comparisons can be made: cross-country comparisons at any given point in time, and within each country over time. In a way, for specific indicators, aggregate components of interest and sub-indices or for the overall ICT Opportunity level, the values of different economies will effectively reflect each other's timeline. For instance, if country A had 20 percent internet penetration in 2004 while country B achieved that level already in 2002, it could be said that country A is two years behind.

7.2.5 Methodological details

The discussion on the conceptual framework pointed to the need to identify the notions of infodensity and info-use and their subcategories to arrive at economies' overall ICT Opportunity level. The move from the theoretical framework to the actual empirical application, primarily through the choice of indicators, will be characterized by adjustment and an approximation of the framework.

The first step towards the construction of the ICT Opportunity Index is the complete collection (or filling of data cells) for the ten indicators, five years, and 183 economies to be part of the index. As mentioned before, the only criterion to exclude an economy was the lack of data and difficulty to estimate missing values. To make values comparable, per capita and per household adjustments were made for all ten indicators.[11]

Outliers, smoothing techniques and scalars

In some cases, for example for international internet bandwidth per capita, series are characterized by an extreme range or outliers. While in theory the conceptual framework does not foresee an upper limit (ICT Opportunities can grow indefinitely), smooth-

ing adjustments for outliers were made necessary for comparability and to limit the impact of one single indicator on the overall ICT Opportunity value. Smoothing adjustments were applied to international internet bandwidth, computers, broadband subscribers and international outgoing telephone traffic. They were based on the mean, the standard deviation (variance) and their ratio (the co-efficient of variation), and applied in a systematic way on the basis of the following rule:

For CV<1.5, max = x + 4std
For 1.5<CV<3, max = x + 3std
For CV>3, max = x + 2std

where:

CV: The series' Coefficient of Variation (difference)
x: The series' mean/average
std: Standard deviation

This procedure resulted in only a few, but useful, maximum values and not in all series. It does not pose an upward boundary to measurements over time. Smoothing techniques to minimize the effect of outliers were applied through application of scalars based on the level of coefficient of variation in the indicator series.

The indicators international bandwidth per capita, broadband subscribers and international outgoing telephone traffic were subject to monotonic transformations by adding the scalars to the numerator and denominator. Scalars were arrived at through a simple and systematically applied rule based on statistical analysis of each individual series, specifically:

For CV<1.5, scalar = 4x
For 1.5<CV<3, scalar = 3x
For CV>3, scalar = 2x

Finally, an adjustment was made to the 'gross enrolment' indicator (part of the skills indicators), which was combined to form a composite indicator. To give adequate recognition to higher education levels, the 'gross enrolment indicator' is adjusted as follows:

$$I^{gross\ enrolment} = (\text{primary} + 2 \times \text{secondary} + 3 \times \text{tertiary})/6$$

Sub-indices

Once a complete and comparable set of indicators has been developed from the raw data, every single indicator is computed into an (sub-) index, regardless of its original unit of measurement. Within each index, an average value and a reference year (2001) are specified. This is important since the ICT Opportunity Index will help compare countries to one another, as well as over time. Thus, for the reference country (average) the formula will be:

$$I_t^{i,c} = (V_t^{i,c} / V_{to}^{i,c}) \times 100$$

where I stands for the value of the index, i refers to individual indicators, V to raw values of indicators, t_o refers to the reference year and t to any other year.

Using the notation j for all other countries we have:

$$I_t^{i,j} = (V_t^{i,j} / V_{to}^{i,c}) \times 100$$

This normalization allows immediate comparisons between other countries and the reference country (the average), and for any country over time.

Once every indicator has been expressed in index form, we proceed to aggregate across each component. After indicators have been treated as explained, the result is an unweighted average. The choice of a geometric rather than an arithmetic mean represents a value judgment that favors symmetrical rather than uneven development across indicators of interest.

Indices are obtained as:

$$\hat{I}_t^{i,j(c)} = \sqrt[n]{\prod_{i=1}^{n} I_{n,t}^{i,j(c)}}$$

with denoting product and n the number of each component's individual index. For networks n=3 (fixed, mobile and bandwidth), for skills n=2 (literacy and gross enrolment), for uptake n=3 (TV, computers and internet users) and for intensity n=2 (broadband subscribers and international outgoing traffic). We continue likewise for the subsequent level of aggregation. Networks and skills are combined into the Infodensity index as:

$$\text{Infodensity} = \sqrt[k]{\prod_{i=1}^{k} I_{n,t}^{i,j(c)}}$$

with k=2. Uptake and intensity are combined into the Info-use index as:

$$\text{Info-use} = \sqrt[z]{\prod_{i=1}^{z} I_{n,t}^{i,j(c)}}$$

where z=2.

Finally, when we have both infodensity and info-use, we arrive at the highest level of aggregation, a country's ICT Opportunity value, simply as:

$$\text{ICT Opportunity Index} = \sqrt[2]{(\text{infodensity x info-use})}$$

The results of the 2007 ICT-OI are presented in Table 7.2.

7.3 RESULTS OF THE 2007 ICT OPPORTUNITY INDEX

The results of the ICT Opportunity Index allow for a number of interesting analytical exercises. The framework of the analysis allows for the identification of progress towards ICT opportunities and the digital divide which here is understood as the relative difference in ICT Opportunity levels among economies (or regions/groups). In addition, analysis can be carried out for each economy, or on the basis of ICT-OI groups that are made up of countries with similar ICT-OI results.

7.3.1 2007 ICT-OI groupings

For analytical purposes, the 183 economies covered by the empirical application are divided into four categories. The division into these categories is based on the results of the latest available data (2005). The basis of the division is the reference country (overall average value) of the index, which lies at ICT-OI value 148 (2007 ICT-OI values range from as low as 12, to as high as 378). The 57 economies which lie above the average were divided into two categories: *high* and *upper*, with 29 economies in the *high* and 28 economies in the *upper* category.[12] The same was done for all economies that lie below the average: the 126 economies below average were divided into two categories, by an equal number of countries: *medium* and *low*. This division into four categories also allows for another perspective for the analysis of the digital divide over time.

High (ICT-OI levels of 249 and above): The 29 economies in this category have achieved a high level of access to and use of Information and Communication Technologies.

They include 17 European countries, six Asian economies – Hong Kong (China), Singapore, Taiwan (China), Macao (China), the Republic of Korea and Japan – as well as Canada, the United States, Australia, Israel, Barbados and New Zealand. It should be noted that this category includes many smaller developed economies (and some city states) in terms of population and/or land area, such as Luxembourg, Switzerland, Denmark, the Netherlands, Singapore, Iceland, and Hong Kong (China), Taiwan (China) and Macau (China), suggesting that it is easier to connect smaller economies. All economies in this category share a high income level.

Upper (ICT-OI levels from 150 to 248): The 28 economies in this category have achieved an elevated level of access to, and use of, for a majority of their inhabitants. What often sets this group apart from the *high* category is imbalance in a specific category. For example some countries in this group may have a high level of infrastructure availability but a lower score in uptake. Analysing the separate category values can be useful for policy-makers seeking to find out where their countries are weak in access to the Information Society. The category includes the Baltic States (apart from Estonia, which is ranked in the *high* category), a number of Central Eastern European countries (Czech Republic, Hungary, Croatia, Slovak Republic, Poland), as well as a number of Arab States (UAE, Bahrain, Qatar and Kuwait). It also includes eight Small Island Developing States, namely Antigua & Barbuda, Aruba, Bahamas, Jamaica, Virgin Islands, Grenada, French Polynesia and Mauritius. The only South American country in the *upper* category is Chile.

Medium (ICT-OI levels from 68 to 149): The 63 economies in this category are generally characterized by competitive markets and major advances in the mobile sector. It includes a number of large countries in terms of populations, including Russia, Brazil, China, and Mexico. It also includes the majority of Latin American and Caribbean countries, such as Uruguay, Argentina, Costa Rica, Trinidad & Tobago, Venezuela, Colombia, Peru, Dominican Republic, and others. While almost all of the economies in this category have commercialized broadband services, penetration rates remain very low (below one percent) for almost all of them. A few countries in the top half of this category, including China, Turkey, Lebanon, Brazil and Argentina, have achieved broadband penetration levels between two-four percent.

Low (ICT-OI levels from 12 to 68): The 63 economies in this category include the majority of Least Developed Countries and African countries. Differences in the ICT levels vary in this category but those in the bottom half have minimal levels of access to the

Table 7.2: ICT Opportunity Index 2001-2005 values and 2005 Ranking

ECONOMY	2001	2002	2003	2004	2005	2005 Rank
Sweden	263.16	299.38	323.92	350.12	377.69	1
Luxembourg	209.43	233.83	259.08	300.19	371.10	2
Hong Kong, China	232.69	272.36	310.53	344.08	365.54	3
Netherlands	237.07	266.23	301.65	328.46	362.82	4
Denmark	253.95	287.83	317.34	332.95	360.79	5
Switzerland	246.82	288.57	326.07	343.08	353.60	6
Singapore	231.45	268.95	309.38	338.14	346.68	7
United Kingdom	208.74	247.23	282.64	315.39	346.37	8
Iceland	226.11	245.90	287.69	316.29	340.57	9
Norway	223.07	250.78	282.77	308.69	338.53	10
Canada	252.19	265.54	297.63	325.75	337.16	11
Belgium	228.68	253.02	287.00	304.16	324.21	12
United States	224.63	250.80	276.47	305.67	323.85	13
Australia	183.80	207.32	227.53	259.88	322.73	14
Austria	230.02	254.45	271.32	290.39	305.60	15
Germany	211.61	230.73	254.10	282.36	303.42	16
Taiwan, China	190.87	228.63	263.14	279.35	302.71	17
Israel	158.92	184.26	208.53	270.71	296.71	18
Finland	204.36	251.27	265.30	286.51	293.51	19
Ireland	180.71	204.70	222.84	260.03	286.32	20
Macao, China	171.23	195.72	227.06	250.39	280.45	21
Korea (Rep.)	202.13	231.28	252.10	265.31	280.08	22
France	190.44	212.67	238.77	260.13	278.34	23
Estonia	151.51	178.78	221.34	254.97	269.81	24
Barbados	126.77	138.26	221.50	249.92	264.85	25
New Zealand	180.16	193.35	210.32	238.05	257.73	26
Japan	180.01	204.74	225.43	246.99	256.90	27
Italy	163.60	188.12	218.37	239.40	255.68	28
Spain	161.65	183.61	207.00	232.89	249.28	29
HIGH AVERAGE	**204.34**	**231.67**	**261.96**	**288.97**	**312.17**	
Slovenia	154.69	191.69	204.03	229.73	246.13	30
Antigua & Barbuda	127.06	132.07	158.22	190.37	244.92	31
Aruba	141.13	143.62	170.75	210.66	238.36	32
Cyprus	155.43	175.02	197.33	202.14	221.95	33
Latvia	109.98	125.34	140.48	172.67	218.77	34
Malta	160.31	170.78	180.87	203.51	212.27	35
Portugal	147.39	164.88	185.32	198.50	209.57	36
Czech Republic	135.19	154.77	162.98	184.38	202.72	37
Lithuania	103.29	123.50	143.21	166.52	201.63	38
Qatar	109.77	123.79	147.97	166.43	196.92	39
Hungary	120.89	137.65	166.85	180.00	192.41	40
United Arab Emirates	133.57	143.00	153.77	167.77	190.99	41
Slovak Republic	123.14	132.01	146.02	165.91	188.92	42
Bahamas	140.45	152.01	163.62	175.05	184.13	43
Bahrain	130.72	144.90	162.07	174.14	182.40	44
Croatia	118.20	132.56	140.76	151.50	176.41	45
Poland	105.16	123.84	132.58	157.87	166.36	46
Jamaica	82.82	112.05	117.89	128.61	165.16	47
Greece	122.29	131.92	136.19	149.62	162.34	48

ECONOMY	2001	2002	2003	2004	2005	2005 Rank
Virgin Islands (US)	115.35	121.44	126.84	147.24	160.13	49
Chile	115.78	128.58	141.73	154.14	157.65	50
Grenada	102.89	124.66	149.25	152.15	156.79	51
Brunei Darussalam	114.70	120.03	131.62	147.89	156.09	52
French Polynesia	100.06	101.68	113.91	134.68	154.21	53
Kuwait	106.27	113.49	128.42	144.00	153.88	54
Romania	80.74	97.89	116.91	131.03	150.45	55
Mauritius	95.74	102.94	110.03	118.88	150.27	56
Malaysia	107.61	115.39	125.05	136.87	150.19	57
UPPER AVERAGE	**120.02**	**133.63**	**148.38**	**165.79**	**185.43**	
Ref. country (average)	**100.00**	**110.52**	**122.51**	**134.62**	**147.56**	
New Caledonia	91.18	100.20	110.86	131.92	146.61	58
Uruguay	104.10	105.06	108.21	123.52	143.31	59
Argentina	101.84	103.57	111.17	126.98	140.40	60
Seychelles	115.43	125.29	128.09	136.98	139.67	61
Lebanon	93.01	108.90	119.04	124.60	139.15	62
Russia	80.14	90.47	105.34	121.85	137.27	63
Brazil	87.22	97.14	104.41	122.56	136.44	64
St. Vincent	88.08	98.43	114.11	116.73	132.19	65
Costa Rica	93.30	105.83	117.23	123.92	130.58	66
Turkey	86.35	89.76	97.97	112.77	128.53	67
Trinidad & Tobago	93.72	95.68	101.36	114.46	127.22	68
Belize	88.75	94.13	102.64	115.70	127.06	69
Mexico	88.04	96.67	103.38	113.21	124.68	70
Bulgaria	94.89	100.00	106.71	114.38	123.46	71
Puerto Rico	87.04	97.44	105.15	113.81	122.83	72
TFYR Macedonia	79.05	87.21	95.80	100.72	120.36	73
Belarus	68.30	82.85	96.49	108.48	120.09	74
Saudi Arabia	80.03	91.88	100.38	109.84	116.20	75
Venezuela	83.44	87.31	93.87	101.91	114.03	76
Bosnia	71.92	81.91	89.87	97.39	113.44	77
Serbia and Montenegro	81.46	95.52	101.81	112.36	111.23	78
China	65.43	77.54	89.03	100.47	109.41	79
Colombia	70.47	76.97	83.12	89.75	105.32	80
Peru	71.58	75.71	82.36	92.69	104.50	81
Ukraine	64.82	70.41	82.43	94.14	102.26	82
Moldova	59.59	68.12	75.71	84.70	102.19	83
Jordan	78.67	84.25	89.23	95.87	102.17	84
Guyana	79.20	82.03	88.32	91.55	100.69	85
Oman	71.23	76.79	82.95	89.06	100.44	86
Thailand	75.17	81.24	90.37	95.21	99.20	87
Maldives	66.71	76.55	85.72	90.46	99.06	88
Suriname	79.13	83.63	89.65	94.37	97.30	89
South Africa	79.58	82.20	85.16	88.26	96.78	90
Panama	79.70	84.15	87.16	94.65	96.69	91
Ecuador	63.86	73.75	80.29	91.34	96.42	92
El Salvador	64.37	69.31	79.86	88.98	95.27	93
Tunisia	63.38	69.05	79.78	87.82	95.12	94
Dominican Rep.	71.91	74.19	79.47	84.67	94.50	95

Table 7.2: ICT Opportunity Index 2001-2005 values and 2005 Ranking (cont'd)

ECONOMY	2001	2002	2003	2004	2005	2005 Rank
Fiji	66.48	75.14	77.76	80.34	92.97	96
Georgia	62.43	70.16	76.55	81.68	90.28	97
Iran (I.R.)	62.25	71.24	79.62	83.58	89.74	98
Palestine	65.85	69.48	74.36	81.83	89.33	99
Mongolia	56.09	60.46	75.42	81.93	87.68	100
Armenia	51.57	60.00	70.35	80.33	87.30	101
Kazakhstan	55.86	63.50	68.56	77.75	85.32	102
Azerbaijan	49.90	64.03	68.95	76.93	83.90	103
Tonga	42.96	55.85	64.72	72.73	80.54	104
Morocco	50.34	53.44	58.91	69.43	79.50	105
Albania	50.32	55.81	63.17	70.28	79.25	106
Egypt	51.89	60.03	67.19	71.91	78.82	107
Philippines	62.11	67.92	72.74	77.48	78.81	108
Cape Verde	60.06	64.64	68.63	73.07	77.70	109
Paraguay	60.44	66.68	69.37	74.78	77.59	110
Viet Nam	43.51	48.14	54.02	65.55	76.66	111
Syria	41.91	53.25	65.00	72.19	76.53	112
Algeria	36.35	45.37	52.87	63.78	75.55	113
Namibia	58.69	61.84	67.10	69.21	73.74	114
Micronesia	26.44	40.80	62.36	70.73	73.67	115
Bolivia	58.87	63.71	66.30	70.23	73.24	116
Guatemala	50.30	56.82	60.64	68.28	72.34	117
Samoa	47.70	49.26	57.00	63.36	68.48	118
Gabon	49.45	54.07	57.68	63.57	68.43	119
Kyrgyzstan	47.83	50.64	57.17	63.48	67.72	120
MEDIUM AVERAGE	**69.39**	**76.56**	**84.14**	**92.42**	**101.22**	
Indonesia	46.72	50.11	55.90	61.42	67.68	121
Libya	45.54	56.17	60.69	65.13	66.71	122
Botswana	59.59	60.62	61.42	62.74	66.16	123
Nicaragua	47.26	50.85	55.11	59.69	64.18	124
Honduras	46.68	51.20	53.47	58.20	63.35	125
S. Tomé & Principe	22.96	46.23	53.36	58.79	61.01	126
Zimbabwe	38.47	49.77	53.24	55.10	60.02	127
Sri Lanka	41.03	46.30	51.74	57.88	58.82	128
Uzbekistan	38.27	42.69	47.86	54.23	58.54	129
Swaziland	42.82	46.60	50.71	54.18	56.31	130
Bhutan	19.45	21.43	47.25	52.08	55.88	131
Cuba	37.67	42.22	43.77	50.07	55.30	132
India	31.52	36.77	40.41	46.43	53.55	133
Turkmenistan	33.85	35.66	37.39	46.11	53.29	134
Sudan	24.94	30.04	39.05	42.49	49.83	135
Senegal	34.12	36.38	40.61	46.07	47.11	136
Yemen	23.51	33.69	37.29	41.73	46.47	137
Togo	39.40	44.00	46.33	47.39	45.81	138
Pakistan	25.34	29.13	36.49	41.29	45.50	139
Tajikistan	23.54	29.39	36.03	42.39	45.20	140
Nigeria	21.49	27.23	31.01	36.67	44.23	141
Gambia	34.38	37.61	40.45	41.87	43.99	142
Vanuatu	31.22	40.05	41.68	42.45	43.50	143
Mauritania	27.85	31.35	33.82	37.19	43.38	144
Kenya	29.81	33.98	39.60	41.18	42.26	145
Djibouti	26.49	32.27	35.86	39.63	41.13	146
Haiti	25.47	30.45	35.54	39.95	40.92	147
Ghana	25.02	30.00	33.85	38.69	40.23	148
Cameroon	26.81	29.57	32.63	36.64	39.62	149
Equatorial Guinea	27.53	32.15	34.41	37.51	39.30	150
Lao P.D.R.	23.57	26.35	29.03	31.29	39.29	151
Côte d'Ivoire	31.56	34.37	36.21	38.10	39.15	152
Zambia	25.57	27.97	31.94	36.05	38.52	153
Benin	22.63	26.01	28.35	30.29	35.20	154
Papua New Guinea	27.51	29.41	30.73	33.02	34.38	155
Solomon Islands	26.78	26.91	26.62	30.41	34.05	156
Bangladesh	18.48	20.80	23.67	26.95	31.56	157
Somalia	16.46	19.06	25.50	30.33	31.51	158
Lesotho	24.86	30.24	30.56	29.68	31.45	159
Tanzania	20.01	22.85	27.48	27.37	31.24	160
Congo	21.37	24.88	25.37	28.90	30.54	161
Uganda	18.91	20.48	22.49	24.51	29.66	162
Angola	16.27	18.87	22.12	27.59	28.82	163
Cambodia	20.25	24.20	25.29	27.29	28.75	164
Comoros	10.49	10.84	21.76	25.93	28.55	165
Nepal	18.97	20.17	23.41	25.01	27.91	166
Eritrea	8.22	8.87	10.02	24.36	27.36	167
Guinea-Bissau	9.67	11.01	20.46	26.79	27.34	168
Madagascar	19.48	21.35	23.32	24.58	26.03	169
Mozambique	17.76	19.89	22.16	24.55	25.70	170
Mali	15.88	17.08	20.44	22.22	22.92	171
Malawi	16.78	18.75	20.81	21.88	22.79	172
Guinea	18.32	21.14	21.89	22.25	21.46	173
Burundi	13.16	14.04	16.66	19.74	21.26	174
Rwanda	16.19	17.11	18.03	18.56	20.27	175
Burkina Faso	14.52	15.56	18.19	18.79	19.69	176
Myanmar	9.03	10.45	15.26	16.06	19.11	177
Ethiopia	10.10	11.96	14.01	16.27	17.68	178
Central African Rep.	12.49	13.02	14.85	16.28	16.97	179
Afghanistan	3.19	8.04	11.30	13.11	14.91	180
Niger	7.90	10.31	11.20	13.56	14.75	181
Chad	11.30	13.43	14.93	14.46	13.82	182
D.R. Congo	7.14	9.72	11.01	11.95	12.33	183
LOW AVERAGE	**24.66**	**28.40**	**32.10**	**35.45**	**38.16**	

Information Society. The majority of countries in this category have not yet launched broadband services and fixed line penetration remains very low.

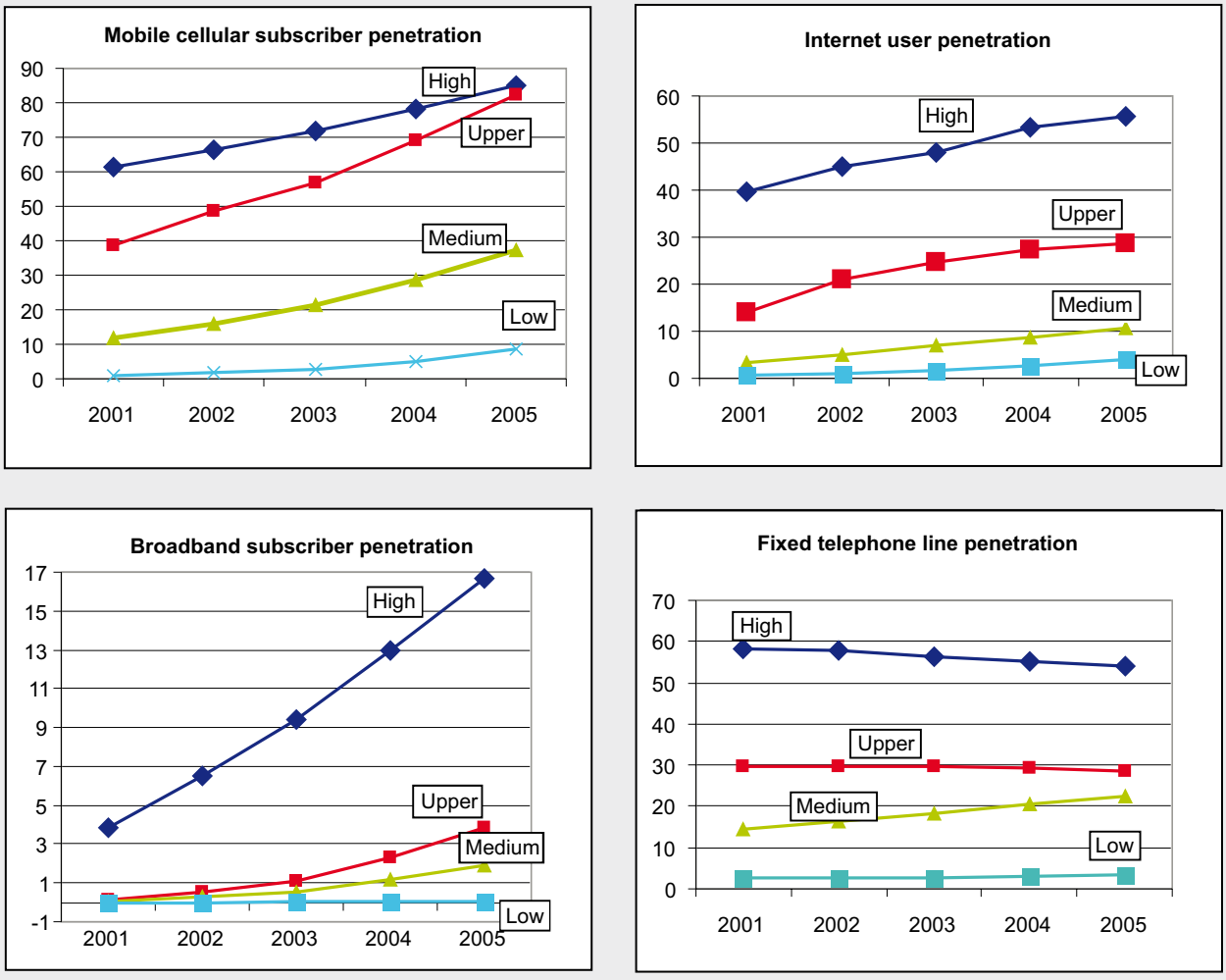
7.3.2 ICT Opportunity progress and discrepancies

The absolute values of the index results, which are further discussed in the section 7.3.3 on "ICT Opportunity Index growth rates: evolution over time", clearly show that almost all economies in the world have made substantial progress since 2001. Figure 7.2 provides a breakdown of penetration rates for four separate ICT-OI indicators, from 2001-2005, for each of the ICT-OI categories (*high*, *upper*, *medium* and *low*). This breakdown highlights that while there is growth in almost all areas and across all categories, penetration rates particularly in terms of internet users and broadband subscribers remain very low for countries with *low* and *medium* ICT-OI levels. The highest penetration levels and highest growth rates across categories have been achieved in the area of mobile cellular subscribers. However, penetration levels range from ten percent (for countries with *low* ICT-OI levels) to over 85 percent in the *high* category.

Similarly, internet user penetration rates remain relatively low (at an average of four percent in 2005) for countries with *low* ICT-OI levels, compared to close to 30 and over 55 percent for the *upper* and *high* categories. Despite the differences, penetration rates are increasing across all categories.

The difference between the categories is most striking in terms of broadband subscribers, where the high

Figure 7.2: 2001-2005 penetration rates for mobile cellular subscribers, fixed telephone lines, internet users and broadband subscribers, by ICT-OI category



Source: ITU.

category is far ahead, at an average of almost 17 percent. Countries from the other ICT-OI categories are lagging behind, with penetration levels of 4, 2, and 0.1 percent.

The only area that is not showing growth across all categories is fixed telephony. Fixed telephone line penetration has slightly decreased for countries in the *high* (from 58 percent in 2001, to 54 percent in 2005) and *upper* (from 30 to 29 percent between 2001-2005) ICT-OI categories, but is increasing in countries with *low* and *medium* ICT-OI levels.

The major differences between categories is confirmed by country level ICT-OI data. While some economies have been able to catch up in terms of their position vis-à-vis the developed countries, others have made less progress. The specific country values help to visualize the degree of the digital divide and provide the basis for more detailed analysis (Table 7.2: ICT Opportunity Index 2001-2005 values and 2005 Ranking). It should be noted that the exact position/ranking of economies is not considered analytically very useful. The prime objective of the ICT Opportunity Index is to identify the digital divide and to help understand how it has evolved since the beginning of this century. To adequately measure differences among economies with highly developed ICT levels, more precise and qualitative indicators would be needed.

The 2007 ICT-OI results were also used to highlight the status and progress of certain country groupings, particularly those that were identified and mentioned during the World Summit on the Information Society (WSIS, see section 3.5 "WSIS groupings").

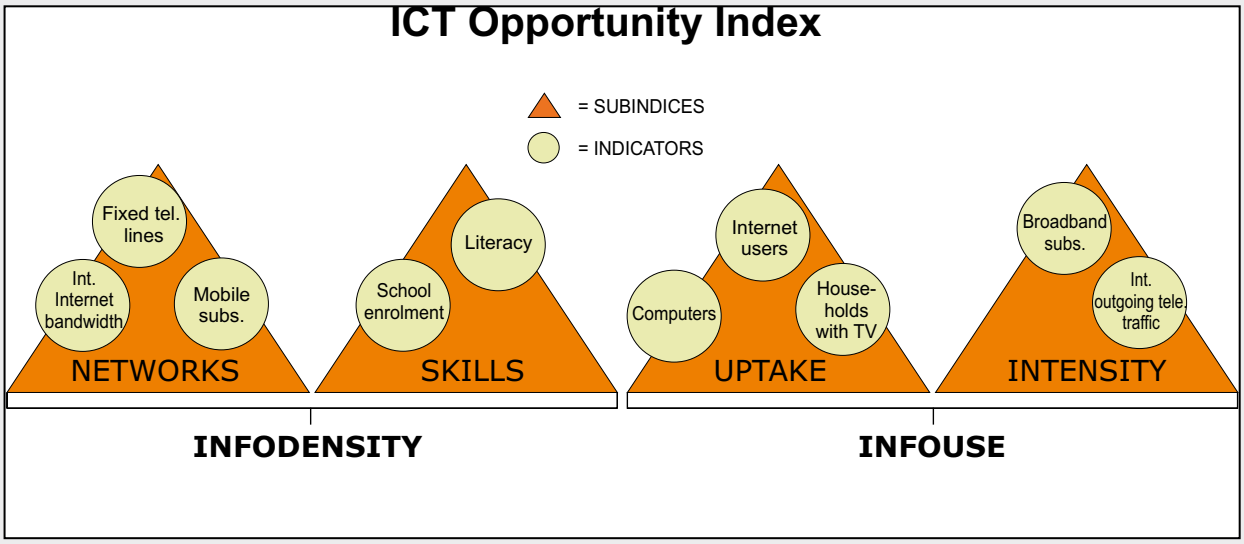
The 2007 ICT-OI is derived from ten indicators, grouped into four sub-indices: the networks index, the skills index, uptake index and the intensity index. These sub indices and the indicators that they are composed of are illustrated in Figure 7.3. Annex 1 provides an overview of the values for each economy and within each index and is useful for the identification of relative strengths and weaknesses.

Apart from cross-country comparisons, the ICT Opportunity Index's methodology is able to highlight relative movements of different ICT-OI groups over the five year period 2001-2005. It shows how fast the four ICT-OI groups are making progress compared to each other. These normalized values are particularly useful to analyze the evolution of the digital divide (see section 7.3.4 on "Tracking the digital divide").

7.3.3 ICT Opportunity Index growth rates: evolution over time

One of the more important uses of the ICT Opportunity Index is to measure progress over time (2001-2005). Seven out the ten countries with the highest growth rates (between 2001 and 2005) are Least Developed Countries (LDCs) (Figure 7.4, left chart). While this is a positive development, growth rates need to be seen in perspective since high growth rates are not

Figure 7.3: ICT-OI: sub-indices and indicators



Source: ITU.

sufficient to overcome the digital divide, particularly in countries that start at very low ICT levels. It is also true that not all developing countries have high growth rates and the list of the ten countries with the lowest growth rates between 2001 and 2005 includes three LDCs (Figure 7.4, right chart).

In addition to grouping countries according to their 2005 ICT-OI level into *low*, *medium*, *upper* and *high*, countries have been categorized into different growth rate bands. These show which countries have had *low*, *medium*, *upper* or *high* growth rates during the period 2001-2005, a useful tool for countries to track their progress. (Annex 2 to this chapter: ICT-OI average annual growth rates, 2001-2005 and growth rate bands).

Table 7.3 on "The Digital Divide over time" provides a very useful overview of the evolution of digital opportunities in terms of the different ICT-OI categories (*high*, *upper*, *medium*, *low*). The first table (A) shows the average values for each category and for each year, along with their respective absolute changes and growth rates for the 2001-2005 period. This simple exercise allows for some key findings.

All categories are making progress, every year. The 2001-2005 data show that growth rates in this period were (on average) highest amongst the *upper* ICT-OI countries (54.5%). Countries in the *low* ICT-OI group had a growth rate of 54.8 percent. The lowest growth rate (45.9 %) occurred in the *medium* category.

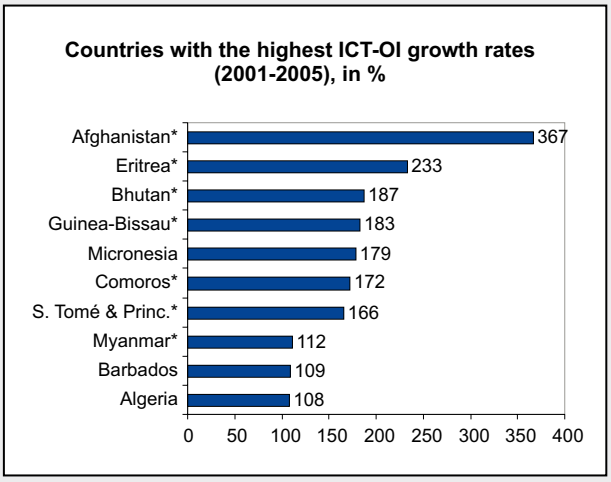
7.3.4 Tracking the digital divide

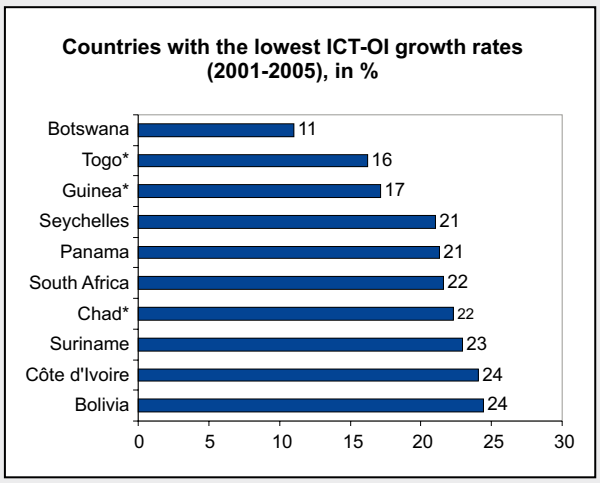
Besides analysing the trend of digital opportunities over time in terms of absolute values (see section A of Table 7.3), it is useful to highlight the relative movement of the digital divide. The normalized values (see section B of Table 7.3) allow for meaningful interpretations of the digital divide between any two groups within the index. Through 'normalization', the difference between the groups is analyzed from the 2005 perspective. It shows differences between groups in terms of their position as of 2005. The direction of this measure over time points to the evolution of the digital divide: a downward movement indicates a closing divide between the two groups, and an upward movement indicates a widening divide (Section C). This analysis shows that the divides between the *high* and any other group has increased over the five-year period 2001-2005.

Between 2001-2005 the divide also grew between the *upper* group and the lower and the *medium* group. A drop during this five year period took place only between the *medium* and the *low* group (from 66.0 in 2001, to 63.1 in 2005).

These findings suggest that between 2001-2005, the digital divide actually increased between those economies that already have very high ICT levels and the rest of the world. It decreased between the *medium* group and the *low* group, indicating that countries with low levels of ICT have somewhat been able to catch up and reduce the divide compared to countries in the *medium* level.

Figure 7.4: 2007 ICT-OI growth rates 2001-2005: top and bottom ten





Note: Countries marked with * are LDCs.
Source: ITU.

However, a look at developments only over the last year (2004/2005) shows a slightly different picture. The divide between the *high* group and every other group was actually decreased during this year, by between four-eight value points, depending on the group (See section D of Table 7.3). This might be due partially to saturation in the mobile sector in many of the developed countries, which allows developing countries with high mobile growth rates, to further catch up.

The same year (2004/2005) showed an increase in the divide between the *upper* and *medium* group and the *upper* and the *low* group. This might be partially due to the fact that economies in the *medium* and *upper* group started to launch broadband services and increase penetration. This was not the case in most economies in the *low* category, where broadband services are almost non-existent.

While the categorization of countries in the ICT-OI provides a very useful insight into the evolution and complexity of the digital divide, more country-specific analysis are needed to understand why some countries are doing better than others. For this, the 2007 ICT-OI and its sub-indices, provide a useful framework.

Table 7.3: The Digital Divide over time

Evolution of the Digital Divide, by group							
Group	***(A) ICT-OI***						
	2001	**2002**	**2003**	**2004**	**2005**	**Change**	**Growth**
High	204.3	231.7	262.0	289.0	312.2	107.8	52.8
Upper	120.0	133.6	148.4	165.8	185.4	65.4	54.5
Medium	69.4	76.6	84.1	92.4	101.2	31.8	45.9
Low	24.7	28.4	32.1	35.5	38.2	13.5	54.8
Reference country (average)	**100.00**	**110.52**	**122.51**	**134.62**	**147.56**	**47.6**	**47.6**
	(B) Normalized ICT Opportunities						
	2001	**2002**	**2003**	**2004**	**2005**		
High	301.5	309.3	315.5	316.7	312.2		
Upper	177.1	178.4	178.7	181.7	185.4		
Medium	102.4	102.2	101.3	101.3	101.2		
Low	36.4	37.9	38.7	38.9	38.2		
Reference country (average)	**147.56**	**147.56**	**147.56**	**147.56**	**147.56**		
	(C) Digital divides						
	2001	**2002**	**2003**	**2004**	**2005**		
High-Low	265.1	271.4	276.8	277.9	274.0		
High-medium	199.1	207.1	214.2	215.4	210.9		
High-upper	124.4	130.9	136.8	135.0	126.7		
Upper-low	140.7	140.5	140.1	142.9	147.3		
Upper-medium	74.7	76.2	77.4	80.4	84.2		
Medium-Low	66.0	64.3	62.7	62.4	63.1		
	(D) Changes in digital divides						
		2001/02	**2002/03**	**2003/04**	**2004/05**		
High-Low		6.2	5.5	1.0	-3.9		
High-medium		8.0	7.1	1.3	-4.5		
High-upper		6.5	5.9	-1.8	-8.3		
Upper-low		-0.2	-0.4	2.8	4.4		
Upper-medium		1.5	1.2	3.1	3.8		
Medium-Low		-1.7	-1.6	-0.2	0.6		

Source: ITU.

7.3.5 WSIS groupings

The World Summit on the Information Society (WSIS) highlighted the need to "*pay special attention to the particular needs of people of developing countries, countries with economies in transitions, Least Developed Countries, Small Island Developing States, Landlocked Developing Counties, Highly Indebted Poor Countries, countries and territories under occupation, countries recovering from conflict and countries and regions with special needs as well as to conditions that pose severe threats to development, such as natural disasters*".[13]

The main objective of the ICT-OI is to track the progress of developing countries and highlight their opportunity to become Information Societies. While there is no official definition of "developed" economies in the UN system, it is usually agreed that this list includes some 30 economies, including countries of Western Europe, Australia, New Zealand, Japan, Singapore, South Korea and Hong Kong (China), Macau (China) and Taiwan (China) in Asia-Pacific as well as the USA, Canada, Bermuda and Israel. Almost all of these countries rank at the top of the ICT-OI although Portugal and Greece are exceptions as they rank somewhat lower.

Since the group of 'developed countries' is very large, it might be more useful for analytical purposes to use some other groupings that were mentioned during the WSIS. Those countries that were especially highlighted in the WSIS Declaration of Principles (paragraph 16) can be grouped into the following categories: Least Developed Countries,[14] Small Island Developing States,[15] Landlocked Developing States,[16] countries with special needs,[17] Heavily Indebted Poor Countries (HIPC),[18] countries affected by natural disasters,[19] and countries with economies in transitions.[20]

A group that has been receiving a lot of attention and is the focus of the development community is that of the LDCs.[21] The close link between development status and digital opportunities is highlighted through the fact that almost all LDCs rank very low in the ICT-OI (Table 7.4).

Table 7.5 provides an overview of all (63) countries ranked in the *low* ICT-OI category[22] and their status in terms of the WSIS classification, based on paragraph 16. It highlights how many countries within each classification (LDC, SIDS, transition economies etc) have low ICT-OI levels.

Table 7.4: LDCs in the ICT-OI

Country	Region	LDC	ICT-OI category
Afghanistan	Asia	LDC	LOW
Angola	Africa	LDC	LOW
Bangladesh	Asia	LDC	LOW
Benin	Africa	LDC	LOW
Bhutan	Asia	LDC	LOW
Burkina Faso	Africa	LDC	LOW
Burundi	Africa	LDC	LOW
Cambodia	Asia	LDC	LOW
Cape Verde	Africa	LDC	MEDIUM
Central African Rep.	Africa	LDC	LOW
Chad	Africa	LDC	LOW
Comoros	Africa	LDC	LOW
D.R. Congo	Africa	LDC	LOW
Djibouti	Africa	LDC	LOW
Equatorial Guinea	Africa	LDC	LOW
Eritrea	Africa	LDC	LOW
Ethiopia	Africa	LDC	LOW
Gambia	Africa	LDC	LOW
Guinea	Africa	LDC	LOW
Guinea-Bissau	Africa	LDC	LOW
Haiti	Americas	LDC	LOW
Lao P.D.R.	Asia	LDC	LOW
Lesotho	Africa	LDC	LOW
Madagascar	Africa	LDC	LOW
Malawi	Africa	LDC	LOW
Maldives	Asia	LDC	MEDIUM
Mali	Africa	LDC	LOW
Mauritania	Africa	LDC	LOW
Mozambique	Africa	LDC	LOW
Myanmar	Asia	LDC	LOW
Nepal	Asia	LDC	LOW
Niger	Africa	LDC	LOW
Rwanda	Africa	LDC	LOW
S. Tomé & Principe	Africa	LDC	LOW
Samoa	Oceania	LDC	MEDIUM
Senegal	Africa	LDC	LOW
Solomon Islands	Oceania	LDC	LOW
Somalia	Africa	LDC	LOW
Sudan	Africa	LDC	LOW
Tanzania	Africa	LDC	LOW
Togo	Africa	LDC	LOW
Uganda	Africa	LDC	LOW
Vanuatu	Oceania	LDC	LOW
Yemen	Asia	LDC	LOW

Source: ITU.

One hundred percent of the "countries with special needs" and "countries emerging from war and armed conflicts" and over 90 percent of all LDCs are within the *low* ICT-OI category. Similarly, 90 percent of the "Heavily Indebted Poor Countries" (HIPC) rank *low*. The three LDCs and four HIPCs that have *medium* ICT-OI levels are Cape Verde, Maldives and Samoa

(Samoa is both, an LDC and a HIPC) and Guyana, Bolivia, and Kyrgyzstan.[23] This indicates that they are doing better in terms of ICT opportunities than their income level and development status would suggest. Although SIDS share an economic vulnerability because of a number of shared characteristics (including small size, dependence on exports and often imported energy, as well as a fragile ecosystem) they are much more diverse in terms of income levels and development status. The group of Small Island Developing States includes a number of high and higher income economies, such as Singapore, Barbados, Jamaica, and others. In 2005, only 24 percent of all SIDS are ranked as *low* ICT-OI economies. Transition economies are doing even better, with only 16 percent situated in the *low* category by 2005. The 26 countries particularly hit by natural disaster during 2005 are represented in all four ICT-OI categories (*low*, *medium*, *upper* and *high*), with 54 percent in the *low* category, including all nine LDCs that were also hit by natural disaster in 2005. One problem with using the 2005 natural disaster statistics to identify this group is that a certain time lag exists between the moment a country suffers a disaster and the moment the impacts on the telecommunication/ICT sector are felt.

As pointed out in Figure 7.4 (2007 ICT-OI growth rates), the best performances in terms of ICT-OI improvement (2001-2005) have been achieved by some economies with very limited ICT Opportunity levels. Out of the top ten growth rate countries (with annual growth rates over 100 percent) seven are ranked in the *low* ICT-OI category. These seven are also LDCs.

Among the 63 economies ranked in the ICT-OI's *low* category, 22 economies show a high growth rate band, meaning their ICT-OI ranking has improved exceptionally well over the period of 2001-2005. Seventy-seven percent of these countries are LDCs, 45 percent are HIPCs. However, not all LDCs, HIPCs or African countries show high growth rate bands over this five-year period and 12 LDCs and 12 HIPCs have low growth rates over the same period, suggesting that some low income countries are finding it difficult to take advantage of and expand their digital opportunities.

An interesting comparison that can be used for all countries and groupings is that of 'income levels' to 'ICT-OI rankings'. While there is an obvious link between a country's income level and its ICT-OI status, it is helpful to see which countries are doing comparatively better (or worse) in terms of ICT opportunities than their GDP per capital (income) level would suggest. To calculate this difference, a country's ICT-OI rank is subtracted from its GDP rank[24] (Table 7.6, GDP rank minus ICT-OI rank). A positive number indicates that the country has achieved higher ICT Opportunity levels than its income level would expect. A negative number, on the other hand, shows that based on the country's income level, its ICT-OI level is comparatively low. This simple comparison helps countries to evaluate their efforts to spread the Information Society in relative terms (or relative to their possibilities and resources). More detailed national analysis and case studies – that go beyond the scope of this publication – can help identify other factors (regulatory framework, pricing strategies, public access projects) to explain a country's relative ranking

A comparison between the SIDS' income levels and their ICT-OI ranks shows that over 60 percent of SIDS are ranked higher in the ICT-OI than their income level (GDP per capita) would suggest. Jamaica, Guyana and S. Tomé & Principe rank as much as 30 positions above their GDP rank. The fact that these economies occupy relatively small land areas is certainly an advantage for spreading access to ICT. Another helpful characteristic is a high population density since it is more difficult to bring ICT infrastructure and access to a highly dispersed population. Four SIDS (Singapore, Maldives, Mauritius and Barbados) rank in the top-ten economies in terms of high population density and all four of these have high ICT-OI rankings, compared to their income levels.

The influence that the degree of population density has can be further analyzed. Take the top twenty most populated countries in the word (Table 7.6). This group of '20 densely populated economies' includes 7 SIDS and 4 LDCs, with some countries represented in both categories. What is remarkable is the number of countries that do comparatively well in terms of digital opportunities, compared to their income level. Fifteen out of these 20 economies are doing better in terms of ICT Opportunities than their income level (as measured by their GDP per capita) would suggest.

Table 7.5: Countries ranked *low* in the ICT-OI and their status with regards to special needs

Country	Region	LDC	SIDS	LLDC	Special need	HIPC	2005 Disaster	Transition Economies	ICT-OI rank	ICT-OI category
Afghanistan	Asia	LDC		LLDC	CEFWAC		Disaster		180	LOW
Angola	Africa	LDC							166	LOW
Bangladesh	Asia	LDC					Disaster		157	LOW
Benin	Africa	LDC				HIPC			154	LOW
Bhutan	Asia	LDC		LLDC					131	LOW
Burkina Faso	Africa	LDC		LLDC		HIPC			176	LOW
Burundi	Africa	LDC		LLDC	CEFWAC	HIPC			174	LOW
Cambodia	Asia	LDC						Transition	163	LOW
Central African Rep.	Africa	LDC		LLDC		HIPC			179	LOW
Chad	Africa	LDC		LLDC		HIPC			182	LOW
Comoros	Africa	LDC	SIDS			HIPC	Disaster		164	LOW
D.R. Congo	Africa	LDC			CEFWAC	HIPC			183	LOW
Djibouti	Africa	LDC					Disaster		146	LOW
Equatorial Guinea	Africa	LDC							150	LOW
Eritrea	Africa	LDC			CEFWAC	HIPC			167	LOW
Ethiopia	Africa	LDC		LLDC	CEFWAC	HIPC			178	LOW
Gambia	Africa	LDC				HIPC			142	LOW
Guinea	Africa	LDC			CEFWAC	HIPC			173	LOW
Guinea-Bissau	Africa	LDC	SIDS		CEFWAC	HIPC			168	LOW
Haiti	Americas	LDC	SIDS			HIPC	Disaster		147	LOW
Lao P.D.R.	Asia	LDC		LLDC				Transition	151	LOW
Lesotho	Africa	LDC		LLDC					159	LOW
Madagascar	Africa	LDC				HIPC			169	LOW
Malawi	Africa	LDC		LLDC		HIPC	Disaster		172	LOW
Mali	Africa	LDC		LLDC		HIPC			171	LOW
Mauritania	Africa	LDC				HIPC			144	LOW
Mozambique	Africa	LDC				HIPC	Disaster		170	LOW
Myanmar	Asia	LDC							177	LOW
Nepal	Asia	LDC		LLDC		HIPC			165	LOW
Niger	Africa	LDC		LLDC		HIPC	Disaster		181	LOW
Rwanda	Africa	LDC		LLDC	CEFWAC	HIPC			175	LOW
S. Tomé & Principe	Africa	LDC	SIDS						126	LOW
Senegal	Africa	LDC				HIPC			136	LOW
Solomon Islands	Oceania	LDC	SIDS						156	LOW
Somalia	Africa	LDC			CEFWAC	HIPC			158	LOW
Sudan	Africa	LDC				HIPC			135	LOW
Tanzania	Africa	LDC				HIPC			160	LOW
Togo	Africa	LDC				HIPC			138	LOW
Uganda	Africa	LDC		LLDC		HIPC			162	LOW
Vanuatu	Oceania	LDC	SIDS						143	LOW
Yemen	Asia	LDC							137	LOW
Zambia	Africa	LDC		LLDC		HIPC	Disaster		153	LOW
Botswana	Africa			LLDC					123	LOW
Cameroon	Africa					HIPC			149	LOW
Congo	Africa					HIPC			161	LOW
Côte d'Ivoire	Africa					HIPC			152	LOW
Cuba	Americas		SIDS				Disaster		132	LOW
Ghana	Africa					HIPC			148	LOW
Honduras	Americas					HIPC			125	LOW
India	Asia						Disaster		133	LOW
Indonesia	Asia						Disaster		121	LOW
Kenya	Africa						Disaster		145	LOW
Libya	Africa								122	LOW
Nicaragua	Americas					HIPC			124	LOW
Nigeria	Africa								141	LOW
Pakistan	Asia						Disaster		139	LOW
Papua New Guinea	Oceania		SIDS						155	LOW
Sri Lanka	Asia								128	LOW
Swaziland	Africa			LLDC					130	LOW
Tajikistan	Asia			LLDC				Transition	140	LOW
Turkmenistan	Asia			LLDC				Transition	134	LOW
Uzbekistan	Asia			LLDC				Transition	129	LOW
Zimbabwe	Africa			LLDC					127	LOW
Countries per category		**45**	**33**	**31**	**9**	**38**	**26**	**31**		
Low' ICT-OI ranking per category		**42**	**8**	**22**	**9**	**34**	**14**	**5**		
Low-ranked countries a % of total		**93.3**	**24.2**	**71.0**	**100.0**	**89.5**	**53.8**	**16.1**		

Note: LDC – Least Developed countries; SIDS – Small Island Developing States; LLDC – Landlocked Developing Countries; CEFWAC – Countries Emerging from War and Armed Conflicts; HIPC – Heavily Indebted Poor Countries; 2005 Disaster – countries particularly affected by natural disasters in 2005.

Source: ITU. Categories and definitions were adapted from UN and IMF.

Table 7.6: ICT Opportunities, income levels and population density

Economy	Region	LDC	SIDS	ICT-OI rank	GDP Rank	Difference (GDP rank minus ICT-OI rank)	Population density (persons per square km)
Macao, China	Asia			21	26	5	19'327.73
Hong Kong, China	Asia			3	21	18	6'629.94
Singapore	Asia		SIDS	7	20	13	6'373.81
Malta	Europe			35	43	8	1'268.99
Maldives	Asia	LDC	SIDS	88	92	4	1'100.67
Bahrain	Asia			44	38	-6	1'024.85
Bangladesh	Asia	LDC		157	159	2	984.89
Mauritius	Africa		SIDS	56	63	7	667.56
Taiwan, China	Asia			17	40	23	632.71
Barbados	Americas		SIDS	25	50	25	625.58
Palestine	Asia			99	128	29	614.95
Aruba	Americas		SIDS	32	28	-4	515.38
Korea (Rep.)	Asia			22	41	19	490.56
Puerto Rico	Americas		SIDS	72	36	-36	441.46
Comoros	Africa	LDC	SIDS	165	152	-13	428.57
Netherlands	Europe			4	8	4	395.99
India	Asia			133	139	6	348.42
Lebanon	Asia			62	64	2	343.94
Belgium	Europe			12	13	1	343.88
Rwanda	Africa	LDC		175	174	-1	343.22

Note: The difference (GDP rank minus ICT-OI rank) is calculated by subtracting a country's ICT-OI rank from its GDP rank. A positive number indicates that the country has achieved higher ICT Opportunity levels than its income level would expect. A negative number, on the other hand, shows that based on the country's income level, its ICT-OI level is comparatively low.

Source: ITU.

7.4 CONCLUSIONS

The 2007 World Telecommunication Indicators and ICT Opportunity Index (ICT-OI) provide the latest available data on the telecommunication/ICT sector, as well as ITU's most recent product in the area of international benchmarking.

The ICT-OI, which has benefited from the expertise of several international and research organizations, is based on a carefully selected list of indicators and methodology. It is an important tool to track the digital divide by measuring the relative difference in ICT Opportunity levels among economies, and over time. It further presents an important step in achieving the objectives identified by the World Summit on the Information Society (WSIS) by helping countries and regions to realistically evaluate their performance. The 2007 ICT-OI, which is an inclusive index and provides measurement across 183 economies, relies on ten indicators that help measure ICT networks, education and skills, uptake and intensity of the use of ICT. For analytical purposes, economies are grouped into four categories, ranging from *high* to *low* ICT Opportunities. Apart from cross-country comparisons, the index's methodology highlights relative movements between 2001-2005, and shows which countries are making progress and how fast.

A summary of the 2007 ICT-OI results showed that significant progress has been made across almost all economies and all areas of the telecommunication/ICT sector since the beginning of this century. At the same time, major differences remain. The findings highlight that the digital divide, which is understood as the relative difference in ICT Opportunity levels among economies and groups, needs to be seen in perspective and will show different results, depending on which economies or groups are being compared. The ICT-OI highlights that between 2001-2005 the divide increased between those economies that already have very high ICT levels and the rest of the world. It decreased between the *medium* group and the *low* group, indicating that countries with low levels of

somewhat been able to catch up and reduce the divide compared to countries in the *medium* level.

An indicator-centric analysis suggests that the majority of countries are lagging behind in terms of broadband uptake and the difference in broadband penetration between economies with *high* ICT-OI levels and the rest of the world is significant and greater than for any other indicator. For policy makers, this finding suggests that more efforts need to be undertaken to integrate and strengthen broadband policies and strategies.

The development of the ICT Opportunity Index has been based on the notion that the tracking of a composite measure is relevant for policy implications, particularly in a developmental context. Further, social and economic policies of countries also impact indirectly on the extent of usage and thus the uptake and intensity of ICT goods and services. It is therefore important not to limit measurements to the ICT sector, only, but instead to monitor broader social and economic trends. It is only then that meaningful inferences can be drawn regarding the impact of ICT on social and economic development.

Finally, it should be noted that more detailed and country specific (case) studies need to be carried out to understand the reasons for the progress that countries are making in the area of telecommunication/ICT. Here, the ICT-OI can be a guiding tool to highlight and select countries that are doing particularly well, over time and compared to other countries. Based on its year-to-year analysis and itemization of indicators, it may also be used to assess the impact of new policies and regulatory changes.

Notes

[1] Only minor changes have been made to the conceptual framework of the ICT-OI published in 2005 and parts of this introduction have been adapted from the previous ICT Opportunity Index publication. See: George Sciadas (Editor). From the Digital Divide to Digital Opportunities. Measuring Infostates for Development. Orbicom and ITU, 2005.

[2] In 2003, ITU developed the Digital Access Index to measure the overall ability of individuals in a country to access and use ICT. The index captured availability of infrastructure, affordability ,educational level and quality. The indicators covered fixed and mobile subscribers, internet access price, literacy and school enrolment, as well as quality parameters such as broadband subscribers and international internet bandwidth. Only those factors that affected the availability of ICT were taken into account.

[3] See http://www.itu.int/ITU-D/ict/publications/dd/summary.html.

[4] This framework was first presented by Orbicom in its publication "Monitoring the Digital Divide – Observatoire de la fracture numérique" in 2002. At this stage, the conceptual framework was presented and articulated with only a pilot application to demonstrate the empirical feasibility of the theory in nine countries. This was mostly used for wide consultations and led to the 2003 publication, after which the joint index with ITU was initiated.

[5] George Sciadas (Editor). From the Digital Divide to Digital Opportunities. Measuring Infostates for Development. Orbicom and ITU, 2005.

[6] See: http://www.itu.int/ITU-D/ict/mdg/.

[7] See Partnership on Measuring ICT for Development, at: http://www.itu.int/ITU-D/ict/partnership/index.html.

[8] A major drawback with the indicator "internet hosts per 100 population" is that although internet hosts are assumed to be located in the country shown by their two-letter ISO country code Top Level Domain (ccTLD) (e.g., .ch for Switzerland), this is not necessarily the case. A host with the .ch domain name might actually be located anywhere in the world. Also, the very popular .com domain name, which is used all over the world, cannot be assigned to one single country.

[9] The importance of broadband technologies was highlighted in the ITU's 2006 World Telecommunication Development Report, see: http://www.itu.int/ITU-D/ict/publications/wtdr_06/index.html.

[10] Each country contact received the available data for the eight ITU indicators for 2001 to 2005: main telephone lines in operation, international outgoing telephone traffic (in minutes), cellular mobile telephone subscribers, internet users, total broadband internet subscribers, international internet bandwidth, number of computers and percentage of households with a TV.

[11] The UNESCO indicators on school enrollment and literacy rate are provided in terms of penetration rates by UNESCO.

[12] Since 57 cannot be divided into two equal groups of countries, 29 countries were classified as *high* and 28 countries were classified as *upper*.

[13] WSIS Declaration of Principles, Para 16.

[14] For the complete list of LDCs, see: http://www.un.org/special-rep/ohrlls/ldc/list.htm.

[15] For the complete list of SIDS see, http://www.itu.int/ITU-D/ldc/sids/sids_region1.html.

[16] For the complete list of LLDS, see: http://www.un.org/special-rep/ohrlls/lldc/list.htm.

[17] For a list of countries with special needs (Countries Emerging from War and Armed Conflicts), see: http://web/ITU-D/ldc/special-needs.html.

[18] For the list of HIPC, see: http://www.imf.org/external/np/pp/eng/2006/082106.pdf (page 5).

[19] While there is no clear definition for this group of countries, a number of organisations (including the United Nations International Strategy for Disaster Reduction, the Centre for Research on the Epidemiology of Disasters (CRED)) have published some information called "2005 disasters in numbers", which lists a total of 25 countries that were particularly affected by natural disasters in 2005. See: http://www.unisdr.org/disaster-statistics/pdf/2005-disaster-in-numbers.pdf.

[20] While the term 'economies in transition' is not clearly defined, the IMF has identified some key ingredients of a transition process, which includes liberalization, macroeconomic stabilization, restructuring and privatization, and legal and institutional reforms. For a list of the 25 IMF defined economies in transition, see: http://www.imf.org/external/np/res/seminars/2004/calvo/pdf/fische.pdf (page 14). Also see:

http://www.ebrd.com/pubs/econo/wp0060.pdf (page 26) and
http://www.un.org/esa/policy/reports/e_i_t/n0647258.pdf (page 24).

[21] The United Nations General Assembly decides which countries are included in (or graduate from) the list of LDCs under the recommendation of ECOSOC, see: http://www.itu.int/ITU-D/ldc/who.html.

[22] As was mentioned earlier in the text, the category 'developing countries' was not included for analytical purposes since this group is very large and includes over 85 percent of the countries included in the ICT-OI.

[23] It should be noted that both, Cape Verde and Samoa, are expected to graduate from the LDC list, soon.

[24] The GDP rank is based on all countries' GDP per capita levels.

Annex 1: 2007 ICT-OI sub-indices: Infodensity (networks and skills) and Infouse (uptake and intensity)

Economy	NET-WORKS SKILLS Index	index	INFO-DENSITY Index	UP-TAKE index	INTENSITY Index	INFOUse Index	ICT-OI value
Sweden	605.1	153.8	**305.1**	464.5	470.59	**467.56**	**377.69**
Luxembourg	675.5	112.0	**275.1**	412.6	607.37	**500.61**	**371.10**
Hong Kong, China	553.7	117.0	**254.5**	366.7	751.74	**525.01**	**365.54**
Netherlands	555.6	141.6	**280.5**	472.6	466.09	**469.35**	**362.82**
Denmark	616.5	145.8	**299.8**	390.2	483.22	**434.22**	**360.79**
Switzerland	548.7	110.3	**246.0**	417.8	618.51	**508.32**	**353.60**
Singapore	437.6	136.3	**244.2**	395.9	611.56	**492.08**	**346.68**
United Kingdom	590.4	156.9	**304.4**	391.1	397.26	**394.17**	**346.37**
Iceland	486.2	141.4	**262.2**	411.5	475.50	**442.36**	**340.57**
Norway	492.8	147.4	**269.5**	387.7	466.27	**425.20**	**338.53**
Canada	398.5	136.0	**232.8**	422.1	565.06	**488.36**	**337.16**
Belgium	498.0	153.3	**276.3**	304.5	475.09	**380.37**	**324.21**
United States	346.7	143.3	**222.8**	443.6	499.37	**470.64**	**323.85**
Australia	426.0	155.9	**257.7**	447.5	365.16	**404.22**	**322.73**
Austria	449.1	131.8	**243.3**	365.1	403.75	**383.94**	**305.60**
Germany	496.0	131.2	**255.0**	355.9	366.09	**360.97**	**303.42**
Taiwan, China	432.0	110.1	**218.1**	381.3	462.92	**420.12**	**302.71**
Israel	335.4	133.7	**211.7**	358.2	482.61	**415.77**	**296.71**
Finland	371.3	154.0	**239.1**	347.9	373.18	**360.33**	**293.51**
Ireland	440.4	137.5	**246.1**	308.8	359.46	**333.15**	**286.32**
Macao, China	358.4	131.0	**216.7**	272.7	483.08	**362.94**	**280.45**
Korea (Rep.)	254.1	144.9	**191.9**	392.3	425.85	**408.74**	**280.08**
France	354.4	137.3	**220.6**	341.4	361.42	**351.26**	**278.34**
Estonia	339.6	137.2	**215.9**	346.2	328.50	**337.24**	**269.81**
Barbados	303.7	130.4	**199.0**	239.7	518.63	**352.57**	**264.85**
New Zealand	256.2	146.9	**194.0**	387.0	302.89	**342.35**	**257.73**
Japan	243.3	132.7	**179.7**	386.5	348.96	**367.25**	**256.90**
Italy	332.4	135.0	**211.8**	305.7	311.60	**308.63**	**255.68**
Spain	331.9	142.3	**217.3**	255.2	320.37	**285.92**	**249.28**
Slovenia	261.8	146.0	**195.5**	332.2	289.02	**309.86**	**246.13**
Antigua & Barbuda	444.0	123.8	**234.4**	236.1	277.26	**255.86**	**244.92**
Aruba	316.9	123.8	**198.1**	155.7	528.52	**286.85**	**238.36**
Cyprus	233.6	121.3	**168.3**	279.1	307.04	**292.72**	**221.95**
Latvia	228.7	138.5	**178.0**	262.1	275.85	**268.90**	**218.77**
Malta	298.3	111.1	**182.0**	202.0	303.39	**247.55**	**212.27**
Portugal	253.4	134.8	**184.9**	184.3	306.29	**237.57**	**209.57**
Czech Republic	295.8	125.0	**192.3**	231.5	197.35	**213.74**	**202.72**
Lithuania	245.9	140.3	**185.7**	219.2	218.66	**218.90**	**201.63**
Qatar	215.6	113.9	**156.7**	199.4	306.99	**247.40**	**196.92**
Hungary	232.6	133.7	**176.3**	192.4	229.06	**209.96**	**192.41**
United Arab Emirates	222.1	93.1	**143.8**	218.7	294.05	**253.60**	**190.99**
Slovak Republic	249.2	122.4	**174.7**	274.6	152.06	**204.36**	**188.92**
Bahamas	195.4	116.4	**150.8**	183.2	275.83	**224.77**	**184.13**
Bahrain	203.1	114.7	**152.6**	182.2	260.73	**217.98**	**182.40**
Croatia	241.5	121.3	**171.2**	217.8	151.75	**181.79**	**176.41**
Poland	190.7	137.5	**162.0**	211.6	137.94	**170.86**	**166.36**
Jamaica	363.9	94.1	**185.0**	154.5	140.65	**147.41**	**165.16**
Greece	252.2	139.2	**187.4**	140.2	141.11	**140.65**	**162.34**
Virgin Islands (US)	228.3	130.4	**172.5**	84.4	261.72	**148.65**	**160.13**
Chile	176.0	122.4	**146.8**	157.0	182.68	**169.33**	**157.65**
Grenada	164.3	130.4	**146.3**	168.1	167.94	**168.00**	**156.79**
Brunei Darussalam	195.7	110.5	**147.0**	173.8	157.95	**165.70**	**156.09**
French Polynesia	126.9	137.3	**132.0**	153.7	211.23	**180.17**	**154.21**
Kuwait	159.3	111.3	**133.1**	210.4	150.38	**177.88**	**153.88**
Romania	158.3	120.8	**138.2**	165.1	162.38	**163.72**	**150.45**
Mauritius	141.6	100.7	**119.4**	185.0	193.28	**189.08**	**150.27**
Malaysia	133.3	104.7	**118.1**	244.3	149.28	**190.96**	**150.19**
Reference country	**164.4**	**102.6**	**129.9**	**147.5**	**190.60**	**167.66**	**147.56**
New Caledonia	158.1	137.1	**147.2**	102.0	208.96	**146.01**	**146.61**
Uruguay	145.9	128.2	**136.8**	164.0	137.49	**150.15**	**143.31**
Argentina	149.4	137.1	**143.1**	135.3	140.23	**137.72**	**140.40**
Seychelles	151.3	102.1	**124.3**	197.5	124.83	**157.00**	**139.67**
Lebanon	110.6	120.9	**115.6**	153.9	182.19	**167.45**	**139.15**
Russia	161.9	139.2	**150.1**	144.7	108.89	**125.53**	**137.27**
Brazil	124.2	121.0	**122.6**	168.6	136.78	**151.86**	**136.44**
St. Vincent	122.2	120.2	**121.2**	115.6	179.83	**144.18**	**132.19**
Costa Rica	121.2	105.0	**112.8**	197.2	115.79	**151.12**	**130.58**
Turkey	158.6	116.0	**135.6**	109.6	135.32	**121.80**	**128.53**
Trinidad & Tobago	156.4	108.1	**130.0**	122.0	127.02	**124.50**	**127.22**
Belize	117.0	105.0	**110.8**	149.3	142.13	**145.66**	**127.06**
Mexico	113.7	108.8	**111.2**	150.9	129.47	**139.80**	**124.68**
Bulgaria	185.5	127.8	**154.0**	128.7	76.15	**99.01**	**123.46**
Puerto Rico	185.3	117.3	**147.4**	68.0	154.02	**102.34**	**122.83**
TFYR Macedonia	137.6	115.3	**126.0**	140.6	94.10	**115.01**	**120.36**
Belarus	133.5	134.4	**134.0**	148.9	77.82	**107.65**	**120.09**
Saudi Arabia	111.1	94.0	**102.2**	174.6	99.93	**132.10**	**116.20**
Venezuela	102.0	114.6	**108.1**	120.0	120.47	**120.24**	**114.03**
Bosnia	118.3	121.3	**119.8**	117.9	97.96	**107.46**	**113.44**
Serbia and Montenegro	165.1	121.3	**141.5**	95.9	79.75	**87.43**	**111.23**
China	113.3	106.1	**109.6**	81.6	146.17	**109.21**	**109.41**
Colombia	131.4	110.9	**120.7**	87.3	96.71	**91.89**	**105.32**
Peru	73.6	113.3	**91.3**	125.2	114.31	**119.62**	**104.50**
Ukraine	118.0	135.3	**126.4**	85.4	80.14	**82.75**	**102.26**
Moldova	101.2	111.2	**106.1**	114.2	84.82	**98.44**	**102.19**
Jordan	87.0	114.1	**99.6**	116.7	94.12	**104.80**	**102.17**
Guyana	97.4	112.1	**104.5**	108.6	86.71	**97.03**	**100.69**
Oman	103.4	100.4	**101.9**	90.7	108.06	**99.01**	**100.44**
Thailand	102.3	114.1	**108.0**	105.3	78.87	**91.13**	**99.20**
Maldives	96.2	94.3	**95.3**	99.7	106.37	**102.99**	**99.06**
Suriname	119.3	107.9	**113.4**	70.5	98.76	**83.46**	**97.30**
South Africa	104.7	101.0	**102.8**	96.3	86.15	**91.08**	**96.78**
Panama	109.4	117.3	**113.3**	72.8	93.44	**82.50**	**96.69**

Annex 1: 2007 ICT-OI sub-indices: Infodensity (networks and skills) and Infouse (uptake and intensity)

Economy	NET-WORKS Index	SKILLS index	INFO-DENSITY Index	UP-TAKE index	INTENSITY Index	INFOUse Index	ICT-OI value
Ecuador	105.3	114.2	**109.7**	89.4	80.40	**84.77**	**96.42**
El Salvador	92.8	94.8	**93.8**	87.4	107.06	**96.73**	**95.27**
Tunisia	107.1	99.2	**103.1**	93.6	82.35	**87.78**	**95.12**
Dominican Rep.	86.4	109.6	**97.3**	79.2	106.39	**91.77**	**94.50**
Fiji	82.9	107.9	**94.6**	78.8	105.95	**91.39**	**92.97**
Georgia	93.3	121.3	**106.4**	75.4	77.84	**76.63**	**90.28**
Iran (I.R.)	76.8	98.4	**86.9**	117.4	73.11	**92.65**	**89.74**
Palestine	78.4	122.7	**98.0**	81.5	81.27	**81.40**	**89.33**
Mongolia	58.3	123.4	**84.8**	111.2	73.82	**90.61**	**87.68**
Armenia	69.6	118.0	**90.7**	92.8	76.17	**84.07**	**87.30**
Kazakhstan	98.9	131.5	**114.1**	55.1	73.90	**63.81**	**85.32**
Azerbaijan	83.0	108.5	**94.9**	74.9	73.42	**74.16**	**83.90**
Tonga	87.1	110.6	**98.1**	43.0	101.69	**66.10**	**80.54**
Morocco	73.1	68.8	**71.0**	78.5	101.15	**89.09**	**79.50**
Albania	91.8	108.9	**100.0**	53.9	73.29	**62.83**	**79.25**
Egypt	75.9	91.2	**83.2**	71.5	77.97	**74.68**	**78.82**
Philippines	64.9	114.2	**86.1**	67.8	76.73	**72.12**	**78.81**
Cape Verde	75.0	65.7	**70.2**	89.7	82.53	**86.02**	**77.70**
Paraguay	64.7	107.7	**83.5**	68.5	75.82	**72.09**	**77.59**
Viet Nam	71.0	96.6	**82.8**	62.7	80.37	**70.97**	**76.66**
Syria	71.7	94.0	**82.1**	68.8	73.90	**71.32**	**76.53**
Algeria	79.9	94.6	**87.0**	45.4	94.83	**65.63**	**75.55**
Namibia	64.0	87.9	**75.0**	68.4	76.91	**72.52**	**73.74**
Micronesia	62.3	110.6	**83.0**	55.7	76.73	**65.39**	**73.67**
Bolivia	67.7	117.3	**89.1**	47.2	76.80	**60.20**	**73.24**
Guatemala	84.5	79.1	**81.8**	48.2	84.96	**63.98**	**72.34**
Samoa	61.3	103.9	**79.8**	46.6	74.20	**58.77**	**68.48**
Gabon	63.6	80.6	**71.6**	52.2	81.96	**65.41**	**68.43**
Kyrgyzstan	51.6	122.5	**79.5**	43.9	75.72	**57.68**	**67.72**
Indonesia	57.5	102.6	**76.8**	48.8	72.84	**59.62**	**67.68**
Libya	48.5	126.3	**78.3**	42.0	77.07	**56.86**	**66.71**
Botswana	82.4	93.1	**87.6**	30.1	83.02	**49.98**	**66.16**
Nicaragua	48.3	99.4	**69.3**	44.7	78.98	**59.42**	**64.18**
Honduras	57.7	99.6	**75.8**	38.7	72.33	**52.93**	**63.35**
S. Tomé & Principe	38.6	69.9	**52.0**	69.7	73.54	**71.60**	**61.01**
Zimbabwe	29.0	78.2	**47.6**	74.3	76.89	**75.61**	**60.02**
Sri Lanka	54.0	98.3	**72.9**	29.4	76.72	**47.48**	**58.82**
Uzbekistan	30.4	113.6	**58.8**	46.8	72.56	**58.27**	**58.54**
Swaziland	46.8	76.9	**60.0**	36.9	75.64	**52.83**	**56.31**
Bhutan	30.6	123.4	**61.5**	35.8	72.12	**50.81**	**55.88**
Cuba	24.4	133.1	**56.9**	40.5	71.26	**53.70**	**55.30**
India	38.9	78.6	**55.3**	35.6	75.48	**51.81**	**53.55**
Turkmenistan	25.0	113.6	**53.3**	39.2	72.35	**53.28**	**53.29**
Sudan	25.1	58.6	**38.4**	58.6	71.54	**64.73**	**49.83**
Senegal	38.9	43.8	**41.3**	36.2	79.78	**53.76**	**47.11**
Yemen	41.0	65.9	**51.9**	24.3	71.17	**41.58**	**46.47**

Economy	NET-WORKS Index	SKILLS index	INFO-DENSITY Index	UP-TAKE index	INTENSITY Index	INFOUse Index	ICT-OI value
Togo	22.5	58.4	**36.2**	47.0	71.47	**57.93**	**45.81**
Pakistan	35.5	55.3	**44.3**	30.3	72.11	**46.73**	**45.50**
Tajikistan	29.6	109.7	**57.0**	18.1	71.19	**35.86**	**45.20**
Nigeria	27.4	74.0	**45.0**	26.5	71.24	**43.45**	**44.23**
Gambia	42.1	50.2	**46.0**	23.6	75.27	**42.11**	**43.99**
Vanuatu	31.2	90.7	**53.2**	16.9	74.96	**35.57**	**43.50**
Mauritania	37.3	59.4	**47.1**	22.0	72.74	**39.99**	**43.38**
Kenya	25.9	73.2	**43.5**	23.7	70.97	**41.03**	**42.26**
Djibouti	25.8	48.2	**35.2**	30.1	76.67	**48.01**	**41.13**
Haiti	25.2	86.1	**46.6**	18.0	71.53	**35.92**	**40.92**
Ghana	30.9	71.1	**46.9**	16.6	71.76	**34.52**	**40.23**
Cameroon	23.8	72.0	**41.4**	20.2	71.41	**37.94**	**39.62**
Equatorial Guinea	39.8	36.9	**38.3**	22.1	73.62	**40.31**	**39.30**
Lao P.D.R.	27.8	78.3	**46.7**	15.4	71.28	**33.09**	**39.29**
Côte d'Ivoire	30.7	47.6	**38.2**	22.5	71.62	**40.12**	**39.15**
Zambia	21.8	59.1	**35.9**	24.1	70.98	**41.38**	**38.52**
Benin	25.2	42.6	**32.8**	20.0	71.56	**37.82**	**35.20**
Papua New Guinea	12.9	51.8	**25.9**	29.5	70.85	**45.68**	**34.38**
Solomon Islands	14.6	86.6	**35.6**	13.8	77.05	**32.60**	**34.05**
Bangladesh	19.5	61.3	**34.6**	11.7	70.91	**28.77**	**31.56**
Somalia	22.6	56.9	**35.9**	10.8	71.06	**27.69**	**31.51**
Lesotho	38.8	80.8	**56.0**	4.3	73.16	**17.67**	**31.45**
Tanzania	17.7	58.1	**32.1**	13.1	70.81	**30.40**	**31.24**
Congo	19.7	73.8	**38.1**	8.4	71.12	**24.49**	**30.54**
Uganda	13.0	65.4	**29.1**	12.8	71.11	**30.23**	**29.66**
Angola	21.3	54.2	**34.0**	8.4	71.22	**24.47**	**28.82**
Cambodia	14.0	76.7	**32.8**	8.9	71.24	**25.20**	**28.75**
Comoros	18.8	33.4	**25.1**	14.7	71.74	**32.48**	**28.55**
Nepal	13.3	66.8	**29.8**	9.6	70.97	**26.14**	**27.91**
Eritrea	10.7	54.4	**24.1**	13.6	70.98	**31.01**	**27.36**
Guinea-Bissau	20.4	29.5	**24.5**	13.1	71.00	**30.49**	**27.34**
Madagascar	11.6	77.0	**29.8**	7.3	70.78	**22.72**	**26.03**
Mozambique	15.0	48.4	**27.0**	8.5	70.88	**24.49**	**25.70**
Mali	19.9	24.0	**21.9**	8.0	71.74	**24.02**	**22.92**
Malawi	16.1	68.3	**33.1**	3.4	71.90	**15.68**	**22.79**
Guinea	10.7	33.6	**18.9**	8.2	72.01	**24.35**	**21.46**
Burundi	10.9	27.6	**17.4**	9.6	70.73	**26.04**	**21.26**
Rwanda	10.7	60.1	**25.3**	3.7	71.86	**16.22**	**20.27**
Burkina Faso	17.3	23.7	**20.3**	5.1	71.76	**19.13**	**19.69**
Myanmar	7.8	86.7	**26.1**	2.8	70.76	**14.01**	**19.11**
Ethiopia	8.7	49.5	**20.7**	3.2	70.77	**15.08**	**17.68**
Central African Rep.	9.9	40.7	**20.0**	2.9	71.12	**14.38**	**16.97**
Afghanistan	12.8	49.9	**25.3**	1.1	70.77	**8.79**	**14.91**
Niger	8.3	33.6	**16.7**	2.4	70.81	**13.00**	**14.75**
Chad	7.7	22.8	**13.2**	3.0	70.82	**14.47**	**13.82**
D.R. Congo	5.2	55.8	**17.0**	1.1	71.20	**8.97**	**12.33**

Annex 2: 2007 ICT-OI average annual growth rates, 2001-2005 and growth rate bands

Economy	Average annual growth rate 2001-2005	Growth rate bands	2005 ICT-OI Value
Afghanistan	366.71	HIGH	14.91
Eritrea	232.96	HIGH	27.36
Bhutan	187.25	HIGH	55.88
Guinea-Bissau	182.64	HIGH	27.34
Micronesia	178.63	HIGH	73.67
Comoros	172.29	HIGH	28.55
S. Tomé & Principe	165.69	HIGH	61.01
Myanmar	111.54	HIGH	19.11
Barbados	108.93	HIGH	264.85
Algeria	107.84	HIGH	75.55
Nigeria	105.87	HIGH	44.23
Sudan	99.76	HIGH	49.83
Jamaica	99.43	HIGH	165.16
Latvia	98.92	HIGH	218.77
Yemen	97.67	HIGH	46.47
Lithuania	95.21	HIGH	201.63
Antigua & Barbuda	92.75	HIGH	244.92
Tajikistan	92.03	HIGH	45.20
Somalia	91.40	HIGH	31.51
Tonga	87.46	HIGH	80.54
Niger	86.75	HIGH	14.75
Israel	86.71	HIGH	296.71
Romania	86.33	HIGH	150.45
Syria	82.59	HIGH	76.53
Pakistan	79.51	HIGH	45.50
Qatar	79.39	HIGH	196.92
Estonia	78.08	HIGH	269.81
Luxembourg	77.20	HIGH	371.10
Angola	77.13	HIGH	28.82
Viet Nam	76.19	HIGH	76.66
Belarus	75.83	HIGH	120.09
Australia	75.59	HIGH	322.73
Ethiopia	74.99	HIGH	17.68
D.R. Congo	72.74	HIGH	12.33
Moldova	71.49	HIGH	102.19
Russia	71.29	HIGH	137.27
Bangladesh	70.74	HIGH	31.56
India	69.90	HIGH	53.55
Armenia	69.29	HIGH	87.30
Aruba	68.90	HIGH	238.36
Azerbaijan	68.12	HIGH	83.90
China	67.22	HIGH	109.41
Lao P.D.R.	66.71	HIGH	39.29
United Kingdom	65.94	HIGH	346.37
Macao, China	63.78	HIGH	280.45
Burundi	61.58	HIGH	21.26
Ghana	60.80	HIGH	40.23
New Caledonia	60.79	UPPER	146.61
Haiti	60.65	UPPER	40.92
Hungary	59.16	UPPER	192.41
Slovenia	59.12	UPPER	246.13
Taiwan, China	58.59	UPPER	302.71
Ireland	58.44	UPPER	286.32
Poland	58.20	UPPER	166.36
Morocco	57.95	UPPER	79.50
Ukraine	57.75	UPPER	102.26
Bosnia	57.72	UPPER	113.44
Albania	57.49	UPPER	79.25
Turkmenistan	57.42	UPPER	53.29
Hong Kong, China	57.09	UPPER	365.54
Mauritius	56.96	UPPER	150.27
Uganda	56.84	UPPER	29.66
Brazil	56.43	UPPER	136.44
Mongolia	56.32	UPPER	87.68
Italy	56.28	UPPER	255.68
Tanzania	56.12	UPPER	31.24
Zimbabwe	56.03	UPPER	60.02
Mauritania	55.73	UPPER	43.38
Benin	55.57	UPPER	35.20
Djibouti	55.25	UPPER	41.13
Spain	54.20	UPPER	249.28
French Polynesia	54.12	UPPER	154.21
Slovak Republic	53.42	UPPER	188.92
Netherlands	53.04	UPPER	362.82
Uzbekistan	52.96	UPPER	58.54
Kazakhstan	52.73	UPPER	85.32
Grenada	52.39	UPPER	156.79
TFYR Macedonia	52.27	UPPER	120.36
Egypt	51.89	UPPER	78.82
Norway	51.76	UPPER	338.53
Ecuador	50.97	UPPER	96.42
Zambia	50.66	UPPER	38.52
Iceland	50.62	UPPER	340.57
St. Vincent	50.08	UPPER	132.19
Tunisia	50.07	UPPER	95.12
Czech Republic	49.96	UPPER	202.72
Singapore	49.79	UPPER	346.68
Lebanon	49.61	UPPER	139.15
Colombia	49.45	UPPER	105.32
Croatia	49.25	UPPER	176.41
Turkey	48.84	UPPER	128.53
Maldives	48.50	UPPER	99.06
El Salvador	48.00	UPPER	95.27
Cameroon	47.77	UPPER	39.62
Nepal	47.14	MEDIUM	27.91
Cuba	46.78	MEDIUM	55.30
Libya	46.47	MEDIUM	66.71
France	46.15	MEDIUM	278.34
Peru	45.99	MEDIUM	104.50
Saudi Arabia	45.19	MEDIUM	116.20
Indonesia	44.87	MEDIUM	67.68
Kuwait	44.80	MEDIUM	153.88
Mozambique	44.67	MEDIUM	25.70
Georgia	44.61	MEDIUM	90.28
Mali	44.28	MEDIUM	22.92
United States	44.17	MEDIUM	323.85
Iran (I.R.)	44.16	MEDIUM	89.74
Guatemala	43.81	MEDIUM	72.34
Finland	43.63	MEDIUM	293.51
Samoa	43.56	MEDIUM	68.48
Sweden	43.52	MEDIUM	377.69
Sri Lanka	43.39	MEDIUM	58.82

Annex 2: 2007 ICT-OI average annual growth rates, 2001-2005 and growth rate bands

Economy	Average annual growth rate 2001-2005	Growth rate bands	2005 ICT-OI Value
Germany	43.38	MEDIUM	303.42
Switzerland	43.26	MEDIUM	353.60
Belize	43.18	MEDIUM	127.06
New Zealand	43.06	MEDIUM	257.73
United Arab Emirates	42.99	MEDIUM	190.99
Congo	42.89	MEDIUM	30.54
Cyprus	42.80	MEDIUM	221.95
Equatorial Guinea	42.77	MEDIUM	39.30
Japan	42.71	MEDIUM	256.90
Portugal	42.19	MEDIUM	209.57
Denmark	42.07	MEDIUM	360.79
Cambodia	41.96	MEDIUM	28.75
Kenya	41.78	MEDIUM	42.26
Belgium	41.77	MEDIUM	324.21
Mexico	41.62	MEDIUM	124.68
Kyrgyzstan	41.60	MEDIUM	67.72
Puerto Rico	41.11	MEDIUM	122.83
Oman	41.01	MEDIUM	100.44
Costa Rica	39.96	MEDIUM	130.58
Fiji	39.84	MEDIUM	92.97
Malaysia	39.57	MEDIUM	150.19
Bahrain	39.53	MEDIUM	182.40
Vanuatu	39.35	MEDIUM	43.50
Virgin Islands (US)	38.82	MEDIUM	160.13
Korea (Rep.)	38.57	MEDIUM	280.08
Gabon	38.39	MEDIUM	68.43
Senegal	38.06	MEDIUM	47.11
Argentina	37.86	LOW	140.40
Uruguay	37.66	LOW	143.31
Venezuela	36.67	LOW	114.03
Serbia and Montenegro	36.54	LOW	111.23
Chile	36.16	LOW	157.65
Brunei Darussalam	36.09	LOW	156.09
Central African Rep.	35.87	LOW	16.97
Nicaragua	35.80	LOW	64.18
Malawi	35.80	LOW	22.79
Trinidad & Tobago	35.74	LOW	127.22
Honduras	35.72	LOW	63.35
Palestine	35.66	LOW	89.33
Burkina Faso	35.62	LOW	19.69
Canada	33.69	LOW	337.16
Madagascar	33.61	LOW	26.03
Austria	32.86	LOW	305.60
Greece	32.75	LOW	162.34
Malta	32.41	LOW	212.27
Thailand	31.97	LOW	99.20
Swaziland	31.48	LOW	56.31
Dominican Rep.	31.41	LOW	94.50
Bahamas	31.10	LOW	184.13
Bulgaria	30.11	LOW	123.46
Jordan	29.87	LOW	102.17
Cape Verde	29.37	LOW	77.70
Paraguay	28.39	LOW	77.59
Gambia	27.97	LOW	43.99
Solomon Islands	27.18	LOW	34.05
Guyana	27.13	LOW	100.69
Philippines	26.87	LOW	78.81
Lesotho	26.51	LOW	31.45
Namibia	25.65	LOW	73.74
Rwanda	25.17	LOW	20.27
Papua New Guinea	24.95	LOW	34.38
Bolivia	24.40	LOW	73.24
Côte d'Ivoire	24.06	LOW	39.15
Suriname	22.97	LOW	97.30
Chad	22.33	LOW	13.82
South Africa	21.61	LOW	96.78
Panama	21.31	LOW	96.69
Seychelles	21.00	LOW	139.67
Guinea	17.15	LOW	21.46
Togo	16.25	LOW	45.81
Botswana	11.02	LOW	66.16

chapter eight
Conclusions

The World Summit on the Information Society (WSIS) was convened in response to rising awareness of the pervasive power of Information and Communication Technologies (ICTs) and growing concerns that developing countries should not be left behind in the process of building the Information Society. At the Summit, world leaders committed to turning the digital divide into a digital opportunity for all. This Report responds to the call of the Geneva Plan of Action for monitoring WSIS implementation and follow-up, with "analytical work on policies and their implementation" to "clarify the magnitude of the digital divide in both its domestic and international dimensions". The Report series is intended to track progress in WSIS implementation, from the conclusion of the Tunis Phase of the Summit in 2005 to the achievement of the WSIS targets towards 2015 and beyond.

Different statistical techniques are used to monitor the evolution of the digital divide. In terms of penetration rates, developing countries (especially China and India) are gaining on OECD countries in fixed lines, mobile phones, Internet usage and broadband usage. Least Developed Countries (LDCs) are also catching up with developing countries in terms of mobile phones, Internet usage and broadband. However, LDCs are actually falling behind in fixed lines, where there is a widening gap between developing countries and LDCs. The digital divide is shrinking in terms of Internet usage - inequality in the distribution of Internet users around the world has reduced sharply over recent years.

Mobile telephony offers the greatest potential to bridge the digital divide, with rapid growth in the number of mobile cellular subscribers around the world. Developing countries have made important gains in mobile telephony, with mobile phones outnumbering fixed lines by seven to one in LDCs, and by as much as nine to one in Sub-Saharan Africa. In more developed markets, consumers are 'cutting the cord' and increasingly substituting mobile phone ownership for their fixed line. Since the number of mobile subscribers overtook the number of fixed lines in 2002, over a billion new subscribers have been added to mobile phone networks. By the end of 2008, more than half the world's population is expected to have access to mobile phones.

The period 2005-06 was one of startling growth in Internet in many countries, thanks to the boost from broadband, both on fixed and mobile networks. The United States remains the largest Internet market in terms of the number of Internet subscribers, but China is gaining fast and, if current growth rates continue, China could overtake the United States within two years. The Digital Opportunity Index (DOI) analyzes the take-up of broadband Internet, as a proportion of total Internet subscribers as one of its indicators. Based on the evidence from the DOI, subscribers in many developed countries are exchanging their narrowband dial-up connection for higher-speed broadband connections, with a long, slow death for dial-up in industrialized economies.

According to the Digital Opportunity Index, 2005/2006 also saw strong growth in third generation (3G) mobile services, particularly in Asia and Europe. Mobile broadband (3G) services are now offered in many developing countries throughout central and eastern Asia, Latin America and the Caribbean. Mobile broadband has grown in speed, with industry promising even higher speeds in the future. W-CDMA networks were operational in 49 countries by the start of 2007, with 24 HSDPA networks in commercial deployment. In 2006, twelve economies had separate networks supporting both W-CDMA and CDMA 2000 1x.

Countries have adopted various national strategies to boost ICT infrastructure and promote digital opportunity. Achieving the goals of the WSIS requires a coherent national strategy, with coordinated efforts by all stakeholders. The Report examines the various strategies that countries have pursued in their efforts to extend access to ICTs, including market liberalization, privatization and competition, and illustrates these strategies with reference to a wealth of country case studies. It discusses the incentives that countries can introduce to promote investment, including liberalization, investor guarantees and protection and fiscal incentives.

However, the Information Society is not without risks, and the Report examines growth in rising online dangers and threats to cybersecurity. The expansion of the Internet is opening up new opportunities for criminals to exploit online vulnerabilities to commit cybercrime acts or even deliberately attack the critical infrastructures of nation states. Viruses, spyware, phishing, identity theft, zero-day exploits, denial of service attacks, zombie botnets, and other vulnerabilities are endangering cyberspace and jeopardizing the very future of the Internet. These risks threaten to undermine user confidence and inhibit the growth of the online world.

Cybercrime is the fastest-growing form of criminality, including both new criminal offences in relation to computers (such as spam, viruses and

hacking), and existing crimes committed using digital or computer technology (such as fraud, harassment, etc.). At the Tunis phase of the WSIS, participants reaffirmed their commitment to deal effectively with the significant and growing problem posed by spam. WSIS Action Line C5 is dedicated to building confidence and security in the use of ICTs. Unless there is progress in building confidence and security in the use of ICTs, users' trust in the Internet may well diminish and this could limit its growth and transformational potential. However, one problem that all cybercrime and spam-fighters constantly face is that the criminal is always one step ahead. Developing countries are especially at risk when electronic networks are used for criminal purposes to harm the integrity of critical infrastructure within countries, as this further creates barriers to extending the benefits of ICTs.

The Report also reviews current implementation and progress in achieving the WSIS targets. During the WSIS, all stakeholders committed to remaining fully engaged to ensure implementation and follow-up of the outcomes of the WSIS, with multi-stakeholder partnerships a key aspect of the WSIS approach to implementation. The Report reviews some of the initiatives underway around the world to extend the benefits of ICTs to more people, new communities and different cultures. It highlights examples of practical projects being introduced by a range of stakeholders to build a diverse and inclusive Information Society, in which everyone can participate.

Information Society Statistics

Contents

NOTE: DATA TABLES 4-12 ARE AVAILABLE IN THE PRICED VERSION OF THIS PUBLICATION.

Introduction to the statistical annex

Data are presented for 181 economies with populations greater than 40'000 and where sufficient data are available to compile the Digital Opportunity Index.

Economies are grouped by geographic region: Africa, the Americas, Asia, Europe and Oceania. In Table 2 and the regional map, Oceania is shown as part of the Asia-Pacific region. Economies are shown in alphabetical order within each region in the tables. The data cover the public telecommunications sector. Due to differing regulatory obligations for the provision of data, a complete measurement of the sector for some economies cannot be achieved. Data for major telecommunication operators, covering at least 90 per cent of the market, are shown for all economies. More detailed information about coverage and country specific notes together with a full time-series from 1960, 1965, 1970, 1975-2004 is contained in the ITU World Telecommunication Indicators Database, available separately online or on CD-ROM.

Data refer to the reporting period that is closest to the end of year indicated. See Table A for the fiscal year reporting period used in each economy.

Telecommunication data are supplied by an annual questionnaire sent to telecommunication authorities and operating companies. These data are supplemented by annual reports and statistical yearbooks of telecommunication ministries, regulators, operators and industry associations. In some cases, estimates are derived from ITU background documents or other references; estimates are shown in italic. Pricing data are obtained from service provider websites and by correspondence with service providers. Demographic and macro-economic data are provided by the relevant international organizations identified in the Technical notes.

The signs and symbols below are used in the tables. The absence of any sign or symbol indicates that data are in units.

Comments and suggestions relating to the Digital Opportunity Index (Data Tables 1-4) and to price data (Data Tables 7, 9, 11) should be addressed to: SPUMail@itu.int.

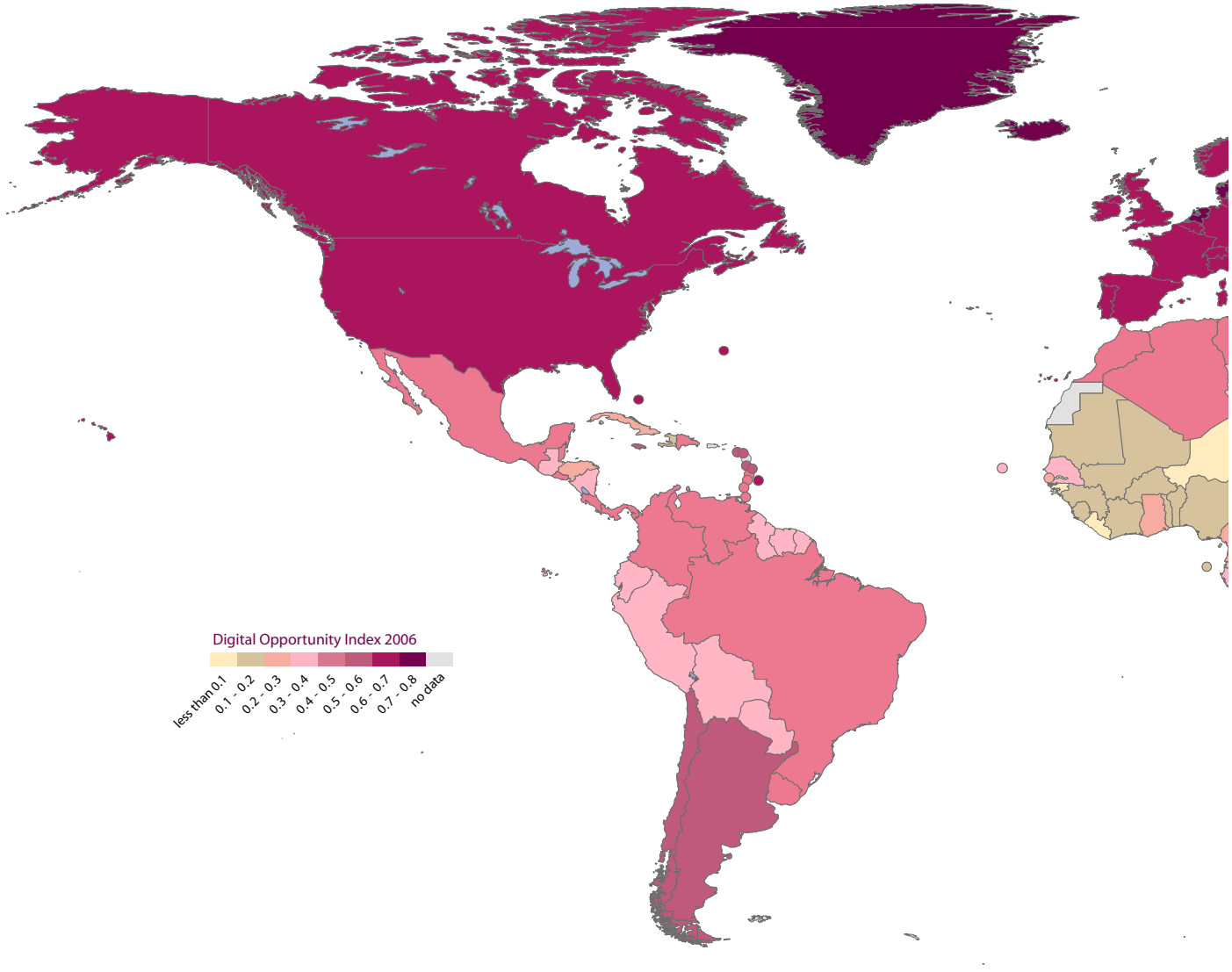
Comments and suggestions relating to the World Telecommunication Indicators (Data Tables 5, 6, 8, 10, 12) and the ICT Opportunity Index (Data Table 4) should be addressed to: indicators@itu.int.

Additional information about the Digital Opportunity Index can be found at: www.itu.int/doi.

Additional information about Telecommunication Indicators can be found at: www.itu.int/ITU-D/ict.

Italic	Year other than that specified or estimate.
k or 000s	Thousands (i.e., 1'000).
M	Millions (i.e., 1'000'000).
B	Billions (i.e., 1'000'000'000).
US$ or USD	United States dollars. See the Technical notes for how US$ figures are obtained.
%	Per cent.
_	Zero or a quantity less than half the unit shown. Also used for data items that are not applicable.
...	Data not available.
CAGR	Compound Annual Growth Rate. See the Technical notes for how this is computed.

Map of Digital Opportunity Worldwide, 2006



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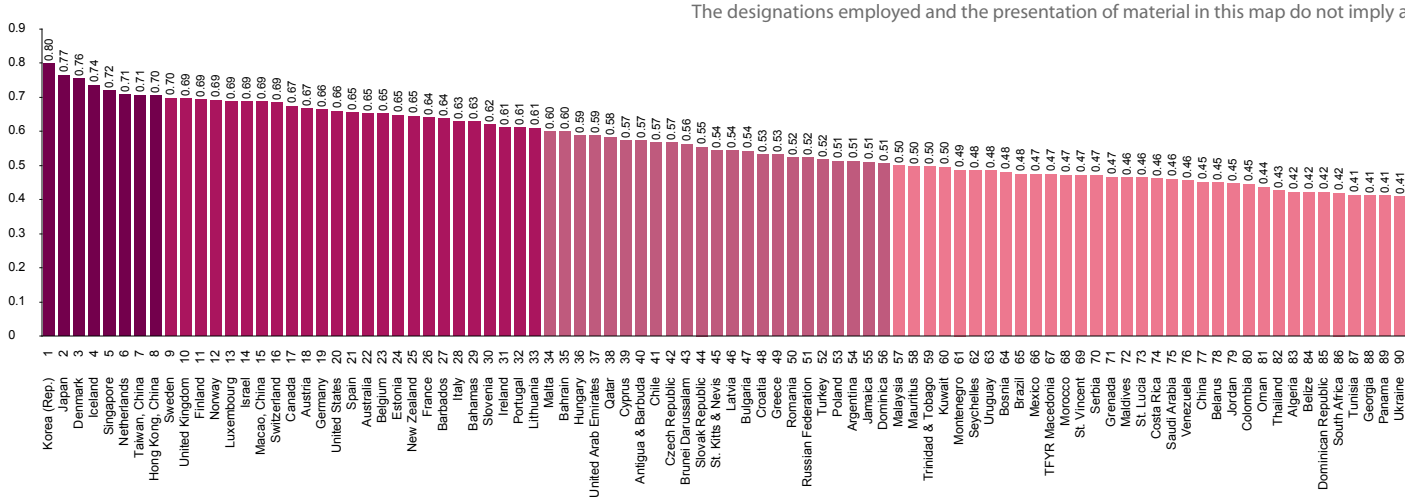
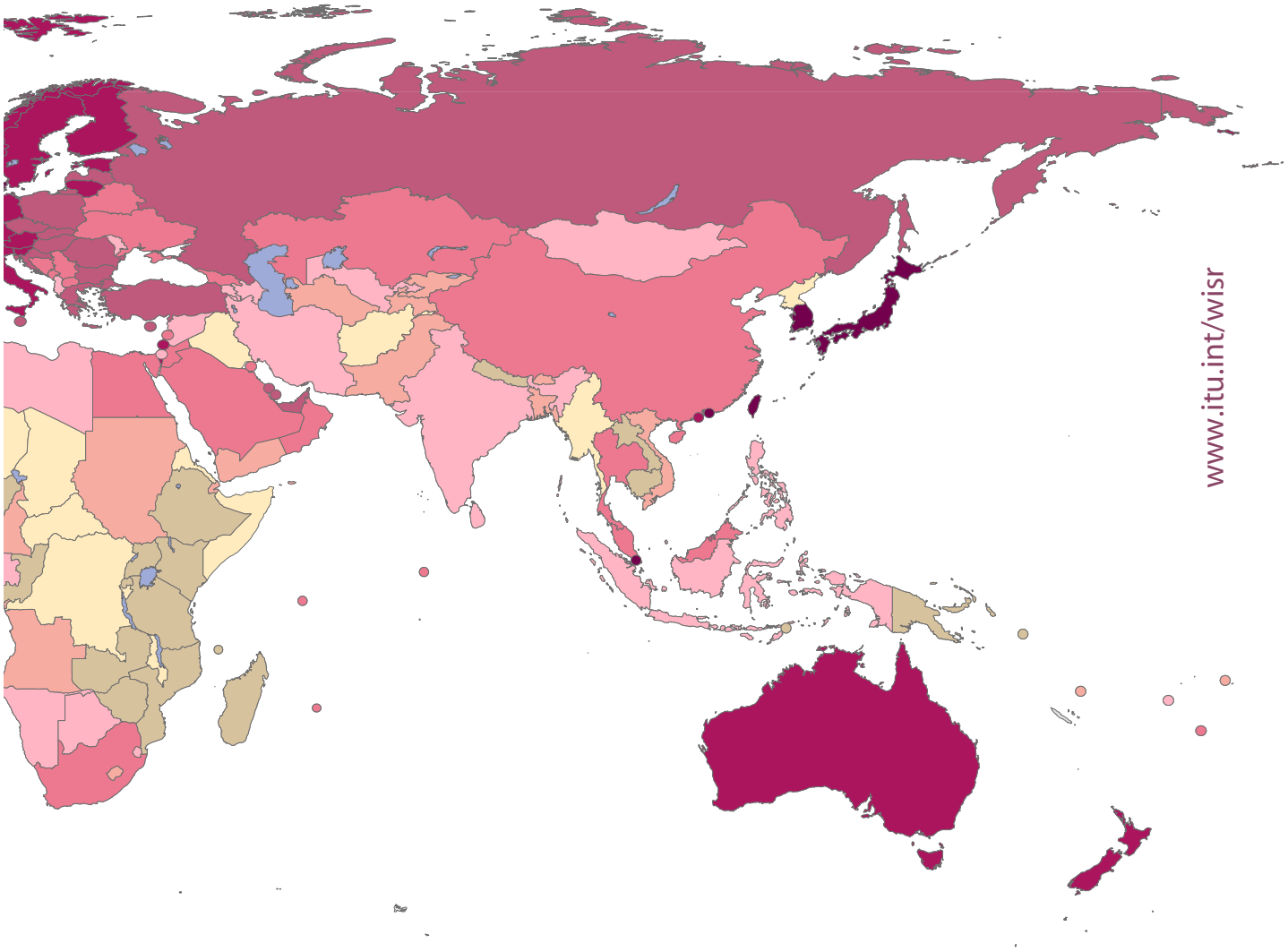


Source: ITU/UNCTAD/KADO Digital Opportunity Platform.



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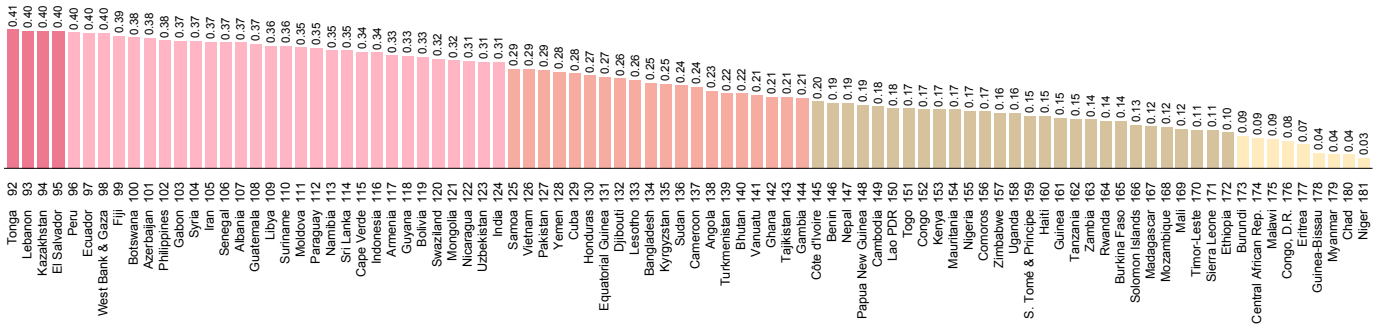


Table 1 Digital Opportunity Index 2005/06 – World

	Economy	Opportunity 2005/2006	Infrastructure 2005/2006	Utilization 2005/2006	Digital Opportunity Index 2005/2006	World Rank 2005/2006
1	Albania	0.91	0.18	0.01	**0.37**	107
2	Algeria	0.93	0.19	0.15	**0.42**	83
3	Angola	0.64	0.03	0.01	**0.23**	138
4	Antigua & Barbuda	0.94	0.49	0.30	**0.57**	40
5	Argentina	0.97	0.36	0.21	**0.51**	54
6	Armenia	0.79	0.17	0.03	**0.33**	117
7	Australia	0.98	0.64	0.32	**0.65**	22
8	Austria	0.99	0.59	0.41	**0.67**	18
9	Azerbaijan	0.93	0.17	0.03	**0.38**	101
10	Bahamas	0.97	0.51	0.40	**0.63**	29
11	Bahrain	0.99	0.57	0.24	**0.60**	35
12	Bangladesh	0.73	0.02	0.01	**0.25**	134
13	Barbados	0.97	0.50	0.44	**0.64**	27
14	Belarus	0.94	0.29	0.12	**0.45**	78
15	Belgium	0.99	0.53	0.43	**0.65**	23
16	Belize	0.76	0.20	0.31	**0.42**	84
17	Benin	0.52	0.03	0.03	**0.19**	146
18	Bhutan	0.61	0.04	0.01	**0.22**	140
19	Bolivia	0.79	0.12	0.07	**0.33**	119
20	Bosnia & Herzegovina	0.95	0.36	0.14	**0.48**	64
21	Botswana	0.93	0.15	0.08	**0.38**	100
22	Brazil	0.92	0.27	0.24	**0.48**	65
23	Brunei Darussalam	0.93	0.50	0.26	**0.56**	43
24	Bulgaria	0.97	0.40	0.26	**0.54**	47
25	Burkina Faso	0.38	0.03	0.01	**0.14**	165
26	Burundi	0.27	0.01	0.00	**0.09**	173
27	Cambodia	0.49	0.03	0.02	**0.18**	149
28	Cameroon	0.66	0.04	0.01	**0.24**	137
29	Canada	0.98	0.57	0.48	**0.67**	17
30	Cape Verde	0.79	0.16	0.07	**0.34**	115
31	Central African Republic	0.25	0.01	0.00	**0.09**	174
32	Chad	0.11	0.01	0.00	**0.04**	180
33	Chile	0.97	0.36	0.37	**0.57**	41
34	China	0.92	0.28	0.16	**0.45**	77
35	Colombia	0.89	0.25	0.19	**0.45**	80
36	Comoros	0.47	0.03	0.00	**0.17**	156
37	Congo (Republic of)	0.48	0.04	0.00	**0.17**	152
38	Costa Rica	0.89	0.27	0.23	**0.46**	74
39	Côte d'Ivoire	0.43	0.06	0.09	**0.20**	145
40	Croatia	0.98	0.47	0.14	**0.53**	48
41	Cuba	0.78	0.05	0.01	**0.28**	129
42	Cyprus	0.99	0.54	0.19	**0.57**	39
43	Czech Republic	0.98	0.43	0.29	**0.57**	42
44	D.R. Congo	0.22	0.02	0.00	**0.08**	176
45	Denmark	0.99	0.84	0.43	**0.76**	3
46	Djibouti	0.74	0.05	0.01	**0.26**	132
47	Dominica	0.91	0.34	0.26	**0.51**	56

	Economy	Opportunity 2005/2006	Infrastructure 2005/2006	Utilization 2005/2006	**Digital Opportunity Index 2005/2006**	World Rank 2005/2006
48	Dominican Republic	0.92	0.16	0.18	**0.42**	85
49	Ecuador	0.89	0.21	0.08	**0.40**	97
50	Egypt	0.96	0.22	0.04	**0.41**	91
51	El Salvador	0.89	0.17	0.14	**0.40**	95
52	Equatorial Guinea	0.73	0.07	0.01	**0.27**	131
53	Eritrea	0.19	0.01	0.00	**0.07**	177
54	Estonia	0.99	0.50	0.45	**0.65**	24
55	Ethiopia	0.30	0.01	0.00	**0.10**	172
56	Fiji	0.79	0.16	0.21	**0.39**	99
57	Finland	0.99	0.65	0.44	**0.69**	11
58	France	0.99	0.53	0.40	**0.64**	26
59	Gabon	0.92	0.13	0.07	**0.37**	103
60	Gambia	0.53	0.08	0.01	**0.21**	144
61	Georgia	0.94	0.14	0.15	**0.41**	88
62	Germany	0.99	0.66	0.34	**0.66**	19
63	Ghana	0.56	0.04	0.03	**0.21**	142
64	Greece	0.99	0.49	0.11	**0.53**	49
65	Grenada	0.93	0.35	0.11	**0.47**	71
66	Guatemala	0.84	0.14	0.11	**0.37**	108
67	Guinea	0.43	0.01	0.00	**0.15**	161
68	Guinea-Bissau	0.10	0.03	0.01	**0.04**	178
69	Guyana	0.72	0.21	0.06	**0.33**	118
70	Haiti	0.43	0.03	0.01	**0.15**	160
71	Honduras	0.72	0.09	0.01	**0.27**	130
72	Hong Kong, China	1.00	0.71	0.40	**0.70**	8
73	Hungary	0.99	0.45	0.32	**0.59**	36
74	Iceland	0.99	0.73	0.49	**0.74**	4
75	India	0.83	0.05	0.05	**0.31**	124
76	Indonesia	0.90	0.09	0.03	**0.34**	116
77	Iran (I.R.)	0.89	0.18	0.04	**0.37**	105
78	Ireland	0.99	0.62	0.22	**0.61**	31
79	Israel	0.98	0.60	0.48	**0.69**	14
80	Italy	0.99	0.56	0.34	**0.63**	28
81	Jamaica	0.93	0.32	0.27	**0.51**	55
82	Japan	0.99	0.73	0.58	**0.77**	2
83	Jordan	0.96	0.26	0.12	**0.45**	79
84	Kazakhstan	0.95	0.22	0.04	**0.40**	94
85	Kenya	0.46	0.05	0.01	**0.17**	153
86	Korea (Rep.)	0.99	0.74	0.67	**0.80**	1
87	Kuwait	0.99	0.42	0.07	**0.50**	60
88	Kyrgyzstan	0.57	0.10	0.06	**0.25**	135
89	Lao P.D.R.	0.47	0.04	0.02	**0.18**	150
90	Latvia	0.98	0.42	0.23	**0.54**	46
91	Lebanon	0.96	0.19	0.05	**0.40**	93
92	Lesotho	0.71	0.05	0.01	**0.26**	133
93	Libya	0.93	0.13	0.02	**0.36**	109
94	Lithuania	0.99	0.46	0.38	**0.61**	33
95	Luxembourg	0.99	0.69	0.39	**0.69**	13
96	Macao, China	1.00	0.69	0.37	**0.69**	15

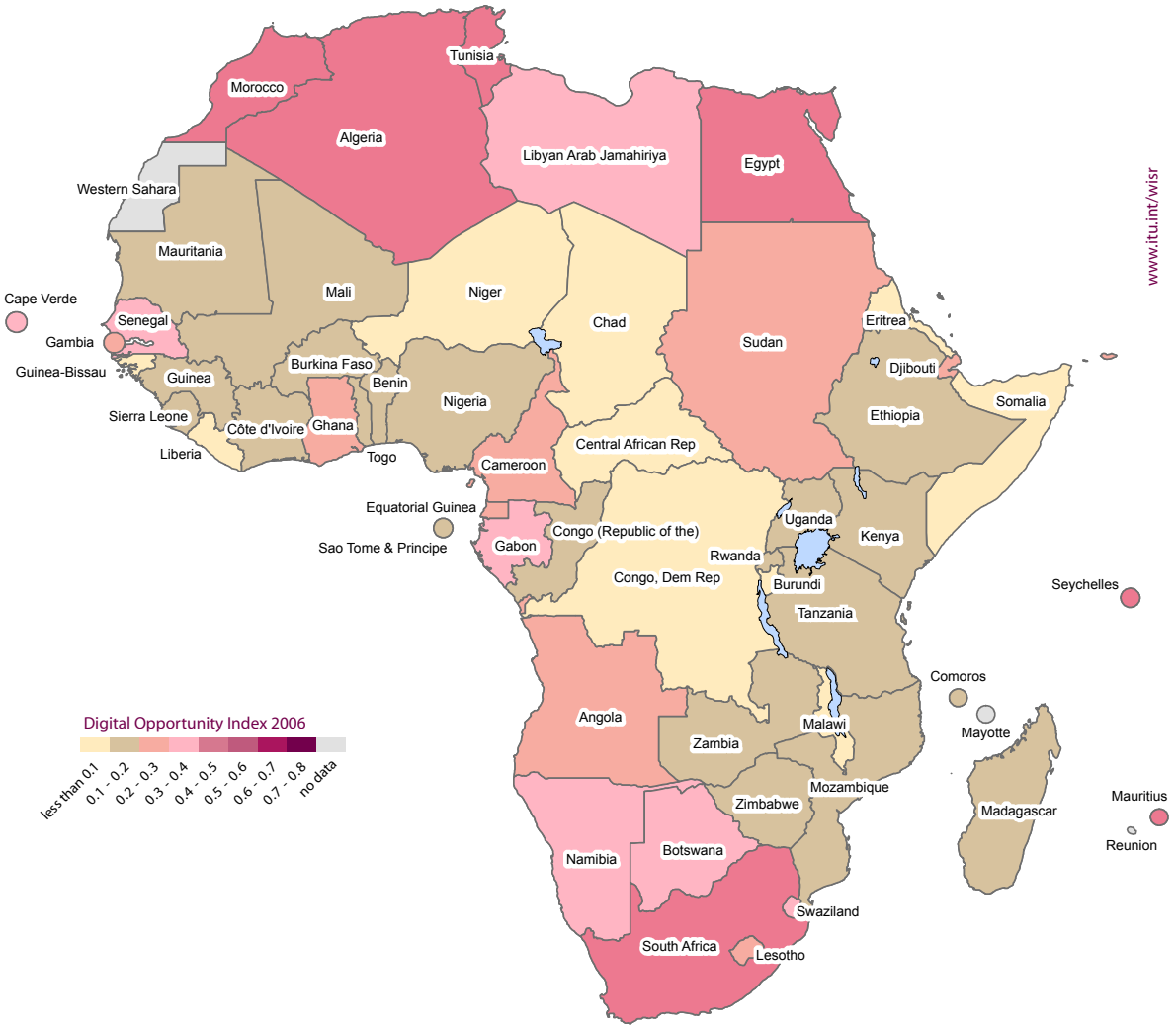
	Economy	Opportunity 2005/2006	Infrastructure 2005/2006	Utilization 2005/2006	**Digital Opportunity Index 2005/2006**	World Rank 2005/2006
97	Madagascar	0.35	0.02	0.00	**0.12**	167
98	Malawi	0.23	0.01	0.01	**0.09**	175
99	Malaysia	0.98	0.34	0.18	**0.50**	57
100	Maldives	0.89	0.27	0.23	**0.46**	72
101	Mali	0.33	0.02	0.00	**0.12**	169
102	Malta	0.99	0.55	0.25	**0.60**	34
103	Mauritania	0.46	0.06	0.00	**0.17**	154
104	Mauritius	0.98	0.43	0.09	**0.50**	58
105	Mexico	0.94	0.24	0.25	**0.47**	66
106	Moldova	0.76	0.20	0.11	**0.35**	111
107	Mongolia	0.76	0.11	0.08	**0.32**	121
108	Montenegro	0.97	0.41	0.08	**0.49**	61
109	Morocco	0.89	0.16	0.37	**0.47**	68
110	Mozambique	0.33	0.02	0.01	**0.12**	168
111	Myanmar	0.10	0.01	0.01	**0.04**	179
112	Namibia	0.88	0.14	0.02	**0.35**	113
113	Nepal	0.56	0.02	0.00	**0.19**	147
114	Netherlands	1.00	0.72	0.41	**0.71**	6
115	New Zealand	0.98	0.67	0.29	**0.65**	25
116	Nicaragua	0.64	0.08	0.22	**0.31**	122
117	Niger	0.06	0.01	0.02	**0.03**	181
118	Nigeria	0.45	0.05	0.01	**0.17**	155
119	Norway	1.00	0.66	0.41	**0.69**	12
120	Oman	0.98	0.28	0.05	**0.44**	81
121	Pakistan	0.76	0.07	0.03	**0.29**	127
122	Palestine	0.90	0.23	0.05	**0.40**	98
123	Panama	0.91	0.22	0.10	**0.41**	89
124	Papua New Guinea	0.53	0.02	0.01	**0.19**	148
125	Paraguay	0.86	0.11	0.08	**0.35**	112
126	Peru	0.82	0.12	0.27	**0.40**	96
127	Philippines	0.93	0.15	0.04	**0.38**	102
128	Poland	0.98	0.42	0.13	**0.51**	53
129	Portugal	0.98	0.49	0.36	**0.61**	32
130	Qatar	0.98	0.55	0.22	**0.58**	38
131	Romania	0.96	0.31	0.30	**0.52**	50
132	Russian Federation	0.97	0.37	0.23	**0.52**	51
133	Rwanda	0.40	0.01	0.01	**0.14**	164
134	S.Tomé & Principe	0.38	0.06	0.03	**0.15**	159
135	Samoa	0.75	0.10	0.02	**0.29**	125
136	Saudi Arabia	0.96	0.35	0.06	**0.46**	75
137	Senegal	0.73	0.07	0.31	**0.37**	106
138	Serbia	0.96	0.39	0.06	**0.47**	70
139	Seychelles	0.96	0.35	0.14	**0.48**	62
140	Sierra Leone	0.32	0.02	0.00	**0.11**	171
141	Singapore	1.00	0.71	0.45	**0.72**	5
142	Slovak Republic	0.98	0.41	0.26	**0.55**	44
143	Slovenia	0.99	0.55	0.32	**0.62**	30
144	Solomon Islands	0.27	0.02	0.08	**0.13**	166
145	South Africa	0.94	0.24	0.08	**0.42**	86

	Economy	Opportunity 2005/2006	Infrastructure 2005/2006	Utilization 2005/2006	**Digital Opportunity Index 2005/2006**	World Rank 2005/2006
146	Spain	0.99	0.59	0.39	**0.65**	21
147	Sri Lanka	0.90	0.08	0.05	**0.35**	114
148	St. Kitts & Nevis	0.93	0.44	0.26	**0.54**	45
149	St. Lucia	0.94	0.32	0.14	**0.46**	73
150	St. Vincent	0.89	0.23	0.29	**0.47**	69
151	Sudan	0.66	0.04	0.02	**0.24**	136
152	Suriname	0.72	0.28	0.07	**0.36**	110
153	Swaziland	0.85	0.10	0.02	**0.32**	120
154	Sweden	0.99	0.72	0.38	**0.70**	9
155	Switzerland	0.99	0.66	0.40	**0.69**	16
156	Syria	0.92	0.17	0.02	**0.37**	104
157	Taiwan, China	0.99	0.75	0.38	**0.71**	7
158	Tajikistan	0.57	0.05	0.01	**0.21**	143
159	Tanzania	0.41	0.03	0.00	**0.15**	162
160	TFYR Macedonia	0.93	0.39	0.10	**0.47**	67
161	Thailand	0.95	0.21	0.12	**0.43**	82
162	Timor-Leste	0.32	0.01	0.00	**0.11**	170
163	Togo	0.46	0.03	0.03	**0.17**	151
164	Tonga	0.94	0.14	0.14	**0.41**	92
165	Trinidad & Tobago	0.98	0.39	0.13	**0.50**	59
166	Tunisia	0.97	0.20	0.07	**0.41**	87
167	Turkey	0.97	0.31	0.27	**0.52**	52
168	Turkmenistan	0.58	0.08	0.00	**0.22**	139
169	Uganda	0.46	0.02	0.01	**0.16**	158
170	Ukraine	0.94	0.25	0.04	**0.41**	90
171	United Arab Emirates	0.99	0.56	0.21	**0.59**	37
172	United Kingdom	0.99	0.70	0.39	**0.69**	10
173	United States	0.98	0.59	0.41	**0.66**	20
174	Uruguay	0.97	0.31	0.18	**0.48**	63
175	Uzbekistan	0.84	0.07	0.03	**0.31**	123
176	Vanuatu	0.57	0.04	0.03	**0.21**	141
177	Venezuela	0.92	0.22	0.23	**0.46**	76
178	Vietnam	0.73	0.07	0.07	**0.29**	126
179	Yemen	0.78	0.06	0.00	**0.28**	128
180	Zambia	0.40	0.03	0.00	**0.14**	163
181	Zimbabwe	0.37	0.06	0.06	**0.16**	157
	WORLD average	**0.79**	**0.26**	**0.15**	**0.40**	**91**
	Africa average (see Table 2a)	0.55	0.08	0.04	**0.22**	140
	Americas average (see Table 2b)	0.87	0.27	0.20	**0.45**	78
	Asia-Pacific average (see Table 2c)	0.82	0.26	0.14	**0.40**	92
	Europe average (see Table 2d)	0.97	0.50	0.28	**0.58**	39

Note:
For data comparability and coverage, see the technical notes.

Source:
ITU/UNCTAD/KADO Digital Opportunity Platform.

Digital Opportunity in Africa, 2006



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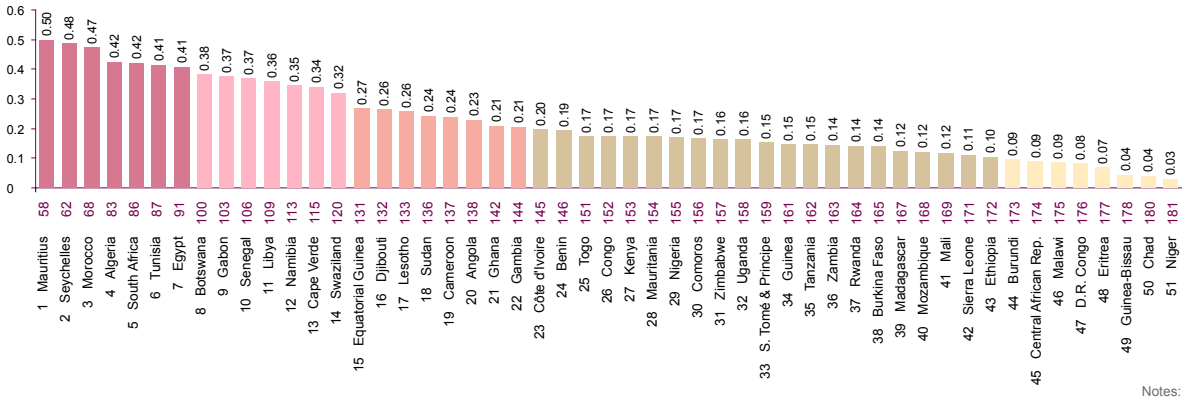
Overall Digital Opportunity Index scores, 2006



Notes:
1) higher score means better digital opportunity
2) numbers in purple show world ranks

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

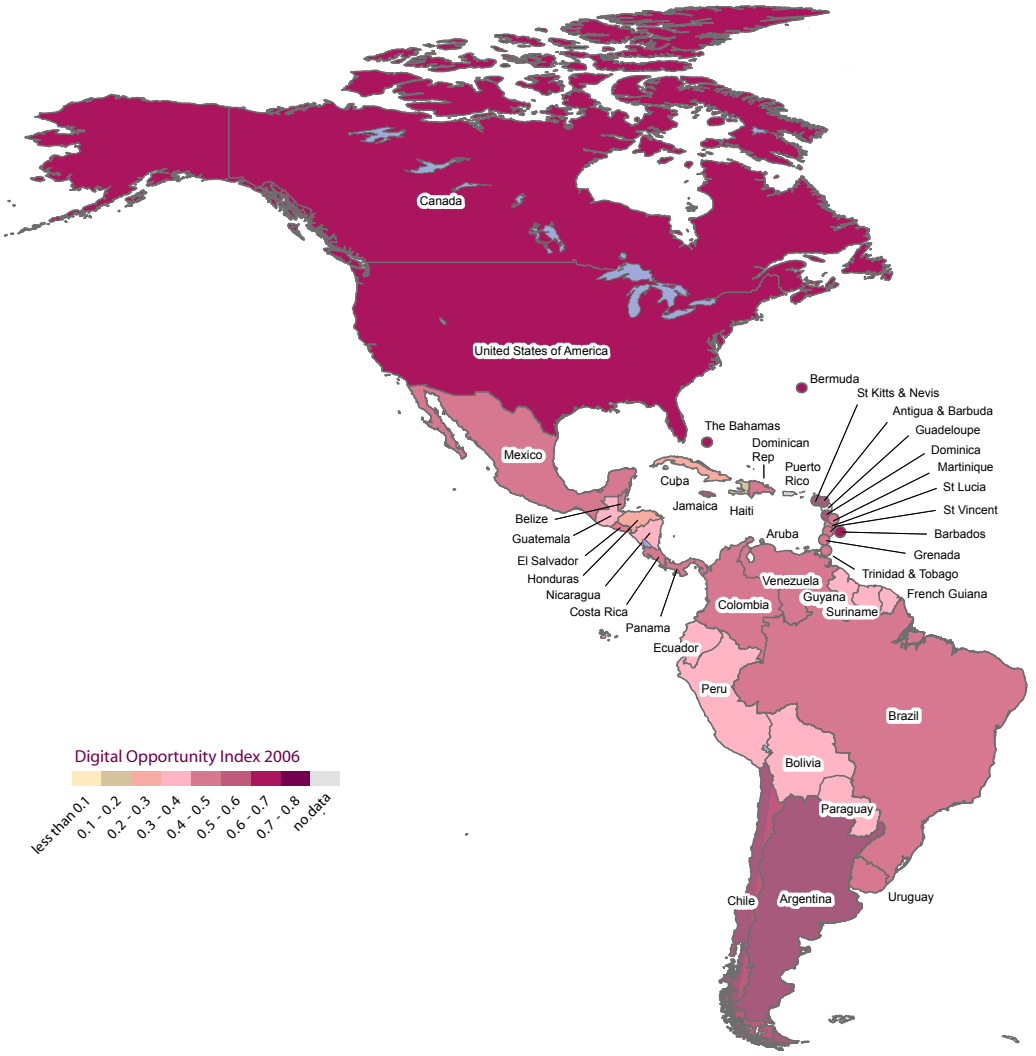
Table 2a Digital Opportunity Index 2005/06 – Africa

Rank in Africa 2005/2006	Economy	Opportunity 2005/2006	Infrastructure 2005/2006	Utilization 2005/2006	**Digital Opportunity Index 2005/2006**	World Rank 2006/2006
1	Mauritius	0.98	0.43	0.09	**0.50**	58
2	Seychelles	0.96	0.35	0.14	**0.48**	62
3	Morocco	0.89	0.16	0.37	**0.47**	68
4	Algeria	0.93	0.19	0.15	**0.42**	83
5	South Africa	0.94	0.24	0.08	**0.42**	86
6	Tunisia	0.97	0.20	0.07	**0.41**	87
7	Egypt	0.96	0.22	0.04	**0.41**	91
8	Botswana	0.93	0.15	0.08	**0.38**	100
9	Gabon	0.92	0.13	0.07	**0.37**	103
10	Senegal	0.73	0.07	0.31	**0.37**	106
11	Libya	0.93	0.13	0.02	**0.36**	109
12	Namibia	0.88	0.14	0.02	**0.35**	113
13	Cape Verde	0.79	0.16	0.07	**0.34**	115
14	Swaziland	0.85	0.10	0.02	**0.32**	120
15	Equatorial Guinea	0.73	0.07	0.01	**0.27**	131
16	Djibouti	0.74	0.05	0.01	**0.26**	132
17	Lesotho	0.71	0.05	0.01	**0.26**	133
18	Sudan	0.66	0.04	0.02	**0.24**	136
19	Cameroon	0.66	0.04	0.01	**0.24**	137
20	Angola	0.64	0.03	0.01	**0.23**	138
21	Ghana	0.56	0.04	0.03	**0.21**	142
22	Gambia	0.53	0.08	0.01	**0.21**	144
23	Côte d'Ivoire	0.43	0.06	0.09	**0.20**	145
24	Benin	0.52	0.03	0.03	**0.19**	146
25	Togo	0.46	0.03	0.03	**0.17**	151
26	Congo (Republic of)	0.48	0.04	0.00	**0.17**	152
27	Kenya	0.46	0.05	0.01	**0.17**	153
28	Mauritania	0.46	0.06	0.00	**0.17**	154
29	Nigeria	0.45	0.05	0.01	**0.17**	155
30	Comoros	0.47	0.03	0.00	**0.17**	156
31	Zimbabwe	0.37	0.06	0.06	**0.16**	157
32	Uganda	0.46	0.02	0.01	**0.16**	158
33	S. Tomé & Principe	0.38	0.06	0.03	**0.15**	159
34	Guinea	0.43	0.01	0.00	**0.15**	161
35	Tanzania	0.41	0.03	0.00	**0.15**	162
36	Zambia	0.40	0.03	0.00	**0.14**	163
37	Rwanda	0.40	0.01	0.01	**0.14**	164
38	Burkina Faso	0.38	0.03	0.01	**0.14**	165
39	Madagascar	0.35	0.02	0.00	**0.12**	167
40	Mozambique	0.33	0.02	0.01	**0.12**	168
41	Mali	0.33	0.02	0.00	**0.12**	169
42	Sierra Leone	0.32	0.02	0.00	**0.11**	171
43	Ethiopia	0.30	0.01	0.00	**0.10**	172
44	Burundi	0.27	0.01	0.00	**0.09**	173
45	Central African Republic	0.25	0.01	0.00	**0.09**	174
46	Malawi	0.23	0.01	0.01	**0.09**	175
47	D.R. Congo	0.22	0.02	0.00	**0.08**	176
48	Eritrea	0.19	0.01	0.00	**0.07**	177
49	Guinea-Bissau	0.10	0.03	0.01	**0.04**	178
50	Chad	0.11	0.01	0.00	**0.04**	180
51	Niger	0.06	0.01	0.02	**0.03**	181
	Africa	**0.55**	**0.08**	**0.04**	0.22	**140**

Note: For data comparability and coverage, see the technical notes.

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Digital Opportunity in the Americas, 2006



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Overall Digital Opportunity Index scores, 2006

Notes:
1) higher score means better digital opportunity
2) numbers in purple show world ranks

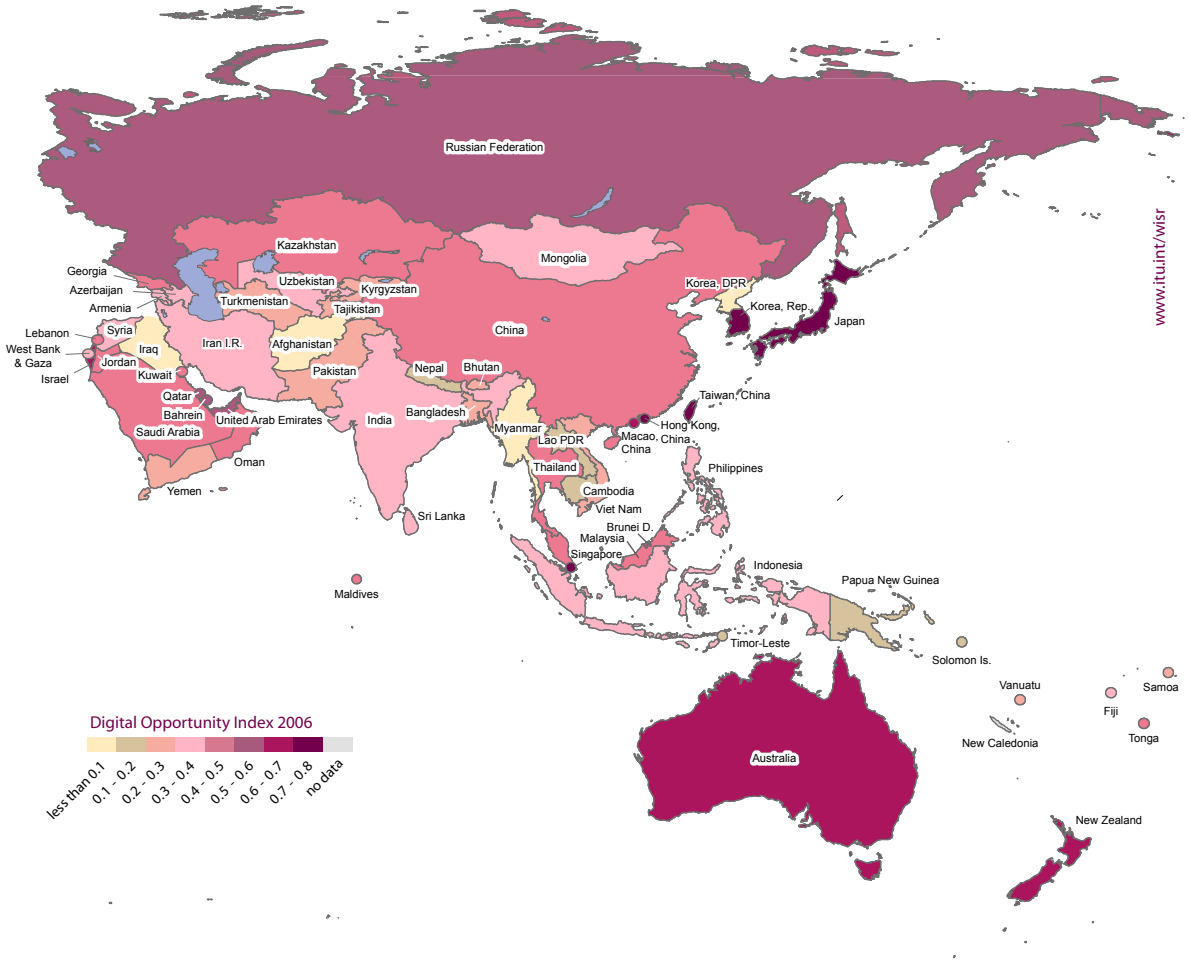
Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Table 2b Digital Opportunity Index 2005/06 – Americas

Rank in Americas 2005/2006	Economy	Opportunity 2005/2006	Infrastructure 2005/2006	Utilization 2005/2006	**Digital Opportunity Index 2005/2006**	World Rank 2005/2006
1	Canada	0.98	0.57	0.48	**0.67**	17
2	United States	0.98	0.59	0.41	**0.66**	20
3	Barbados	0.97	0.50	0.44	**0.64**	27
4	Bahamas	0.97	0.51	0.40	**0.63**	29
5	Antigua & Barbuda	0.94	0.49	0.30	**0.57**	40
6	Chile	0.97	0.36	0.37	**0.57**	41
7	St. Kitts & Nevis	0.93	0.44	0.26	**0.54**	45
8	Argentina	0.97	0.36	0.21	**0.51**	54
9	Jamaica	0.93	0.32	0.27	**0.51**	55
10	Dominica	0.91	0.34	0.26	**0.51**	56
11	Trinidad & Tobago	0.98	0.39	0.13	**0.50**	59
12	Uruguay	0.97	0.31	0.18	**0.48**	63
13	Brazil	0.92	0.27	0.24	**0.48**	65
14	Mexico	0.94	0.24	0.25	**0.47**	66
15	St. Vincent	0.89	0.23	0.29	**0.47**	69
16	Grenada	0.93	0.35	0.11	**0.47**	71
17	St. Lucia	0.94	0.32	0.14	**0.46**	73
18	Costa Rica	0.89	0.27	0.23	**0.46**	74
19	Venezuela	0.92	0.22	0.23	**0.46**	76
20	Colombia	0.89	0.25	0.19	**0.45**	80
21	Belize	0.76	0.20	0.31	**0.42**	84
22	Dominican Republic	0.92	0.16	0.18	**0.42**	85
23	Panama	0.91	0.22	0.10	**0.41**	89
24	El Salvador	0.89	0.17	0.14	**0.40**	95
25	Peru	0.82	0.12	0.27	**0.40**	96
26	Ecuador	0.89	0.21	0.08	**0.40**	97
27	Guatemala	0.84	0.14	0.11	**0.37**	108
28	Suriname	0.72	0.28	0.07	**0.36**	110
29	Paraguay	0.86	0.11	0.08	**0.35**	112
30	Guyana	0.72	0.21	0.06	**0.33**	118
31	Bolivia	0.79	0.12	0.07	**0.33**	119
32	Nicaragua	0.64	0.08	0.22	**0.31**	122
33	Cuba	0.78	0.05	0.01	**0.28**	129
34	Honduras	0.72	0.09	0.01	**0.27**	130
35	Haiti	0.43	0.03	0.01	**0.15**	160
	America	**0.87**	**0.27**	**0.20**	0.45	**78**

Note: For data comparability and coverage, see the technical notes.
Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Digital Opportunity in Asia-Pacific, 2006



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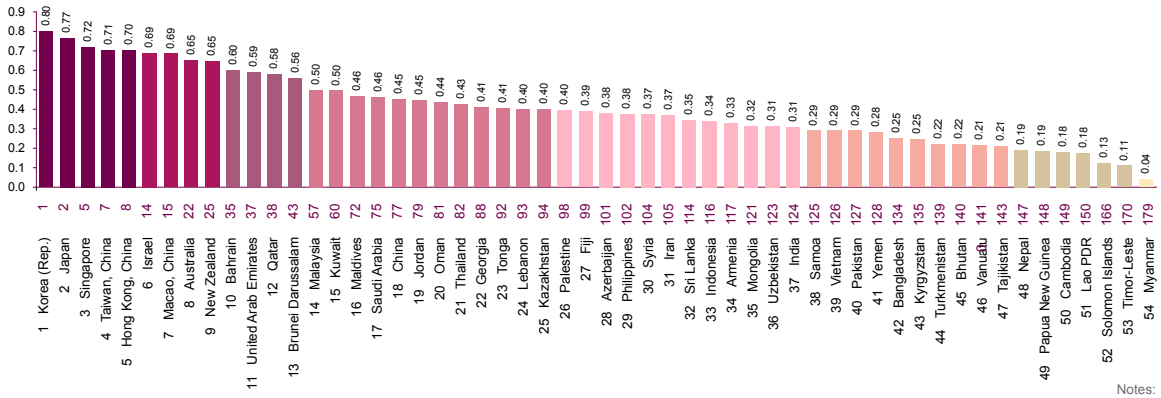
Overall Digital Opportunity Index scores, 2006



Notes:
1) higher score means better digital opportunity
2) numbers in purple show world ranks

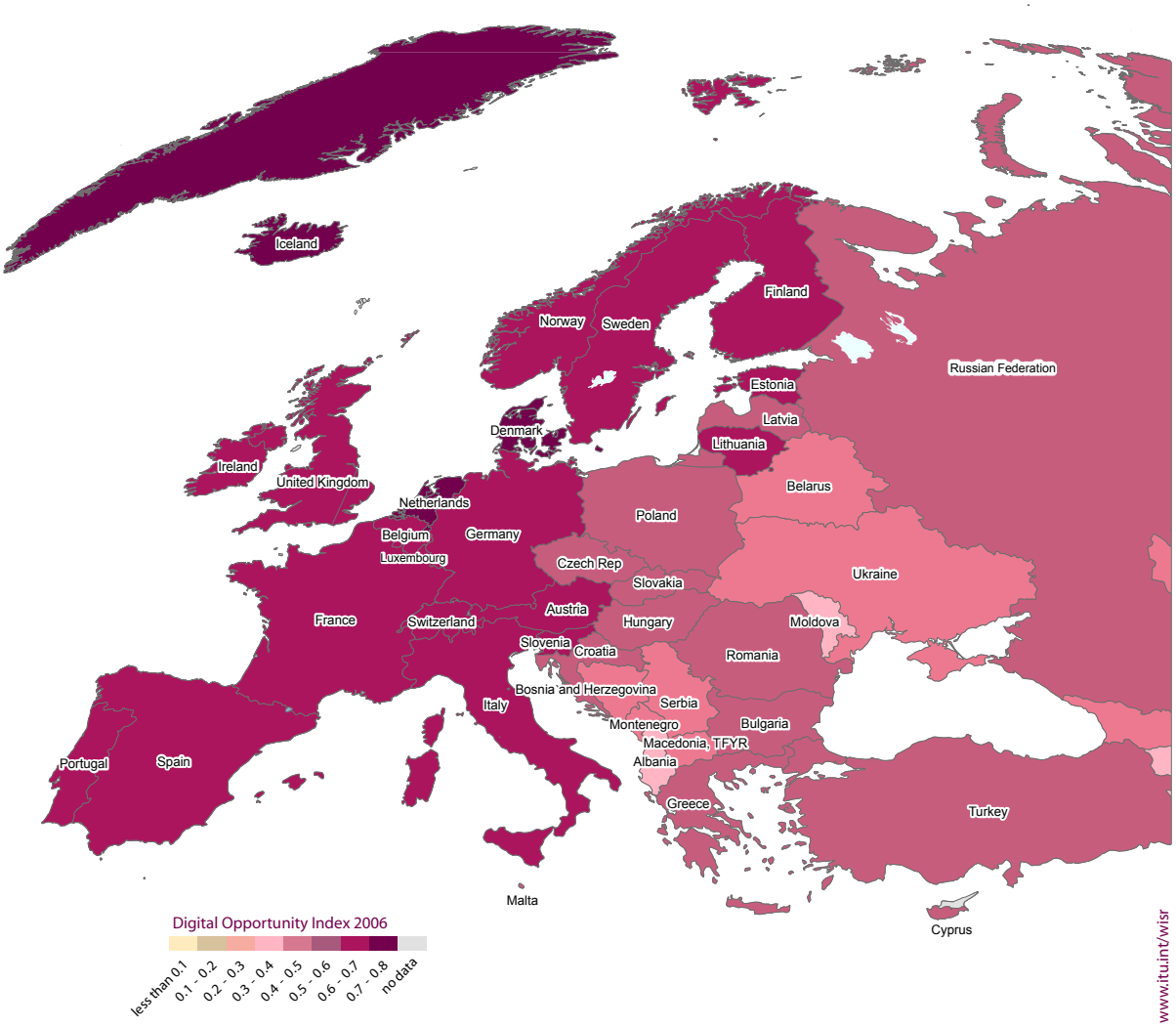
Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Table 2c Digital Opportunity Index 2005/06 – Asia-Pacific

Rank in Asia-Pacific 05/06	Economy	Opportunity 2005/2006	Infrastructure 2005/2006	Utilization 2005/2006	**Digital Opportunity Index 2005/2006**	World Rank 2005/2006
1	Korea (Rep.)	0.99	0.74	0.67	**0.80**	1
2	Japan	0.99	0.73	0.58	**0.77**	2
3	Singapore	1.00	0.71	0.45	**0.72**	5
4	Taiwan, China	0.99	0.75	0.38	**0.71**	7
5	Hong Kong, China	1.00	0.71	0.40	**0.70**	8
6	Israel	0.98	0.60	0.48	**0.69**	14
7	Macao, China	1.00	0.69	0.37	**0.69**	15
8	Australia	0.98	0.64	0.32	**0.65**	22
9	New Zealand	0.98	0.67	0.29	**0.65**	25
10	Bahrain	0.99	0.57	0.24	**0.60**	35
11	United Arab Emirates	0.99	0.56	0.21	**0.59**	37
12	Qatar	0.98	0.55	0.22	**0.58**	38
13	Brunei Darussalam	0.93	0.50	0.26	**0.56**	43
14	Malaysia	0.98	0.34	0.18	**0.50**	57
15	Kuwait	0.99	0.42	0.07	**0.50**	60
16	Maldives	0.89	0.27	0.23	**0.46**	72
17	Saudi Arabia	0.96	0.35	0.06	**0.46**	75
18	China	0.92	0.28	0.16	**0.45**	77
19	Jordan	0.96	0.26	0.12	**0.45**	79
20	Oman	0.98	0.28	0.05	**0.44**	81
21	Thailand	0.95	0.21	0.12	**0.43**	82
22	Georgia	0.94	0.14	0.15	**0.41**	88
23	Tonga	0.94	0.14	0.14	**0.41**	92
24	Lebanon	0.96	0.19	0.05	**0.40**	93
25	Kazakhstan	0.95	0.22	0.04	**0.40**	94
26	Palestine	0.90	0.23	0.05	**0.40**	98
27	Fiji	0.79	0.16	0.21	**0.39**	99
28	Azerbaijan	0.93	0.17	0.03	**0.38**	101
29	Philippines	0.93	0.15	0.04	**0.38**	102
30	Syria	0.92	0.17	0.02	**0.37**	104
31	Iran (I.R.)	0.89	0.18	0.04	**0.37**	105
32	Sri Lanka	0.90	0.08	0.05	**0.35**	114
33	Indonesia	0.90	0.09	0.03	**0.34**	116
34	Armenia	0.79	0.17	0.03	**0.33**	117
35	Mongolia	0.76	0.11	0.08	**0.32**	121
36	Uzbekistan	0.84	0.07	0.03	**0.31**	123
37	India	0.83	0.05	0.05	**0.31**	124
38	Samoa	0.75	0.10	0.02	**0.29**	125
39	Vietnam	0.73	0.07	0.07	**0.29**	126
40	Pakistan	0.76	0.07	0.03	**0.29**	127
41	Yemen	0.78	0.06	0.00	**0.28**	128
42	Bangladesh	0.73	0.02	0.01	**0.25**	134
43	Kyrgyzstan	0.57	0.10	0.06	**0.25**	135
44	Turkmenistan	0.58	0.08	0.00	**0.22**	139
45	Bhutan	0.61	0.04	0.01	**0.22**	140
46	Vanuatu	0.57	0.04	0.03	**0.21**	141
47	Tajikistan	0.57	0.05	0.01	**0.21**	143
48	Nepal	0.56	0.02	0.00	**0.19**	147
49	Papua New Guinea	0.53	0.02	0.01	**0.19**	148
50	Cambodia	0.49	0.03	0.02	**0.18**	149
51	Lao PDR	0.47	0.04	0.02	**0.18**	150
52	Solomon Islands	0.27	0.02	0.08	**0.13**	166
53	Timor-Leste	0.32	0.01	0.00	**0.11**	170
54	Myanmar	0.10	0.01	0.01	**0.04**	179
	Asia-Pacific	**0.82**	**0.26**	**0.14**	0.40	**92**

Note: For data comparability and coverage, see the technical notes. Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Digital Opportunity in Europe, 2006



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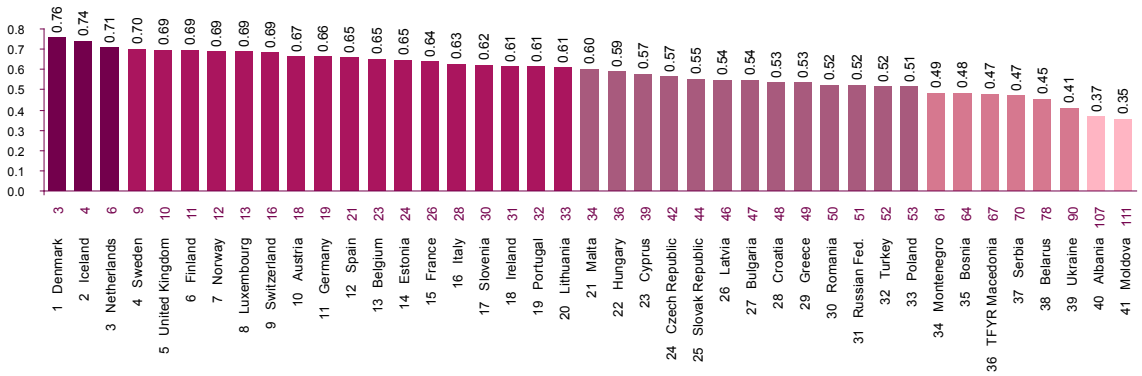
Overall Digital Opportunity Index scores, 2006



Notes:
1) higher score means better digital opportunity
2) numbers in purple show world ranks

Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Table 2d Digital Opportunity Index 2005/06 – Europe

Rank in Europe 2005/2006	Economy	Opportunity 2005/2006	Infrastructure 2005/2006	Utilization 2005/2006	**Digital Opportunity Index 2005/2006**	World Rank 2005/2006
1	Denmark	0.99	0.84	0.43	**0.76**	3
2	Iceland	0.99	0.73	0.49	**0.74**	4
3	Netherlands	1.00	0.72	0.41	**0.71**	6
4	Sweden	0.99	0.72	0.38	**0.70**	9
5	United Kingdom	0.99	0.70	0.39	**0.69**	10
6	Finland	0.99	0.65	0.44	**0.69**	11
7	Norway	1.00	0.66	0.41	**0.69**	12
8	Luxembourg	0.99	0.69	0.39	**0.69**	13
9	Switzerland	0.99	0.66	0.40	**0.69**	16
10	Austria	0.99	0.59	0.41	**0.67**	18
11	Germany	0.99	0.66	0.34	**0.66**	19
12	Spain	0.99	0.59	0.39	**0.65**	21
13	Belgium	0.99	0.53	0.43	**0.65**	23
14	Estonia	0.99	0.50	0.45	**0.65**	24
15	France	0.99	0.53	0.40	**0.64**	26
16	Italy	0.99	0.56	0.34	**0.63**	28
17	Slovenia	0.99	0.55	0.32	**0.62**	30
18	Ireland	0.99	0.62	0.22	**0.61**	31
19	Portugal	0.98	0.49	0.36	**0.61**	32
20	Lithuania	0.99	0.46	0.38	**0.61**	33
21	Malta	0.99	0.55	0.25	**0.60**	34
22	Hungary	0.99	0.45	0.32	**0.59**	36
23	Cyprus	0.99	0.54	0.19	**0.57**	39
24	Czech Republic	0.98	0.43	0.29	**0.57**	42
25	Slovak Republic	0.98	0.41	0.26	**0.55**	44
26	Latvia	0.98	0.42	0.23	**0.54**	46
27	Bulgaria	0.97	0.40	0.26	**0.54**	47
28	Croatia	0.98	0.47	0.14	**0.53**	48
29	Greece	0.99	0.49	0.11	**0.53**	49
30	Romania	0.96	0.31	0.30	**0.52**	50
31	Russian Federation	0.97	0.37	0.23	**0.52**	51
32	Turkey	0.97	0.31	0.27	**0.52**	52
33	Poland	0.98	0.42	0.13	**0.51**	53
34	Montenegro	0.97	0.41	0.08	**0.49**	61
35	Bosnia	0.95	0.36	0.14	**0.48**	64
36	TFYR Macedonia	0.93	0.39	0.10	**0.47**	67
37	Serbia	0.96	0.39	0.06	**0.47**	70
38	Belarus	0.94	0.29	0.12	**0.45**	78
39	Ukraine	0.94	0.25	0.04	**0.41**	90
40	Albania	0.91	0.18	0.01	**0.37**	107
41	Moldova	0.76	0.20	0.11	**0.35**	111
	Europe	**0.97**	**0.50**	**0.28**	0.58	**39**

Note: For data comparability and coverage, see the technical notes.
Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Table 3 DOI time series

	Economy	DOI 2001	DOI 2002	DOI 2003	DOI 2004	DOI 2005	Digital Opportunity Index 2005/06	World Rank 2005/06	Change in ranks 2004/06
1	Albania	…	…	…	0.34	0.35	**0.37**	107	-5
2	Algeria	…	…	…	0.35	0.39	**0.42**	83	9
3	Angola	…	…	…	0.14	0.19	**0.23**	138	8
4	Antigua & Barbuda	…	…	…	0.44	0.49	**0.57**	40	18
5	Argentina	0.40	0.42	0.42	0.44	0.47	**0.51**	54	5
6	Armenia	…	…	…	0.25	0.29	**0.33**	117	5
7	Australia	0.52	0.54	0.56	0.59	0.62	**0.65**	22	0
8	Austria	0.53	0.57	0.58	0.61	0.62	**0.66**	18	-1
9	Azerbaijan	…	…	…	0.34	0.35	**0.38**	101	0
10	Bahamas	…	…	…	0.56	0.59	**0.63**	29	-3
11	Bahrain	0.44	0.47	0.50	0.52	0.57	**0.60**	35	-2
12	Bangladesh	…	…	…	0.19	0.21	**0.25**	134	3
13	Barbados	…	…	…	0.50	0.57	**0.64**	27	10
14	Belarus	…	…	…	0.38	0.42	**0.45**	78	1
15	Belgium	0.50	0.55	0.57	0.60	0.63	**0.65**	23	-3
16	Belize	…	…	…	0.34	0.38	**0.42**	84	16
17	Benin	…	…	…	0.12	0.15	**0.19**	146	11
18	Bhutan	…	…	…	0.12	0.17	**0.22**	140	15
19	Bolivia	…	…	…	0.28	0.31	**0.33**	119	-8
20	Bosnia	…	…	…	0.39	0.41	**0.48**	64	9
21	Botswana	…	…	…	0.34	0.35	**0.38**	100	-1
22	Brazil	0.32	0.34	0.38	0.39	0.43	**0.47**	65	7
23	Brunei Darussalam	…	…	…	0.52	0.54	**0.56**	43	-8
24	Bulgaria	…	…	…	0.47	0.49	**0.54**	47	3
25	Burkina Faso	…	…	…	0.13	0.13	**0.14**	165	-15
26	Burundi	…	…	…	0.09	0.09	**0.09**	173	-8
27	Cambodia	…	…	…	0.17	0.18	**0.18**	149	-8
28	Cameroon	…	…	…	0.17	0.21	**0.24**	137	3
29	Canada	0.55	0.54	0.61	0.63	0.65	**0.67**	17	-7
30	Cape Verde	…	…	…	0.31	0.32	**0.34**	115	-7
31	Central African Rep.	…	…	…	0.09	0.09	**0.09**	174	-7
32	Chad	…	…	…	0.03	0.03	**0.04**	180	-3
33	Chile	0.40	0.42	0.45	0.49	0.53	**0.57**	41	0
34	China	0.29	0.32	0.34	0.38	0.41	**0.45**	77	-3
35	Colombia	0.33	0.34	0.36	0.36	0.39	**0.44**	80	5
36	Comoros	…	…	…	0.13	0.15	**0.17**	156	-2
37	Congo	…	…	…	0.17	0.17	**0.17**	152	-9
38	Costa Rica	…	…	…	0.41	0.42	**0.46**	74	-7
39	Côte d'Ivoire	…	…	…	0.12	0.17	**0.20**	145	13
40	Croatia	…	…	…	0.48	0.50	**0.53**	48	-4
41	Cuba	…	…	…	0.26	0.27	**0.28**	129	-10
42	Cyprus	0.45	0.47	0.50	0.52	0.55	**0.57**	39	-5
43	Czech Republic	0.42	0.45	0.47	0.49	0.52	**0.57**	42	0
44	D.R. Congo	…	…	…	0.06	0.08	**0.08**	176	-4
45	Denmark	0.55	0.57	0.61	0.66	0.70	**0.75**	3	3
46	Djibouti	…	…	…	0.20	0.23	**0.26**	132	1

	Economy	DOI 2001	DOI 2002	DOI 2003	DOI 2004	DOI 2005	Digital Opportunity Index 2005/06	World Rank 2005/06	Change in ranks 2004/06
47	Dominica	…	…	…	0.46	0.49	**0.51**	56	-5
48	Dominican Republic	…	…	…	0.34	0.39	**0.42**	85	12
49	Ecuador	…	…	…	0.34	0.37	**0.40**	97	-4
50	Egypt	0.29	0.31	0.35	0.37	0.38	**0.41**	91	-10
51	El Salvador	…	…	…	0.35	0.38	**0.40**	95	-5
52	Equatorial Guinea	…	…	…	0.24	0.25	**0.27**	131	-7
53	Eritrea	…	…	…	0.01	0.04	**0.07**	177	2
54	Estonia	0.44	0.48	0.52	0.56	0.63	**0.65**	24	4
55	Ethiopia	0.08	0.09	0.08	0.08	0.09	**0.10**	172	-3
56	Fiji	…	…	…	0.30	0.31	**0.39**	99	10
57	Finland	0.53	0.54	0.58	0.61	0.65	**0.69**	11	4
58	France	0.47	0.51	0.53	0.56	0.60	**0.64**	26	3
59	Gabon	…	…	…	0.26	0.32	**0.37**	103	18
60	Gambia	…	…	…	0.19	0.20	**0.21**	144	-9
61	Georgia	…	…	…	0.35	0.38	**0.41**	88	3
62	Germany	0.52	0.55	0.58	0.59	0.63	**0.66**	19	2
63	Ghana	…	…	…	0.10	0.15	**0.21**	142	19
64	Greece	0.45	0.47	0.48	0.49	0.51	**0.53**	49	-9
65	Grenada	…	…	…	0.42	0.45	**0.46**	71	-11
66	Guatemala	0.26	0.28	0.29	0.32	0.33	**0.36**	108	-2
67	Guinea	…	…	…	0.13	0.14	**0.15**	161	-9
68	Guinea-Bissau	…	…	…	0.04	0.04	**0.04**	178	-3
69	Guyana	…	…	…	0.27	0.29	**0.33**	118	-3
70	Haiti	…	…	…	0.15	0.15	**0.15**	160	-15
71	Honduras	0.18	0.19	0.20	0.23	0.24	**0.27**	130	-3
72	Hong Kong, China	0.56	0.60	0.63	0.67	0.69	**0.70**	8	-4
73	Hungary	0.40	0.44	0.48	0.51	0.55	**0.59**	36	0
74	Iceland	0.60	0.62	0.65	0.67	0.69	**0.73**	4	-1
75	India	0.17	0.20	0.22	0.26	0.29	**0.31**	124	-4
76	Indonesia	0.24	0.27	0.28	0.30	0.33	**0.34**	116	-6
77	Iran	…	…	…	0.36	0.36	**0.37**	105	-19
78	Ireland	…	…	…	0.54	0.57	**0.61**	31	0
79	Israel	0.50	0.53	0.56	0.62	0.66	**0.69**	14	-1
80	Italy	0.49	0.51	0.53	0.55	0.59	**0.63**	28	2
81	Jamaica	…	…	…	0.45	0.49	**0.51**	55	-3
82	Japan	0.54	0.58	0.63	0.67	0.71	**0.76**	2	0
83	Jordan	0.32	0.37	0.38	0.39	0.41	**0.45**	79	-8
84	Kazakhstan	…	…	…	0.35	0.37	**0.40**	94	-7
85	Kenya	0.08	0.09	0.11	0.13	0.14	**0.17**	153	-2
86	Korea (Rep.)	0.60	0.66	0.70	0.75	0.78	**0.80**	1	0
87	Kuwait	…	…	…	0.47	0.49	**0.49**	60	-12
88	Kyrgyzstan	…	…	…	0.21	0.25	**0.25**	135	-5
89	Lao P.D.R.	…	…	…	0.12	0.15	**0.18**	150	9
90	Latvia	…	…	…	0.45	0.47	**0.54**	46	9
91	Lebanon	…	…	…	0.38	0.39	**0.40**	93	-18
92	Lesotho	…	…	…	0.20	0.23	**0.26**	133	-1
93	Libya	…	…	…	0.35	0.35	**0.36**	109	-21

	Economy	DOI 2001	DOI 2002	DOI 2003	DOI 2004	DOI 2005	Digital Opportunity Index 2005/06	World Rank 2005/06	Change in ranks 2004/06
94	Lithuania	…	…	…	0.49	0.54	**0.61**	33	10
95	Luxembourg	0.51	0.56	0.58	0.61	0.64	**0.69**	13	3
96	Macao, China	0.51	0.55	0.58	0.62	0.65	**0.69**	15	-3
97	Madagascar	…	…	…	0.07	0.07	**0.12**	167	4
98	Malawi	…	…	…	0.08	0.08	**0.09**	175	-7
99	Malaysia	0.42	0.43	0.44	0.45	0.47	**0.50**	57	-4
100	Maldives	0.21	0.24	0.31	0.37	0.42	**0.46**	72	8
101	Mali	…	…	…	0.10	0.11	**0.12**	169	-6
102	Malta	…	…	…	0.56	0.57	**0.60**	34	-7
103	Mauritania	…	…	…	0.14	0.16	**0.17**	154	-8
104	Mauritius	0.41	0.43	0.45	0.47	0.48	**0.50**	58	-11
105	Mexico	0.35	0.37	0.40	0.40	0.44	**0.47**	66	2
106	Moldova	…	…	…	0.28	0.32	**0.35**	111	1
107	Mongolia	…	…	…	0.26	0.29	**0.32**	121	-4
108	Montenegro	…	…	…	…	…	**0.49**	61	N/A
109	Morocco	…	…	…	0.33	0.40	**0.47**	68	36
110	Mozambique	…	…	…	0.05	0.06	**0.12**	168	5
111	Myanmar	…	…	…	0.04	0.04	**0.04**	179	-3
112	Namibia	…	…	…	0.33	0.34	**0.34**	113	-10
113	Nepal	…	…	…	0.15	0.17	**0.19**	147	-3
114	Netherlands	0.56	0.59	0.61	0.64	0.68	**0.71**	6	2
115	New Zealand	0.51	0.54	0.55	0.57	0.61	**0.64**	25	0
116	Nicaragua	…	…	…	0.21	0.25	**0.31**	122	9
117	Niger	…	…	…	0.02	0.03	**0.03**	181	-3
118	Nigeria	…	…	…	0.10	0.14	**0.17**	155	7
119	Norway	0.56	0.57	0.58	0.63	0.66	**0.69**	12	-1
120	Oman	…	…	…	0.40	0.41	**0.44**	81	-11
121	Pakistan	…	…	…	0.24	0.26	**0.29**	127	-2
122	Palestine	…	…	…	0.35	0.37	**0.39**	98	-9
123	Panama	…	…	…	0.38	0.40	**0.41**	89	-12
124	Papua New Guinea	…	…	…	0.18	0.18	**0.19**	148	-10
125	Paraguay	…	…	…	0.28	0.30	**0.35**	112	1
126	Peru	0.28	0.29	0.32	0.34	0.38	**0.40**	96	-2
127	Philippines	0.30	0.31	0.33	0.34	0.36	**0.37**	102	-6
128	Poland	0.39	0.41	0.43	0.47	0.52	**0.51**	53	-4
129	Portugal	0.45	0.47	0.48	0.50	0.52	**0.61**	32	6
130	Qatar	…	…	…	0.50	0.53	**0.58**	38	1
131	Romania	…	…	…	0.42	0.46	**0.52**	50	13
132	Russian Federation	0.32	0.33	0.35	0.38	0.45	**0.52**	51	27
133	Rwanda	0.05	0.05	0.06	0.08	0.10	**0.14**	164	6
134	S. Tomé & Principe	…	…	…	0.13	0.14	**0.15**	159	-6
135	Samoa	…	…	…	0.24	0.26	**0.29**	125	-2
136	Saudi Arabia	…	…	…	0.41	0.43	**0.46**	75	-9
137	Senegal	…	…	…	0.22	0.30	**0.37**	106	22
138	Serbia	…	…	…	…	…	**0.47**	70	N/A
139	Seychelles	…	…	…	0.45	0.46	**0.48**	62	-8
140	Sierra Leone	…	…	…	0.04	0.09	**0.11**	171	3
141	Singapore	0.56	0.59	0.63	0.66	0.69	**0.72**	5	0

	Economy	DOI 2001	DOI 2002	DOI 2003	DOI 2004	DOI 2005	Digital Opportunity Index 2005/06	World Rank 2005/06	Change in ranks 2004/06
142	Slovak Republic	…	…	…	0.47	0.52	**0.55**	44	2
143	Slovenia	…	0.51	0.56	0.58	0.59	**0.62**	30	-7
144	Solomon Islands	…	…	…	0.10	0.10	**0.13**	166	-2
145	South Africa	0.35	0.36	0.36	0.37	0.38	**0.42**	86	-3
146	Spain	0.47	0.50	0.54	0.58	0.61	**0.65**	21	3
147	Sri Lanka	…	…	…	0.27	0.32	**0.34**	114	2
148	St. Kitts & Nevis	…	…	…	0.47	0.51	**0.54**	45	0
149	St. Lucia	…	…	…	0.42	0.44	**0.46**	73	-12
150	St. Vincent	…	…	…	0.44	0.44	**0.47**	69	-13
151	Sudan	…	…	…	0.23	0.24	**0.24**	136	-10
152	Suriname	…	…	…	0.32	0.34	**0.36**	110	-5
153	Swaziland	…	…	…	0.32	0.32	**0.32**	120	-13
154	Sweden	0.57	0.60	0.63	0.65	0.68	**0.70**	9	-2
155	Switzerland	0.54	0.56	0.59	0.61	0.64	**0.68**	16	-2
156	Syria	…	…	…	0.34	0.36	**0.37**	104	-6
157	Taiwan	0.54	0.58	0.61	0.63	0.66	**0.70**	7	2
158	Tajikistan	…	…	…	0.14	0.18	**0.21**	143	5
159	Tanzania	…	…	…	0.09	0.11	**0.15**	162	4
160	TFYR Macedonia	…	…	…	0.42	0.44	**0.47**	67	-3
161	Thailand	0.33	0.35	0.37	0.38	0.40	**0.43**	82	-6
162	Timor-Leste	…	…	…	0.11	0.11	**0.11**	170	-10
163	Togo	…	…	…	0.17	0.17	**0.17**	151	-9
164	Tonga	…	…	…	0.36	0.39	**0.41**	92	-8
165	Trinidad & Tobago	…	…	…	0.44	0.46	**0.50**	59	-2
166	Tunisia	…	…	…	0.37	0.39	**0.41**	87	-5
167	Turkey	0.37	0.39	0.41	0.41	0.45	**0.52**	52	13
168	Turkmenistan	…	…	…	0.27	0.25	**0.22**	139	-25
169	Uganda	0.04	0.06	0.09	0.12	0.16	**0.16**	158	-2
170	Ukraine	…	…	…	0.34	0.36	**0.41**	90	5
171	United Arab Emirates	0.48	0.50	0.52	0.53	0.55	**0.59**	37	-5
172	United Kingdom	0.52	0.55	0.58	0.60	0.66	**0.69**	10	8
173	United States	0.54	0.56	0.58	0.60	0.63	**0.66**	20	-1
174	Uruguay	…	…	…	0.42	0.45	**0.48**	63	-1
175	Uzbekistan	…	…	…	0.26	0.29	**0.31**	123	-5
176	Vanuatu	…	…	…	0.20	0.20	**0.21**	141	-7
177	Venezuela	0.32	0.34	0.38	0.40	0.43	**0.46**	76	-7
178	Vietnam	…	…	…	0.19	0.26	**0.29**	126	10
179	Yemen	…	…	…	0.22	0.25	**0.28**	128	1
180	Zambia	…	…	…	0.14	0.14	**0.14**	163	-14
181	Zimbabwe	…	…	…	0.18	0.17	**0.16**	157	-18
	WORLD average	**-**	**-**	**-**	**0.35**	**0.37**	0.40	**91**	
	Africa (Table 2a)	-	-	-	0.18	0.20	**0.22**	140	
	Americas (Table 2b)	-	-	-	0.39	0.42	**0.45**	78	
	Asia-Pacific (Table 2c)	-	-	-	0.35	0.38	**0.40**	92	
	Europe (Table 2d)	-	-	-	0.51	0.55	**0.58**	39	

Note: For data comparability and coverage, see the technical notes.
Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

Technical Notes

General methodology

The compound annual growth rate (CAGR) is computed by the formula:

$$[(P_v / P_0)^{(1/n)}]-1$$

where P_v = Present value

P_0 = Beginning value

n = Number of years

The result is multiplied by 100 to obtain a percentage.

United States dollar figures are calculated by applying the average annual exchange rate (from the International Monetary Fund, IMF) to the figure reported in national currency, unless otherwise noted. For economies where the IMF rate is unavailable or where the exchange rate typically applied to foreign exchange transactions differs markedly from the official IMF rate, a World Bank conversion rate is used. For the few economies where neither the IMF nor World Bank rates are available, a United Nations end-of-period rate is used.

Group figures are either totals or weighted averages depending on the indicator. For example, for main telephone lines, the total number of main telephone lines for each grouping is shown, while for main lines per 100 inhabitants, the weighted average is shown. Group figures are shown in bold in the tables. In cases of significant missing data and country rankings, group totals are not shown. Group growth rates generally refer to economies for which data is available for both years. Data was collected and updated on an ongoing basis up to the date of publication; different collection times and dates may account for slight discrepancies between individual entries.

1. Digital Opportunity Index 2006

The Digital Opportunity Index 2006 is calculated according to the methodology described in the Annex to Chapter Three for 181 economies (including Serbia and Montenegro separately), ranked in alphabetical order. Index values are calculated for each indicator by calculating the data value as a proportion of the reference values in the Annex (usually 100 per cent for per capita penetration, household penetration rates and broadband ratios). This gives an index value for the eleven indicators. A simple average of these index values is taken to give values for the DOI sub-indices of Opportunity, Infrastructure and Utilization, which are averaged to obtain a country's overall Digital Opportunity Index (DOI) score. World rank 2005/2006 shows the relative position of each economy in terms of its overall DOI score, on a scale of 1 to 181, where 1 represents the highest overall DOI score.

2. Regional Tables of Digital Opportunity Index 2006

This data presents the Digital Opportunity Index (DOI) 2006 for 181 countries in regional order, with the DOI sub-indices of Opportunity, Infrastructure and Utilization. World rank shows the relative position of each economy in terms of its overall DOI score, on a scale of 1 to 181, where 1 represents the highest overall DOI score. Regional ranking gives the relative ranking of the country within each region:

Africa – between 1 and 51;

Americas – between 1 and 35;

Asia-Pacific – between 1 and 54;

Europe – between 1 and 41;

Where 1 is the highest Digital Opportunity Index score achieved within the region.

3. Digital Opportunity Index over Time, 2001-2006

This table presents the Digital Opportunity Index (DOI) for 2001, 2002, 2003, 2004, 2005 and 2006, where such values exist. World rank 2005/2006 shows the relative position of each economy in terms of its DOI score, on a scale of 1 to 181, where 1 represents the highest overall DOI score.

4. Composite ICT Indices

This table presents the various composite indices that have been prepared by different organizations to measure the Information Society, including the Digital Opportunity Index, the Global IT Readiness Index (data provided by the World Economic Forum), the ICT Opportunity Index and the UNCTAD ICT Diffusion Index (data provided by UNCTAD). The table details the scores and ranks of each index, as well as world and regional averages.

5. Key indicators

The data for Population are mid-year estimates from the United Nations (UN). National statistics have been used for some countries. The data for gross domestic product (GDP) are from the IMF, the Organisation for Economic Co-operation and Development (OECD) or the World Bank. They are current price data in national currency converted to United States dollars by the method identified above. GDP per capita is calculated by dividing total GDP by total population. Readers are advised to consult the publications of the international organisations listed in Sources for precise definitions of the demographic and macro-economic data. Fixed telephone subscribers refers to the total number of mainlines in operation within each country and Mobile cellular telephone subscribers refers to

total people subscribing to a cellular mobile service. Effective teledensity per 100 capita is calculated by dividing the total number of fixed or cellular mobile subscribers (whichever is greatest) by the total population and multiplying by 100 to give the penetration rate per 100 inhabitants. The last column indicates whether fixed (f) or mobile (m) teledensity is higher.

6. Cellular Mobile subscribers

Cellular mobile telephone subscribers refers to the total number of users of portable telephones subscribing to an automatic public mobile telephone service using cellular technology that provides access to the PSTN, for both 2000 and 2005. The Compound Annual Growth Rate (CAGR) refers to the average annual growth rate in the total number of cellular subscribers over the period shown, computed by the formula above. Per 100 inhabitants is obtained by dividing the number of cellular subscribers by the population and multiplying by 100. As a percentage (%) of total telephone subscribers is obtained by dividing the number of cellular subscribers by the total number of telephone subscribers (sum of the fixed telephone lines and the cellular subscribers) and multiplying by 100.

7. Mobile prices

The table shows the costs associated with cellular mobile telephone service. Where possible, the prices of the incumbent and/or major operator were taken, from operators' websites or by correspondence - this may not necessarily be the most cost-effective connection, but rather a representative package on offer to consumers in August 2006. Connection charge refers to connection charges for basic telephone service in USD, using average annual exchange rates for 2006. Offers of free local calls on connection were not taken into account. Per minute local call refers to the average cost of a one-minute mobile call to within the same network, off-net and to a fixed line during Peak and Off-peak hours. Any taxes involved in these charges are included to improve comparability. Cost of a local SMS is the charge to the consumer of sending a single short messaging service (SMS) text within the local exchange area. The OECD low-user basket gives the price of a standard basket of monthly mobile usage in USD determined by the OECD for 25 outgoing calls per month (on and off the network and to fixed line) in predetermined ratios, as well as thirty SMS messages. For more details on the OECD Teligen methodology, see www.oecd.org. As a percentage (%) of monthly income is the price of the OECD low-user mobile basket divided by per capita monthly income (World Bank, Atlas method, no PPP).

8. Information technology

Internet hosts refers to the number of computers in the economy that are directly connected to the worldwide Internet. Note that Internet host computers are identified by a two-digit country code or three-digit generic top-level domain reflecting the nature of the organization using the Internet computer. The numbers of hosts are assigned to countries based on the country code, although this may not necessarily indicate that the host is physically located in the country. In addition, all other hosts for which there is no country code identification (e.g. generic top-level domains such as .edu or .com) are assigned to the United States. Therefore, the number of Internet hosts shown for each country can only be considered an approximation. Data on Internet host computers come from Internet Software Consortium (http://www.isc.org) and RIPE (http://www.ripe.net). Internet users gives reported estimates and derivations based on reported Internet access provider subscriber counts or calculated by multiplying the number of hosts by an estimated multiplier. Estimated PCs shows the number of personal computers (PCs) in use, both in absolute numbers and in terms of PCs per 100 inhabitants. These numbers are derived from the annual ITU questionnaire, supplemented by other sources.

9. Internet prices

This table gives a representative selection of the cheapest offers for 20 hours of commercial Internet access in each country (or the cheapest commercial package most closely approximating to this, whether through broadband or dial-up access). The cost of 20 hours of dial-up access is calculated. For dial-up, the cost is assumed to spread across 10 hours of peak usage and 10 hours of off-peak usage. The cost of dial-up also includes telephone usage charges, based on twenty hours of local calls of one-hour duration, with twenty connection charges. If operators offer a special Internet dial-up tariff, this is used. Where countries have a flat rate telephone usage charge (per call rather than per minute), calls are assumed to last one hour. Note that the monthly rental for the telephone line is not included. If there is a specific 20 hour package (i.e. 20 hours included in the subscription price), this is assumed to be the cheapest. Where broadband is available, the cost of a monthly broadband subscription is compared to the cost of dial-up, since in some countries, broadband may be cheaper. (Where broadband is used, telephone usage charges are not included).

10. Fixed broadband susbcribers

Although various definitions of broadband exist, the statistics here exclude services offering a combined throughput of less than 256 kbit/s in one or both directions. DSL subscribers refers to the total number of digital subscriber lines. Cable modem Internet subscribers refers to Internet subscribers via a cable TV network. Other refers to other known values for DSL,

broadband access technologies that are not related to DSL or cable modem. Examples may include fibre-optic, fixed wireless, apartment LANs or satellite connections. Total fixed broadband subscribers refers to the sum of the last known values for DSL, cable modem and other broadband subscribers. As a result, the Total broadband subscribers figure may combine data from different years. Total broadband subscribers per 100 inhabitants is calculated by dividing the total number of broadband subscribers by the population and multiplying by 100. The Growth Rate refers to the annual growth rate in the number of broadband subscribers from 2004-5, calculated by the formula above. Fixed broadband subscriber data originate from various sources, including: ITU research, OECD, the Arab Advisors Group and other sources.

11. Broadband prices

The prices gathered for the Broadband prices table give a broad representation of typical broadband offers available in an economy. Broadband is considered any dedicated connection to the Internet of 256 kbit/s or faster. They are not necessarily the cheapest, fastest or most cost-effective connections. Rather, they give a small sample of the offers available to consumers. All prices were gathered during March 2006 and translated into United States dollars using the average annual exchange rates for 2006. Broadband offers are usually residential offerings, unless ISPs offer only business packages. Since ADSL technologies are increasingly used to replace leased lines in businesses, the costs shown in the table may be very high in some developing economies and markets, as they represent replacements for leased lines (indicated by the abbreviation L), rather than residential broadband offers. In general, ISP choices do not necessarily reflect the dominant ISP in the market. Some ISPs place download limits on broadband connections and where applicable, the service offering closest to 1 Gigabyte of data per month is used. Other ISPs may put time restrictions on broadband usage. The service offering closest to 100 hours per month is selected. The prices included are those advertised and may or may not include ISP charges. Where ISP charges are known to be separate, they are included. Taxes may or may not be included in the advertised prices. All prices are gathered in local currency and converted to nominal US$ using the average annual exchange rate for 2006. Most prices in the table are for DSL services. Cable modem prices are given if they are found to be lower or more prevalent. The prices shown do not include installation charges or telephone line rentals that are often required for DSL service. In most cases, two prices are gathered for each economy. Lower speed monthly charge refers to a lower-speed connection (typically at download speeds of 256 - 1'024 kbit/s) and gives an example of a typical "entry-level" broadband offer in the economy. The monthly charge reflects the ISP charge for one month of service. Charges do not include installation fees or modem rentals. Speed (kbit/s) down represents the advertised maximum theoretical download speed and not speeds guaranteed to users. Higher speed monthly charge refers to a faster and typically more expensive offer available in the economy. This offer may be from a different provider other than the Lower speed offering. Download speeds are theoretical maxima. Lowest sampled cost US$ per 100 kbit/s gives the most cost-effective subscription based on criteria of least cost per 100 kbit/s. This is calculated by dividing the monthly subscription charge in US$ by the theoretical download speed, and then multiplying by 100. This figure is calculated for each recorded sample and the lowest cost per 100 kbit/s is given. Lowest sampled cost as a % of monthly income (GNI) is Lowest sampled cost US$ per 100 kbit/s divided by per capita monthly income (World Bank, Atlas method, no PPP). The figure is then reported as a percentage (multiplied by 100). ISP lists the name of the Internet service provider whose sampled price was the lowest per 100 kbit/s over all the country samples.

12. Market growth

This table analyses growth in the cellular mobile and mainline telephone markets. Total Cellular Mobile Subscribers refers to the total number of users of portable telephones subscribing to an automatic public mobile telephone service using cellular technology that provides access to the PSTN for 2005. 'Lines' added or lost describes the total number of cellular mobile subscribers gained or lost between 2004-2005, obtained by subtracting the 2004 year total from the 2005 total. Growth rate presents the annual growth rate or percentage change (increase or decline) over this period. Total main telephone lines refers to telephone lines connecting a customer's equipment (e.g., telephone set, facsimile machine) to the Public Switched Telephone Network (PSTN) and which have a dedicated port on a telephone exchange. It includes ISDN subscribers but not broadband lines, even though these may be used for voice, to avoid double counting. Note that for most countries, main lines also include public payphones. Main telephone lines added or lost describes the difference in the number of telephone lines between 2004-2005, obtained by subtracting the 2004 year total from the 2005 total. Growth rate presents the annual growth rate or percentage change (increase or decline) over this period.

Sources

Demographic and economic

In addition to national sources, demographic and economic statistics were obtained from the following:

International Monetary Fund. Various years. International Financial Statistics. Washington D.C

United Nations. Various years. Monthly Bulletin of Statistics. New York.

World Bank. Various years. World Development Indicators. Washington D.C.

Telecommunications

Telecommunication data are obtained through an annual questionnaire. The questionnaire is sent to the government Ministry responsible for telecommunications, the telecommunication regulator or telecommunication operator. Data is cross-checked and supplemented from reports issued by these organisations as well as regional telecommunication agencies. For pricing data, information is obtained from company websites or by correspondence. In a few cases, data are obtained from mission reports prepared by ITU staff or from other sources (see the Technical Notes). In some instances, estimates, generally based on extrapolation or interpolation techniques, are made by ITU staff.

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The full text for the report and Data Tables 1-3 are available at:
www.itu.int/wisr and www.unctad.org/wisr.

To purchase a full electronic version or a hard copy of the report, including the full statistical annex, please use the ITU electronic bookshop service at www.itu.int/wisr or contact sales@itu.int.

The second edition of the World Information Society Report, published by ITU and UNCTAD, looks beyond the World Summit on the Information Society (WSIS, Geneva 2003 - Tunis 2005) to the creation of an inclusive, people-centred and development-oriented Information Society, open to all. The report tracks progress in digital opportunity for 181 economies over the past few years since the start of the WSIS process and is accompanied by a series of tables providing the latest statistics on the development of Information and Communication Technologies (ICTs) worldwide.

The report has been created by the "Digital Opportunity Platform", an open multi-stakeholder platform with contributions from governments, private sector, academics and civil society, as well as inter-governmental organisations.

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