International Telecommunication Union

World Telecommunication/ICT Development Report 2010

MONITORING THE WSIS TARGETS

A mid-term review

UN-DESA UNESCO WHO

working together towards 2015 World Summit Geneva 2003 Tunis 2005 on the Information Society
Turning targets into action

WTDC 2010 HYDERABAD

International Telecommunication Union

World Telecommunication/ICT Development Report 2010

MONITORING THE WSIS TARGETS

A mid-term review

UN-DESA UNESCO WHO

working together towards 2015 World Summit Geneva 2003 Tunis 2005 on the Information Society Turning targets into action

WTDC 2010 HYDERABAD

International Telecommunication Union
Place des Nations
CH-1211 Geneva Switzerland

Original language of publication: English.

Foreword

The ninth edition of the World Telecommunication/ICT Development Report is being published at the half-way point between the World Summit on the Information Society (WSIS) in 2005 and the target date for the Millennium Development Goals (MDGs) in 2015. This gives us a unique opportunity for a mid-term review — so this report focuses on the WSIS targets, and shows us that while we have achieved much in some areas we still have far to go in others.

This is of critical importance in an era where Information and Communication Technologies (ICTs) underpin almost every single activity undertaken in the modern world, and affect everyone on the planet — even those who do not themselves have first-hand access to ICTs. Good examples include food distribution, power networks, water supplies or mass transportation, all of which are controlled and managed today by ICT networks and applications.

As this report shows, tremendous progress has been made over the past decade, with close to five billion mobile cellular subscriptions worldwide at the end of 2010, and almost two billion people throughout the world now having access to the Internet.

But there is still a vast amount of work to be done. In particular, we need to bring affordable fast broadband access within reach of the great majority of the world's people — noting today that three quarters of the world's inhabitants still have no access to the Internet at all. So what we need is to see a rapid and equitable spread of broadband networks matching the extraordinary growth of mobile cellular networks over the past decade.

The key — as this report acknowledges — will be in recognizing that broadband networks deliver benefits right across society, and can quickly pay for themselves in terms of the savings gained through the more efficient provision of essential services such as healthcare, education, power, water, transportation and e-government.

Personally I have tremendous faith that the public and private sectors will work together — as they did in the creation of mobile cellular networks — to roll out the necessary infrastructure and create the necessary services to bring broadband to all the world's people. For this to happen, we also need to recognize, as this report explains, the vital importance of making sure that people are well-equipped to take advantage of all this new technology (through human capacity building) and that enough attention is paid to the need to create and share far more local-language content across the Internet. And we need to continue to monitor and attain the WSIS targets by 2015, in line with the MDGs.

I am absolutely certain that the next decade will be the decade of broadband. This is why ITU is working with UNESCO in establishing the Broadband Commission for Digital Development. The commission will be chaired by President Paul Kagame of Rwanda and Carlos Slim Helú, Honorary Lifetime Chairman of *Grupo Carso*, with Irina Bokova, Director-General of UNESCO, and myself, as vice-chairs. The Broadband Commission has the full support of the UN Secretary-General, Ban Ki-moon, and will report to the 2010 MDG Summit in September.

The commission complements ITU's own "Build on Broadband" campaign, which is designed to increase awareness of the vital role broadband will play in the 21st century in every country in the world. I therefore expect broadband to be high on the agenda at the World Telecommunication Development Conference 2010, which is taking place in Hyderabad, India, from 24 May to 4 June, and I look forward to seeing you there and to sharing in the debates which will shape global ICT development over the next four years – and beyond.

Dr Hamadoun I. Touré
Secretary-General
International Telecommunication Union

Preface

I am pleased to present the World Telecommunication/ICT Development Report (WTDR) 2010, which focuses on *Monitoring the WSIS targets*. This ninth edition of the WTDR, which contains a mid-term review of the achievements of the World Summit on the Information Society (WSIS), is a contribution to the World Telecommunication Development Conference (WTDC) to take place in Hyderabad, India, from 24 May to 4 June, 2010.

ITU has a long history of measuring developments in the area of telecommunications and ICTs, both in terms of infrastructure and — more recently — in terms of use. At the international level, the Union has taken on a lead role not only in measuring and analysing ICT trends, but also in identifying indicators and definitions. Together with other international and regional organizations, and within the framework of the *Partnership on Measuring ICT for Development*, we have also been working towards a set of internationally comparable and harmonized data. Through this report, ITU is reaffirming its leading role in measuring the information society.

The year 2010 marks the midpoint between the Tunis phase of WSIS (2005) and the deadline for achieving the ten targets that governments agreed upon at the Summit (2015). These targets range from connecting villages, schools, health centres, libraries and government agencies, to developing content, and providing ICT services to people. The main objective of the report is to provide policy-makers with a comprehensive assessment of what has been achieved so far, and what remains to be done. Besides highlighting actual progress and trends since WSIS, the report also proposes quantitative indicators to measure the ten WSIS targets. This is the first time a full-scale global monitoring process and assessment of the targets is being put in place.

The report highlights the major achievements that have been accomplished in connecting people via mobile technologies. Today, mobile cellular networks already cover close to 90 per cent of the world population, and we expect coverage to reach 100 per cent by 2015. We are also confident that by 2015 more than half of the world population will be using a mobile telephone. At the same time, the report shows that, in a number of areas, substantial efforts need to be made to achieve the targets. Too many schools in developing countries continue to be deprived of access to the Internet, and three-quarters of people in the world are not yet online. Only a very small proportion of the information hosted by libraries and archives has been digitized, and even less is available online. The report also points to the persistent broadband divide, which policy-makers need to tackle urgently. Whereas, by the end of 2009, most people in the developed countries enjoyed Internet access with a high-speed connection, broadband penetration rates in the developing world stood at a meagre 3.5 per cent.

The WTDR is the fruit of a joint effort by several international organizations, led by ITU, and includes contributions from UNESCO, WHO and UNDESA, as well as from representatives of civil society. This collaborative effort not only reflects the broad range of subjects covered by WSIS, but also underlines the cross-cutting nature of the information society, and the recognition that ICTs are truly a development enabler and hence of tremendous importance for any development debate.

I am convinced that this report will prove useful in evaluating progress on the WSIS outcomes and the development of the global information society. Its findings and recommendations will provide a valuable input to the debate at WTDC.

Sami Al Basheer Al Morshid
Director
Telecommunication Development Bureau (BDT)
International Telecommunication Union

Acknowledgements

The *World Telecommunication/ICT Development Report (WTDR) 2010: Monitoring the WSIS* targets was prepared by the Market Information and Statistics Division within the Telecommunication Development Bureau of ITU. The core team included Susan Teltscher (Head of Division), Vanessa Gray (chapters on Targets 1, 2, 7, 8 and 10) and Desirée van Welsum (chapters on Targets 3, 4, 5, 6 and 9). Philippa Biggs of the ITU General Secretariat co-authored the chapter on Target 3. Esperanza Magpantay, Doris Olaya and Andreea Todoran (during her internship at ITU) provided substantive comments and inputs, as well as statistical tables, on various chapters of the report. Olivier Poupaert contributed to the data collection and analysis. Susan Schorr, Head, a.i., Special Initiatives Division, made helpful suggestions on the chapter on Target 10. The work was carried out under the overall direction of Mario Maniewicz, Chief, Policies and Strategies Department, Telecommunication Development Bureau.

ITU is grateful to a large number of outside contributors who have collaborated in the drafting of this report. These include the following:

The chapters on Targets 2 and 7 were contributed by the UNESCO Institute for Statistics (UIS), in particular Patrick Lucas, Claude Akpabie and Beatriz Valdez-Melgar. Katsiaryna Miniukovich (Ministry of Education of Belarus) provided useful inputs to the chapter on Target 2 and Joel Peetersoo (Ministry of Education and Research of Estonia) to the chapter on Target 7.

The chapter on Target 5 was contributed by the World Health Organization (WHO), in particular Misha Kay, with Najeeb Al Shorbaji, Joan Dzenowagis, Marina Takane, Jonathan Santos and Diana Zandi.

The chapter on Target 6 was contributed by the United Nations Department of Economic and Social Affairs (UNDESA), in particular Seema Hafeez.

The chapter on Target 9 was contributed by Daniel Pimienta from the Networks and Development Foundation (FUNREDES), with inputs from Daniel Prado (*Union Latine*), Jean-François C. Morfin (Intlnet), Viola Krebs (ICVolunteers) and Deirdre Williams (St Lucia). Matthew Zook from ZookNIC provided data on ccTDLs.

Michael Minges provided substantive inputs to the chapters on Targets 1, 2, 4, 8 and 10. Guido Koller and Manuela Höfler of the *Schweizerisches Bundesarchiv*, and Annick Carteret of the International Council on Archives, provided inputs to the chapter on Target 4. The chapter also includes data from the Universal Postal Union (UPU), which is gratefully acknowledged.

ITU also appreciates the cooperation of countries that responded to the 2009 ITU Questionnaire on the WSIS Targets.

The report was edited by the ITU English Translation Section, led by Anthony Pitt. The desktop publishing was carried out by Nathalie Rollet, and the cover was designed by Stephane Rollet. Administrative support was provided by Herawasih Yasandikusuma.

Contents

Charts

Figures

Boxes

Tables

List of abbreviations

3G	Third-generation (mobile technology)
4G	Fourth-generation (mobile technology)
ADSL	Asymmetric digital subscriber line
ALICE	*America Latina Interconectada Con Europa*
AM	Amplitude modulation
APAN	Asia-Pacific Advanced Network
ARCEP	*Autorité de régulation des communications électroniques et des postes*
ARNES	Academic and Research Network of Slovenia
ATM	Automated teller machine
BDT	Bangladesh Taka (currency)
kLBHIS	Belize Health Information System
BioGRID	Biological General Repository for Interaction Datasets
BLSS	Bhutan Living Standard Survey
CAGR	Compound annual growth rate
CAI	Computer-assisted instruction
CAREN	Central Asian Research and Education Network
CASBAA	Cable & Satellite Broadcasting Association of Asia
CATV	Cable television
ccTLDs	Country code top-level domains
CD/DVD	Compact disc/Digital versatile (or video) disc
CDMA	Code Division Multiple Access
cdmaOne	Code Division Multiple Access One
CDMA2000 1X	Code Division Multiple Access 1 times Radio Transmission Technology
CDMA2000 1xEV-DO	(Evolution-Data Optimized) Code Division Multiple Access 1x Evolution-Data Optimized
CERN	European Organization for Nuclear Research
CERNET	China Education and Research Network
CIC	Community information centre
CIS	Commonwealth of Independent States
CLARA	*Cooperación Latino Americana de Redes Avanzadas*
COSINE	Co-operation for Open Systems Interconnection in Europe
CSTNET	China Science and Technology Network
CyNet	Cyprus' National Research and Education Network
DANTE	Delivery of Advanced Network Technology to Europe
DBCDE	Department of Broadband, Communications and the Digital Economy (Australia)
DHS	Demographic and Health Survey

DICE	DANTE-Internet2-CANARIE-Esnet
DTH	Direct-to-home
DTT	Digital terrestrial television
DVB-H	Digital video broadcasting — Handheld
DVD	Digital versatile (or video) disc
DVG-H	Digital video broadcast — Handheld
ECA	See UNECA
ECLAC	See UNECLAC
ECOSOC	United Nations Economic and Social Council
EFA	Education for All
EFTA	European Free Trade Association
EGMUS	European Group on Museum Statistics
EHR/EMR	Electronic health records/Electronic medical records
eLAC	Strategy for the Information Society in Latin America and the Caribbean
ERNET	Education and Research Network
ESCAP	See UNESCAP
ESCWA	See UNESCWA
ESnet	Energy Sciences Network
EU	European Union
FAIFE	Free Access to Information and Freedom of Expression
FCC	Federal Communications Commission
FM	Frequency modulation
FTTH	Fibre-to-the-home
FUNREDES	*Fundación Redes y Desarrollo*
Gbit/s	Gigabits per second
GDP	Gross domestic product
GOe	Global Observatory for eHealth
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
gTLD	Generic top-level domains
HIMSS	Healthcare Information and Management Systems Society
HINARI	Health InterNetwork Access to Research Initiative
HIV/AIDS	Human immunodeficiency virus/Acquired immune deficiency syndrome
HSPA	High Speed Packet Access
IAI	Internet-assisted instruction
ICA	International Council on Archives
ICANN	Internet Corporation for Assigned Names and Numbers
ICC	Israeli Cultural Centre

ICCROM	International Centre for the Study of the Preservation and Restoration of Cultural Property
ICOM	International Council of Museums
ICT	Information and communication technology
ICTs	Information and communication technologies
ICT4D	ICT for development
ICT4E	ICT for education
iDEN	Integrated Digital Enhanced Network
IDN	Internationalized domain names
IDRC	International Development Research Centre
IFLA	International Federation of Library Associations
IGF	Internet Governance Forum
IMF	International Monetary Fund
INEI	*Instituto Nacional de Estadística e Informática*
INR	Indian Rupee (currency)
IP	Internet Protocol
IPTV	Internet Protocol television
IPv6	Internet Protocol version 6
IQD	Iraqi dinar (currency)
ISCED	UNESCO's International Standard Classification of Education
ISDB-T	Integrated services digital broadcasting — Terrestrial
ISP	Internet service provider
IT	Information technology
ITU	International Telecommunication Union
JPEG	Joint Photographic Experts Group
KES	Kenya shilling (currency)
LAN	Local area network
LHC	Large Hadron Collider
LDC	Least developed country
LKR	Sri Lanka rupee (currency)
LOP	Language Observatory Project
LW	Longwave
MAAYA	World Network for Linguistic Diversity
MAN	Metropolitan access network
Mbit/s	Megabits per second
MCIT	Ministry of Communication and Information Technology in Egypt
MCMC	Malaysian Communications and Multimedia Commission
MDGs	Millennium Development Goals
MMDS	Multichannel multipoint distribution service
MUR	Mauritius rupee (currency)

MVNO	Mobile virtual network operator
NALIS	National Library and Information System Authority
NASA	National Aeronautics and Space Administration
NEPAD	New Partnership for Africa's Development
NGN	Nigerian naira (currency)
NGO	Non-governmental organization
NLB	National Library Board
NREN	National research and education network
NSO	National statistical office
OECD	Organisation for Economic Co-operation and Development
Ofcom	Office of Communications
OIF	*Organisation internationale de la francophonie*
OSILAC	*Observatorio para la Sociedad de la Información en Latinoamérica y el Caribe*
PC	Personal computer
PDA	Personal digital assistant
PDC	Personal Digital Cellular
PHP	Philippine peso (currency)
PIA	Public Internet access
PIAC	Public Internet access centre
PIAP	Public Internet access point
PISA	Programme for International Student Assessment
PoP	Point of presence
PPP	Public-private partnership
RAN	Radio access network
RARE	*Réseaux associés pour la recherche européene*
RCP	*Red Cientifica Peruana*
RENATER	*Réseau national de télécommunications pour la technologie, l'enseignement et la recherche*
R&D	Research and development
RIA	Research ICT Africa
SABC	South African Broadcasting Corporation
SCA-ECLAC	ECLAC Statistical Conference of the Americas
SKMM	Suruhanjaya Komunikasi and Multimedia Malaysia
SMATV	Satellite master antenna television
SW	Shortwave
T-DMB	Terrestrial digital multimedia broadcasting
TD-SCDMA	Time Division Synchronous Code Division Multiple Access
TDMA	Time Division Multiple Access
TEIN	Trans-Eurasia Information Network
TERENA	Trans-European Research and Education Networking Association

TGEG	Task Force on E-government Indicators
TLD	Top-level domain
TOEFEL	Test of English as a Foreign Language
TV	Television
UIS	UNESCO Institute for Statistics
UN	United Nations
UNCSTD	United Nations Commission on Science and Technology for Development
UNCTAD	United Nations Conference on Trade and Development
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNECLAC	United Nations Economic Commission for Latin America and the Caribbean
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCWA	United Nations Economic and Social Commission for Western Asia
UNGIS	United Nations Group on the Information Society
UNHCR	United Nations High Commissioner for Refugees
UNSC	United Nations Statistical Commission
UPU	Universal Postal Union
USB	Universal serial bus
USD	United States dollar (currency)
VPN	Virtual private network
VSAT	Very small aperture terminal
WAN	Wide area network
WAP	Wireless Application Protocol
WCDMA	Wideband Code Division Multiple Access
WDL	World Digital Library
WHO	World Health Organization
Wi-Fi	Wireless fidelity
WiMax	Worldwide interoperability for microwave access
WISE	Working Group for ICT Statistics in Education
WLCG	Worldwide LHC Computing Grid
WSIS	World Summit on the Information Society
WTDR	World Telecommunication/ICT Development Report

Executive summary

The World Summit on the Information Society (WSIS) held in Geneva (2003) and Tunis (2005) brought together governments, civil society and the business sector to discuss a broad range of subjects related to ICT for development. In the end, governments agreed on a set of commitments and actions to foster the establishment of an inclusive information society. In particular, ten targets were identified in the Geneva Plan of Action, along with numerous recommendations based on different action lines (Action Lines C1 — C11). The targets, to be achieved by 2015, are:

1. To connect villages with ICTs and establish community access points
2. To connect universities, colleges, secondary schools and primary schools with ICTs
3. To connect scientific and research centres with ICTs
4. To connect public libraries, cultural centres, museums, post offices and archives with ICTs
5. To connect health centres and hospitals with ICTs
6. To connect all local and central government departments and establish websites and e-mail addresses
7. To adapt all primary and secondary school curricula to meet the challenges of the information society, taking into account national circumstances
8. To ensure that all of the world's population have access to television and radio services
9. To encourage the development of content and put in place technical conditions in order to facilitate the presence and use of all world languages on the Internet
10. To ensure that more than half the world's inhabitants have access to ICTs within their reach

At the midpoint between 2005 and 2015, WTDR 2010 reviews progress towards the WSIS targets

The year 2010 marks the midpoint between the Tunis phase of WSIS (2005) and the deadline for achieving the WSIS targets (2015), in line with the target date of the Millennium Development Goals (MDGs). This World Telecommunication/ICT Development Report presents a mid-term review of the progress made towards achieving the ten WSIS targets. The overall objective of the report is to provide policy-makers with a comprehensive assessment of the WSIS targets to date and, based on the findings, make suggestions on the types of policy measures required to meet them. The report also highlights the need for formal monitoring of progress towards achieving the WSIS targets. Currently, there are no agreed indicators for the targets which countries could use for monitoring purposes.

The WSIS outcome documents make reference to quantitative review, monitoring and evaluation of progress. The Geneva Plan of Action calls for the establishment of compa-

rable indicators, and the Tunis Agenda for the Information Society provides suggestions related to the "periodic evaluation" of the WSIS outcomes. In particular, it acknowledges the efforts of the *Partnership on Measuring ICT for Development* (hereinafter referred to as the *Partnership*) to develop a core list of ICT indicators and to build statistical capability in developing countries in order to monitor their evolution towards becoming information societies. It also requests the United Nations General Assembly to make an overall review of the implementation of the WSIS outcomes in 2015.

Important developments have occurred since WSIS, and the Internet has become a general-purpose technology like electricity

Although some stakeholders, notably the members of the *Partnership*, have addressed the important task of monitoring progress, the WSIS targets are very broad and cover areas which go beyond the *Partnership's* core list and which are particularly challenging to measure and compare internationally. The report reviews these challenges and proposes quantitative indicators for monitoring the targets, along the lines of the internationally agreed indicators used for tracking the MDGs.

The report also takes into consideration important ICT developments that have occurred since the Geneva phase of the Summit, which were not anticipated at the time of WSIS. The most striking example is the rise of mobile telephony and related applications. On the technology side, the launch of new standards in the mobile sector, the convergence of technologies and the steady increase in high-speed communication infrastructure have significantly altered the way ICTs are accessed and used. The emergence of Web 2.0 and user-created content on the Internet are shaping today's information society developments.

It is widely recognized that ICTs are increasingly important for economic and social development. Indeed, today the Internet is considered as a general-purpose technology and access to broadband is regarded as a basic infrastructure, in the same way as electricity or roads. In some countries, such as Estonia, Finland and France, access to the Internet is a fundamental human right for their citizens. Such developments need to be taken into consideration when reviewing the WSIS targets and their achievement, and appropriate adjustments to the targets need to be made, especially to include broadband Internet.

WTDR 2010 is a collaborative effort among UN agencies

In view of the broad range of subjects covered by the WSIS outcome documents and the targets, the report has been drafted in close collaboration with other UN agencies and stakeholders, in particular the UNESCO Institute for Statistics (Targets 2 and 7), the UN Department of Social and Economic Affairs (Target 6) and the World Health Organization (Target 5). Representatives from civil society provided substantive inputs to the chapter covering Target 9.

The report is based on the latest available data. While some data are collected at the international level, notably by ITU, UNESCO and UNDESA, overall data availability relating to the WSIS targets is poor. To complement these data sources, a survey was carried out by ITU among its Member States, between September and November 2009. The information provided by countries is featured throughout the report.

The following sections summarize the main findings and conclusions for each of the ten targets.

Target 1: Connect villages with ICTs and establish community access points

With no internationally agreed definition of what constitutes a "village," and given the lack of data on the number of villages by country, Target 1 measures ICTs in *rural and remote areas*. This is consistent with the fundamental intent of Target 1, which was formulated to ensure that people living in rural areas are not excluded from the information society. Rural areas stand to benefit from connectivity even more than others, on account of their geographical situation and because ICTs have the potential to deliver health, education and other services that might otherwise be less widely available. The target further recognizes the need to ensure the availability of public Internet access.

Seventy-five per cent of the world's rural population is covered by a mobile cellular signal

Mobile technology is currently the most widely diffused ICT, and available data suggest that by the end of 2008 almost three-quarters of the world's rural inhabitants were covered by a mobile cellular signal, up from 40 per cent in 2003. The lowest coverage is in Africa, where just over 50 per cent of the rural population is within reach of a mobile cellular network. This still represents a significant improvement from 2003, however, when coverage stood at only 20 per cent. Complete mobile coverage of all rural areas worldwide by 2015, or even earlier, should become a clear policy target and would appear achievable with the right policy emphasis. Countries also need to take advantage of wireless technologies to deliver high-speed Internet access and launch 3G networks, where they are not yet available. To this end, policy-makers also need to monitor the percentage of the population within reach of a 3G mobile cellular signal.

In many developing countries, more than half of rural households have a mobile telephone, but very few have Internet access

Data on the proportion of households with a fixed and/or mobile telephone show that rural households in developing countries rely predominantly on mobile telephony. The proportion of rural households with a mobile telephone has reached, or now exceeds, 50 per cent in many developing countries. In comparison, fixed (wired) telephone penetration in rural households is much lower, and even non-existent in some areas.

In contrast to the diffusion of mobile technologies, the report finds that many rural households are still deprived of basic access to the Internet. A lack of electricity and the high price of computers and Internet are major barriers in developing countries. Unsurprisingly, broadband Internet penetration levels in rural households are even lower.

More public Internet access facilities are necessary in order to bring more people online

Where rural household Internet access is very low, community access points are critical for bringing people online. Indeed, a growing number of developing countries are moving ahead with the installation of public Internet access facilities in rural areas, often financed through universal access contributions or licence conditions. Existing data suggest that, in many developing countries, people in rural areas use the Internet in public locations. This is especially true in Latin America, where considerable policy emphasis has been placed on setting up public Internet access centres. Nevertheless, the low proportion of Internet users in developing countries (even lower in rural areas) suggests that much remains to be done to bring Internet to rural communities.

There are a number of strategies and policies that governments should pursue so as to increase Internet and broadband access and usage in rural areas. These include intensifying competition in all ICT markets, adapting universal access and service policies in order to integrate the delivery of ICTs to rural areas, and fostering wireless broadband access. Given the low number of Internet users in many developing countries, governments need to adopt the appropriate policies and provide the necessary resources to encourage the establishment of sufficient public Internet access points, preferably equipped with broadband technology, especially in rural areas. With increasing incomes — and the availability of electricity — people will opt for the convenience of using ICTs at home. Therefore, as household Internet access goes up, community access is likely to go down. Policy-makers need to keep this relationship in mind and policies to promote

public access need to move in tandem with facilitating home ICT access. As incomes rise, the emphasis should shift from public towards household access.

Target 2: Connect universities, colleges, secondary schools and primary schools with ICTs

Too many schools in developing countries have no Internet access

Target 2 recognizes the multiple benefits of providing access to ICT infrastructure within education systems. ICT connectivity in schools provides students with new resources and pedagogical tools, allows them to acquire the skills required for the information society, improves administrative processes and supports teacher training. Outside school hours, connected schools can provide access to ICTs for the community, including marginalized groups.

The target must address newer and older ICTs, both of which hold effective potential for delivering educational content. Older (broadcasting) technologies, such as radio and TV, may complement newer technologies, including the Internet and computers. For some schools, they are the only relevant alternative if newer ICTs are not available, or affordable. Since it is assumed that higher-education institutions are largely connected to basic ICTs, and Internet access in universities is covered by Target 3, the report proposes that Target 2 focus solely on monitoring ICT connectivity in primary and secondary schools.

Students in developed countries have access to more computers

In terms of e-education technologies, Internet access in schools is the most widely tracked indicator and often the subject of policy discussion and goals, suggesting that policy-makers attach great importance to it. In the main, in 2010 schools in developed countries are connected to the Internet, and usually through high-speed broadband networks, which offer the greatest potential for delivering innovative and useful applications and services. A number of developing countries have initiated projects to bring ICTs to schools, have set clear targets and have achieved high levels of Internet and even broadband penetration. Overall, though, Internet penetration levels in developing countries are still low, and many schools remain deprived of any form of Internet access. Unless many more governments take far-reaching policy decisions soon, it is unlikely that all schools will be connected to the Internet by 2015, let alone through high-speed networks.

Existing data on the learner-to-computer ratio show that there are important variations across countries, with relatively more computers for fewer students in most developed economies and less favourable ratios in the developing world. Many students today do not have access to a computer at all.

Governments need to set clear targets and ensure that in the long term schools are online, at high speed

In view of the very limited availability of newer ICTs in many developing countries, older ICTs represent an important alternative. The availability and use of TVs and radios for educational purposes in schools vary between developed and developing countries, but also within each group, suggesting that policies and objectives depend very much on national circumstances and priorities. Whereas in some countries, especially developing countries, all schools use radios and TVs for educational purposes, penetration levels are very low in others. Although penetration levels for TV and radio are fairly similar, TV-assisted instruction tends to dominate in a number of countries.

Data further suggest that, for a number of countries, broadcasting technologies are a relevant alternative only if newer technologies are not available or affordable. Bringing radios and TVs into schools could therefore be considered as a short- to medium-term target that should ultimately be complemented by Internet access.

Besides identifying the most appropriate strategies to equip schools with ICTs, policy-makers need to set clear targets and implement the necessary policies to ensure that,

in the long term, all primary and secondary schools are online, at high speed, and that students have access to computers at schools.

Target 3: Connect scientific and research centres with ICTs

Universities and research centres have been closely related to the Internet since its inception. In some developing countries, the major universities or the academic network even acted as the first Internet service provider (ISP). Today, they continue to pioneer advances in ICTs in network infrastructure, services and applications, including the latest developments in grid and cloud computing. Most research centres and universities are connected to the Internet, often with a broadband connection.

Most research institutes and universities have access to the Internet, often through a broadband connection

It is also important to connect scientific and research centres and universities to *national research and educational networks* (NRENs), defined as specialized ISPs dedicated to supporting the needs of the research and education community. These NRENs not only help to further knowledge and facilitate scientific discoveries — they can also help build human capital and promote economic development. Many universities and research institutes are connected to the NREN, where one exists. By early 2010, around 62 per cent of countries had an NREN, ranging from 100 and 88 per cent of countries in the CIS and Europe, respectively, to 33 per cent of countries in Africa.

When connected to international research networks, NRENs can also contribute to promoting international collaboration and enabling positive research and development spill overs. NRENs can also facilitate the expansion of Internet access to local populations, for example by providing Internet access to students.

By 2010, around 62 per cent of countries had a national research and educational network

Besides providing access to the Internet, NRENs administer and support high-speed backbone networks employed by research projects. Data for European NRENs show significant growth in the bandwidth available to research networks, and between 2002 and 2008 the bandwidth of NRENs in 44 countries increased from less than 20 000 to close to 200 000 Mbit/s. Over the same period, the number of countries with NRENs with more than 10 Gigabits of bandwidth increased from just one to 14. While an increasing number of NRENs are operating at Gigabit capacity, existing data suggest that the available network bandwidth varies greatly between countries, and NRENs in a number of developing countries, in particular, are still restricted to only a few Megabits of capacity.

NRENs are increasingly interconnected and the number of international research networks is growing. While all regions enjoy at least some of the benefits of these advanced research and education networks, there is a need to interconnect regional networks of NRENs still further and to establish these networks in countries where they do not yet exist. It is important to ensure that developing countries, including the least developed countries, can also benefit by participating in and contributing to the pioneering developments in scientific and academic research that characterize the information society.

Today, the bandwidth of countries' national research and educational networks ranges from just a few Megabits to over 10 Gigabits

In order to promote the expansion of the NREN, and to include as many institutions as possible (universities and research centres, but also government departments, schools, hospitals, libraries and archives), governments must work with NRENs to ensure that they are fully embedded within the national innovation system and that they serve the needs of the local research community. Governments could consider conducting consultations with NREN stakeholders in order to review challenges and bottlenecks to boosting network deployment and connectivity. National policies should focus on the roll-out and growth of NRENs in developing countries, and enhance their bandwidth capacities. Governments should also consider prioritizing the research institutes to be connected to the NREN, based on their size and the types of research performed. In addition, NRENs

should explore partnerships with other regional and global networks, and could negotiate public-private partnerships with existing telecommunication operators.

Target 4: Connect public libraries, cultural centres, museums, post offices and archives with ICTs

While the institutions covered by Target 4 are similar to the extent that they are all highly knowledge- and information-intensive, they are also quite different, notably in terms of the specific purpose they serve and the role they can play in providing Internet access or online content. Indeed, the objective of connecting these institutions can be twofold: providing public Internet access (in libraries, cultural centres and post offices), and developing local content in local languages and preserving cultural heritage (notably through libraries, museums and archives).

In developed countries, most libraries, museums and archives are connected to the Internet, often at broadband speeds, but not yet in developing countries

Internet access in the institutions covered by this target is highest in developed countries. The potential for improvement is greatest in developing countries, where much more needs to be done if all institutions are to have access to the Internet by 2015, especially for those located outside urban areas. At the same time, providing public Internet access is most relevant in developing countries, since in the developed world more people have access to the Internet at home, at work or at school.

Libraries, post offices and — in certain cases — cultural centres are ideal locations for providing public Internet access to the community. They already have an existing infrastructure with a network of branches, and are open to the public, which means they may reach a population that does not have access to the Internet at home or at work.

Libraries, museums and archives share the potential to provide online content. They each host treasures of local content which should be digitized and made available online so as to promote cultural diversity and provide wider access to the world's cultural heritage for researchers and the general public. In most developed countries, these institutions are present on the Internet, although the available online information needs to be expanded. Some of the major institutions in developing countries also have a website, although generally without as much accessible information. Therefore, one of the main challenges is to bring more institutions in developing countries online and to encourage them to use the Internet to offer digitized content. Unfortunately, many developing countries lack the resources for an information technology budget, and a broadband Internet connection is not always available or affordable.

More should be done to encourage public Internet access through libraries and post offices, especially in areas where household Internet penetration remains low

With the right policy focus, Target 4 could be attained by 2015, even if there is still some way to go, especially in developing countries. There are many initiatives under way to connect libraries, museums, post offices, cultural centres and archives, and the cost of connecting them is relatively low, especially relative to the potential benefits. Indeed, there are relatively fewer of these institutions than, for example, households or schools, thus increasing the feasibility of reaching the target. Governments could look to supplementary sources of funding, including the private sector, development agencies and philanthropy organizations. Combining private funds with public resources could help to connect these institutions and enable them to create websites.

Target 5: Connect health centres and hospitals with ICTs

The health sector stands to benefit greatly from the use of ICTs and ICT applications, for example through the more efficient delivery of healthcare services and the provision of health information to the general public. The use of ICTs in the health sector also improves the collection, storage, retrieval and transmission of individual patient information. Furthermore, given the soaring use of mobile technologies worldwide, m-health (which refers to medical and public-health practices supported by mobile devices) holds huge promise for improving the delivery of health services to an increasing share of the world's population. Thus, ICTs have the potential to contribute to more effective delivery of health services and to increase the efficiency of health systems.

Besides establishing basic Internet access, health institutions are starting to increase their use of ICTs, for example by introducing electronic patient records

By the end of 2009, some progress had been made in establishing basic Internet access in health institutions, including in developing countries, but much more needs to be done if all health institutions are to enjoy Internet access by 2015. It is likely that progress will initially be made in the major cities of developing countries, and less so in the remote and isolated regions, even though ICTs can potentially bring even greater benefits in remote geographical areas.

In addition to growing access to the Internet, health institutions are increasingly using ICTs for their own ends, for example through the connection of health institutions to HINARI (an online initiative to provide access to health research). While most countries have introduced some form of electronic patient records, in low-income countries this facility is not yet used intensively, and most patient records are still kept primarily in paper format.

M-health has great potential for growth, and for delivering innovative health applications

Over 75 per cent of countries report at least one m-health initiative. This is an area which has great potential for further growth, especially in the developing world. M-health or other applications, including telemedicine, can deliver healthcare services at a distance, by providing and exchanging information for diagnosis, treatment and prevention of diseases and injuries. They can also promote research and evaluation, and helping in the education of healthcare providers. Governments in developing countries should therefore ensure the effective implementation of such initiatives.

Governments need to recognize the importance of ICT access and use in the health sector, and the benefits it will bring for the health of citizens, not to mention the potential for cost savings, including through increased efficiencies. Policy-makers need to put in place and implement enabling framework conditions for e-health, which will be critical for increasing ICT in the health sector. Government support needs to be reflected in the policy environment as well as the funding environment. Today, funding constitutes an important barrier to the spread of e-health. Governments can look to alternative funding sources, such as donor or private funds, as well as public-private partnerships, in order to complement public funding used for providing Internet access to health institutions and supporting the use of ICTs for the delivery of health services.

Substantial efforts are required if Target 5 is to be achieved by 2015, including interministerial cooperation and adequate funding

Interministerial cooperation is also crucial in the area of e-health. Any significant ICT initiatives in the e-health domain will need to be agreed on and governed by several ministries, usually those in charge of health, ICTs and finance. The successful development and implementation of e-health projects requires a common understanding by all parties of some of the key issues, including the strategic approach and goals, costs and financing mechanisms.

Target 6: Connect all local and central government departments and establish websites and e-mail addresses

Today, almost all central governments have a web presence and provide at least basic information to their citizens, including in the developing world

The use of ICT in government — referred to as e-government — can be key to achieving specific social and economic development goals. Governments are increasingly recognizing the role ICTs can play in promoting effective and speedy solutions for development through the delivery of public services. E-government can contribute effectively to creating an enabling environment for development, by enhancing transparency and accountability and promoting good governance in the public sector. As such, e-government is a major tool for public-sector reform towards better governance, which is one of the objectives of the United Nations Millennium Declaration.

Many countries have been reforming and modernizing their public-sector systems. This involves putting in place ICT infrastructure and promoting the use of ICTs to maximize impact and increase public-sector efficiency. Indeed, while investment in infrastructure is necessary for the diffusion of ICTs, the impact will ultimately depend on the use that is being made of them. Therefore, Target 6 also needs to address how governments use ICTs to improve the provision of information and services to their citizens.

Some progress has been made in achieving Target 6. At the end of 2009, no fewer than 189 countries had a central government website and provided at least basic information to their citizens, up from 173 in 2003. Also, in the majority of countries, government ministries and departments had a web presence, suggesting that by 2015 this part of the target will be achieved.

In most developing countries, sophisticated interactive and transactional online services are not yet available

The government sector also plays an important role in making relevant applications and content available online. Some countries, especially developed countries, have started to provide more sophisticated interactive and transactional online services. In most developing countries, however, such services are not yet provided online. By 2009, for example, only 21 (out of 192) countries worldwide offered tracking of (government-provided) permits as an online service to their citizens. Much is therefore left to be done to achieve this aspect of the target.

In developed countries, government institutions tend to have access to the Internet, often through a broadband connection. Much less is known about Internet access for government institutions in developing countries and in local government entities. In developing countries, a lack of resources — financial, human and infrastructure — is a constraint for increasing access to the Internet.

Most central government departments in developed countries now have access to the Internet, but less is known about the situation in developing countries or in local governments

It is also important to obtain more information about the use of ICTs within government institutions, both in developed and developing countries, especially regarding the type and quality of the connectivity, the extent of its diffusion (for example, what percentage of staff in government institutions have access to the Internet), and the actual use to which access to ICTs and the Internet is put. Indeed, little information is available on how ICTs are used, for example, for reforming and restructuring the interdepartmental organization of different levels of government.

In order to achieve the target on e-government by 2015, action needs to be taken at both the national and international levels. Specific recommendations include the formulation of a framework for an integrated e-government development strategy to exploit the synergies of new technologies in government departments and entities. Policy-makers must ensure the deployment of infrastructure, in particular broadband, as well as the effective use of ICTs in government. Governments should also develop appropriate online services which will attract users to utilize the Internet. By encouraging the development of local content through partnerships with the private sector, development agencies, non-governmental organizations and the academic and research sector, governments

can provide even more incentives for citizens to go online to access public services. The dissemination of best practices and lessons learnt from experiences in effective e-government and e-governance worldwide can inform such policies. Further recommendations include the formal adoption of ICT-for-development and e-government plans, continued follow-up on e-government development at the local level, and support for e-government capacity building at the national and local level.

Target 7: Adapt all primary and secondary school curricula to meet the challenges of the information society, taking into account national circumstances

Target 7 recognizes the need for countries to take active steps in investing in people and their skills. It is the second target (besides Target 2) that focuses on schools, highlighting the importance that education institutions have in enabling countries to effect the transition to information societies. It further implies that ICTs can be used to complement conventional delivery mechanisms, so as to ensure quality and equal education opportunities for all, including traditionally underserved or marginalized groups.

Both developing and developed countries find it challenging to train a sufficient number of teachers

Addressing this target effectively means going beyond just connecting schools with ICT infrastructure and providing the human and physical resources necessary to adapt curricula. It needs to measure to what degree teachers are qualified to use and to teach ICTs, since an adequate pool of skilled teachers is a prerequisite for adapting curricula to meet the needs of the information society. The progress in achieving this target is also analysed in terms of the adoption of computer- and Internet-assisted instruction.

The report finds that guaranteeing an adequate supply of trained teachers remains a major challenge confronting many countries throughout both the developing and developed world. A number of developed and developing countries have taken concrete steps to provide teachers with the necessary skills to teach and use ICTs. The percentage of teachers who have ICT qualifications varies from zero to six per cent in countries with available data.

Major discrepancies also exist in terms of the proportion of primary- and secondary-school teachers trained to teach subjects using ICT facilities, with the proportion ranging from zero in some countries to 100 per cent in others.

Similarly, where data are available on the different forms of ICT-assisted instruction, the variation across countries is striking. Whereas in a number of countries an ICT-adapted curriculum is present for all or a majority of primary and secondary schools, in many developing countries only a small proportion of schools have effectively integrated ICTs as part of the curriculum. Countries that have adopted full-scale implementation of computer- and Internet-assisted instruction in their schools also have a relatively higher proportion of trained teachers, whereas other countries show signs that they are still in the early stages of implementation.

More schools use computers than the Internet to deliver educational content

The report also finds that, overall, the level of computer-assisted instruction is higher than the level of Internet-assisted instruction, suggesting that access to the Internet, which requires the availability of at least basic telecommunication/ICT infrastructure, may be a barrier.

To adapt school curricula to meet the challenges of the information society, and hence fulfil Target 7, policy imperatives must go beyond capital investments in ICT-related infrastructure. It is essential that initiatives also develop ICT-skills building among the teaching force, so that the knowledge can be passed down to students. While many developing countries must continue to commit resources with a view to connecting edu-

cational institutions to ICTs, policy-makers must at the same time address the challenges of adapting curricula in primary and secondary schools to meet the demands of an ever-changing society.

Target 8: Ensure that all of the world's population have access to television and radio services

Today, the world's surface is covered by terrestrial and/or satellite radio and TV signals

Target 8 specifically addresses the need to take advantage of broadcasting technologies — often referred to as "older" or traditional ICTs — to help countries move towards the information society. In addition to providing access to information and news, including for illiterate segments of the population and in the case of emergencies, broadcasting services can also be employed for educational purposes. They complement printed media, and are particularly important in those countries and areas where Internet penetration levels are relatively low, or where the availability of online content in local languages is limited.

To monitor basic access to broadcasting services, it is important to go beyond the coverage of broadcasting signals, and to measure the availability of broadcasting devices (TVs and radios). Furthermore, it is useful to track the availability of multichannel television services, since these provide higher-quality services and more content, important factors for increasing demand for and leveraging the benefits of television services.

The report finds that Target 8 has largely been achieved in terms of access to broadcasting signals, the entire world's surface being covered by terrestrial and/or satellite radio and TV. In terms of the devices that allow people to receive radio and TV services, access is also widespread: the target has been achieved in the developed world, where almost all households have access to a radio and TV, while in the developing world, a large proportion of households have access to a TV and/or a radio, although penetration rates vary among countries and regions.

A total of 1.4 billion households — or five billion people — have a TV, half of them with multichannel services

TVs tend to be more popular and available than radios in many developing countries and regions, except Africa. By the end of 2009, there were some 1.4 billion households with a TV around the world, providing some five billion people access to a TV at home. This corresponds to a household TV penetration rate of 79 per cent, up from 73 per cent in 2002. Europe, the Americas and the CIS all have household television penetration rates exceeding 90 per cent, followed by the Arab States and Asia and the Pacific with 82 and 75 per cent, respectively. Africa stands out since, on average, only 28 per cent of households possess a TV.

The delivery of multichannel television, including satellite, cable, IPTV and digital terrestrial TV, has spread rapidly over the last decade and, by 2008, close to 50 per cent of households with a TV had multichannel services, compared to around 40 per cent in 2000.

The lack of electricity and content are major barriers to overcoming the broadcasting divide

Radios continue to play an important role in LDCs and in Africa, particularly in rural areas where incomes tend to be relatively low and where electricity is limited. In LDCs, radios are also more prevalent than TVs: around a third of households on average have a TV, compared to two-thirds with a radio. These data suggest that in those countries more efforts need to be made to bring broadcasting services to all households, in particular in rural areas.

The report argues that the broadcasting digital divide is not a pure income divide. Although income is without doubt an important factor, particularly in LDCs, the lack of electricity and the lack of content are major barriers that governments need to tackle. Policy-makers can also increase competition in the provision of content (for both TV and

radio services), especially in countries with a limited number of broadcasters. Satellite services offer the possibility for most developing countries to ensure nationwide broadcasting coverage, and countries could take advantage of existing regional systems to increase the availability of coverage and content. Increasing access to terrestrial digital and multichannel TV, for example through government subsidies, is an important objective in the information society and another way of expanding on existing content.

Target 9: Encourage the development of content and put in place technical conditions in order to facilitate the presence and use of all world languages on the Internet

Most WSIS targets focus on providing Internet access to institutions and citizens. However, access is only part of the story. The true essence of the Internet is that it fosters communication between humans (and with networked objects), and allows them to retrieve and exchange meaningful information. This implies that citizens need relevant content, in their (local) language. The main objective of Target 9 is to ensure that the Internet serves people worldwide by offering the greatest possible diversity in terms of content and languages.

The persistent digital divide is at least partly related to the issue of languages and content on the Internet

Although discussions on the digital divide often focus on the availability of infrastructure, the lack of local content in local languages is critical: if there is nothing relevant for people to find on the Internet, they have no reason to go online. Thus, greater availability of local content, in local languages, will encourage more people to use the Internet. The development of user-friendly and affordable ICT applications targeted towards citizens and local communities is critical for increasing Internet use and building an inclusive information society.

Until recently, progress on Target 9 has been held back by a number of technical details with regard to the representation of different languages on the Internet, as well as the idea that English can act as an Internet *lingua franca*. However, efforts are increasingly being made not only to overcome technical barriers but also to encourage the production of local content, in local languages. Producing more content in local languages is key to bringing more people online, especially since it is estimated that only 15 per cent of the world population understands English. The proportion of English-speaking Internet users is indeed declining, falling from 80 per cent in 1996 to around 30 per cent in 2007, reflecting the fact that non-English speakers are increasingly going online.

Even though English is still the predominant language on the Internet, only an estimated 15 per cent of the world population understands it

The WSIS process has made an important contribution by acknowledging the issue of linguistic diversity and ensuring it has received higher priority on the global Internet-related policy agenda in recent years. Some changes have already taken place, such as the introduction of non-Latin script web addresses for domain names, reflecting the fact that more than half of the 1.7 billion people who use the Internet today speak languages with non-Latin scripts. This is likely to increase the demand for linguistic diversity on the Internet, adding a bottom-up driver to the efforts made at the political level and in the context of the WSIS process.

The internationalization of domain names is expected to increase demand for linguistic diversity on the Internet

The number of initiatives to promote linguistic diversity is also rapidly increasing, and this process can be expected to show some tangible results by 2015, with likely increases in the number of languages that can be used on the Internet, the availability of local content, and the number of language versions of the main software and applications used on the Internet. However, it is difficult to determine precisely what drives the production of content and what incentives could be provided to stimulate the development of local content.

Implementing Target 9 requires, for example, the development and implementation of policies that promote diversity of cultural expression and indigenous knowledge and

traditions through the creation of varied information content. This requires, in turn, the development of local content (including through the translation and adaptation of existing content), digital archives and diverse forms of digital and traditional media, with support from local authorities.

It is also important to nurture local capacity for the creation and distribution of software in local languages. This calls for technologies and research in areas such as translation, iconographies, and voice-assisted services; the required hardware and software models covering character sets, language codes, electronic dictionaries, terminology and thesauri, multilingual search engines, machine-translation tools, internationalized domain names and content referencing; as well as general and application software which should also be available in local languages.

Eighty-six per cent of the world's population is covered by a mobile cellular network

Target 10: Ensure that more than half the world's inhabitants have access to ICTs within their reach

Target 10 goes to the heart of all the WSIS targets, since the success of creating an information society depends primarily on whether people have access to ICTs.

While the target sets a clear and quantifiable goal, i.e. "*more than half the world's inhabitants*," it is vague in terms of the technologies or services concerned ("ICTs"). Two key technologies which need to be covered are mobile cellular and Internet. Also, it is important to monitor not only access to ICTs, but also their actual use. To reflect the importance of the use of ICTs, the target could be amended to read "*Ensure that more than half the world's inhabitants have access to ICTs within their reach and make use of them*."

By 2015, more than half of world's inhabitants are expected to be using a mobile phone

One of the most striking developments since the conclusion of the Summit, surpassing all possible expectations, has been the rise of mobile telephony in all parts of the world. Mobile cellular network coverage already stands at 86 per cent of the population, and is likely to reach close to 100 per cent by 2015. This would translate into (potential) access to telephone services for all people in the world.

The mid-term review reveals that, with respect to the number of mobile cellular subscriptions, the target has been achieved. By the end of 2009, worldwide mobile cellular penetration stood at 67 per cent, compared to 20 per cent in 2003, at the time of the first phase of the Summit, when few foresaw the rapid take-up of mobile services. Developing countries surpassed the 50 per cent penetration mark in 2008, and a number of regions (Europe and CIS) have passed the 100 per cent penetration mark. These penetration figures include double counts (because one person may have more than one subscription or SIM card) and do not therefore equate exactly to the number of actual users of mobile telephones. Recent data on the number of people who actually *use* a mobile phone show that most developed countries have already achieved Target 10 and many developing countries are steadily approaching it. If countries manage to sustain current growth rates, The target will be attained, with more than half of world's inhabitants expected to be using a mobile phone by 2015.

By 2009, 1.7 billion people — or 26 per cent of the world population — were online and 25 per cent of households had access to the Internet

It is not possible to talk about the information society without measuring how many people are using the Internet. By the end of 2009, some 1.7 billion people, or 26 per cent of the world population, were online and global Internet user penetration has doubled between 2003 and 2009. While developed countries have achieved the target, with an estimated 64 per cent penetration rate at the end of 2009, less than 20 per cent of people in the developing world were using the Internet. Data also show that in the majority of countries still more men than women use the Internet. Major efforts are required to bring half the world population — including half of the female population — online by 2015.

Target 10 specifies that ICTs should be "*within reach*." The report therefore also examines the availability of Internet access at home. Data show that at the end of 2008, some 25 per cent of households globally had Internet access. In the developed world, almost 60 per cent of households had Internet, compared to only 12 per cent in the developing world.

The report finds that the broadband divide remains significant and while some countries and regions of the world are going increasingly high-speed, others risk falling behind. Whereas in the developed countries most households today enjoy a broadband connection, penetration levels in the developing countries remain much lower. By the end of 2009, the fixed (wired) broadband penetration rate of developing countries stood at only 3.5 per cent, up from around one per cent in 2003. While these figures refer to broadband subscriptions rather than users (and one subscription is likely to benefit several users), they are still a good indication of the long way left to go before reaching the target.

While most people in the developed world use a broadband Internet connection, the developing countries are still far from reaching the target

However, current developments in the mobile sector are expected to have a major impact on *wireless* broadband access in the near future. Wireless broadband only started to take off after the conclusion of WSIS. While penetration rates are still as low as those for fixed (wired) broadband, especially in developing countries, an increasing number of countries are offering 3G (and now even 4G) services, and the number of subscriptions is expected to increase rapidly in the near future. Given the importance of high-speed Internet access, the report proposes that Target 10 should aim at ensuring that more than half the world's inhabitants have broadband Internet access by 2015.

To achieve Target 10, governments need to take action on various fronts. This includes building the necessary infrastructure and providing public access; expanding skills; and creating relevant and local content. On the infrastructure side, governments need to exploit the potential of wireless broadband by expanding mobile network coverage, including 3G coverage, to all segments of the population, and particularly to rural areas, where fixed (wired) networks are limited. Governments can also encourage the uptake and use of broadband networks by increasing competition to lower the cost of access, and by providing public access for those portions of the population who cannot afford home access. Increasing the use of ICTs also calls for appropriate policies to provide citizens with ICT skills and to promote the development of locally relevant content. By creating an enabling environment for an inclusive information society, governments play a key role in increasing ICT access and use.

Towards 2015

Since WSIS, the greatest progress has been made in connecting people via mobile technologies, but three-quarters of the population are not yet on the Internet

The assessment of each of the ten WSIS targets has shown that, since the Summit, the area where most progress has been made is connecting people via mobile technologies. Mobile cellular network coverage already stands at 86 per cent of the population, and there is every chance it will rise to close to 100 per cent by 2015. Mobile cellular telephony has grown sharply, and it looks very much like more than half of the world population will be using a mobile telephone by 2015, thus fulfilling Target 10. Similarly, basic radio and TV services are widely available, and could reach the majority of the world population by 2015, provided electricity and broadcast content do not form a barrier. Furthermore, global Internet user penetration has doubled between 2003 and 2009, and by the end of 2009 around one-quarter of the world population was online — up from around 12 per cent in 2003. Good progress has also been made with respect to bringing Internet access to central governments, research and scientific institutions and to some extent schools, hospitals, museums, libraries and archives, at least in the major cities of developing countries.

Despite these encouraging trends, by the end of 2009 three-quarters of the world population (and more than 80 per cent of the developing countries' population) were not

yet using the Internet, and even fewer via a broadband connection. In most developing countries, households, schools, hospitals and other public institutions located outside the major urban areas are not yet connected to (broadband) Internet. With five more years to go to 2015, all stakeholders should step up efforts to bring high-speed Internet to a larger number of people and institutions, especially in the developing world.

Turning targets into actions

In view of the challenges highlighted, and to ensure that the WSIS targets and goals are achieved by 2015, a concerted policy effort is needed on the part of all national, regional and international stakeholders. It should also be remembered that, given the significant impact that ICT use has on development in other economic and social areas, progress in ICT development will also drive progress towards the attainment of other international development goals, including the MDGs, also set for 2015. Policy action should focus on three main areas:

Access to broadband Internet for half the world population by 2015

1. **Expanding broadband Internet access**. Affordable, high-speed Internet access is central to the development of an information and knowledge-based society. Like the printing press, electricity or the automobile, Internet is a technology that has far-reaching impacts on society. Internet, and especially broadband Internet, is increasingly accepted as a general-purpose technology that dramatically affects the way people communicate, do business, interact with governments and educate and inform themselves. This requires governments to pursue policies that will have a significant impact on Internet usage, including an enhanced effort to deploy (fixed/wired and/or wireless) broadband infrastructure and to include broadband in universal access plans. It might be possible to reach the goal of providing broadband Internet access to at least half the population by 2015 in view of the rapid spread of wireless broadband. Countries that have not yet done so should launch 3G networks as soon as possible and take advantage of the opportunities that wireless broadband networks offer, in particular high-speed access to the Internet. Developing countries need to seize the potential of wireless broadband for stimulating competition in the Internet market and increasing access levels. This is particularly relevant considering that fixed (wired) broadband options are extremely limited in many developing nations.

ICT skills for ICT use

2. **Building an ICT-literate society**. In order to be used effectively, ICTs, particularly Internet, require a basic level of ICT literacy. Furthermore, many people around the world cannot use the Internet and its related applications (in areas such as health, education or government) because they are illiterate. This is tied to education, and learning opportunities must be universal if ICT use is to expand further. ICTs must be provided in schools, and ICT-skills development should form part of the curriculum. In addition, there are various segments of the population beyond school age who require ICT training. Policy-makers in developing countries, in partnership with the international community, should continue to commit resources to connecting education institutions to ICTs and address the multifaceted challenges of adapting curricula in primary and secondary schools to meet the demands of an ever-changing society.

More online content in more languages

3. **Developing online content and applications**. Greater availability of local content, in local languages, will drive more people to use the Internet. The development of user-friendly and affordable ICT applications, geared to citizens and local communities, is critical for increasing Internet use and building an inclusive information society. This must include initiatives and applications in the areas of e-health, e-government and e-business. In order to make content accessible to local communities, language diversity is of vital importance. Digitizing books, documents, exhibits and collections available in local libraries, museums, archives and cultural institutions could dramatically increase the availability of online content in local languages. Yet “e-culture” is often overlooked in national ICT strategies. The digitization and online availability of existing content should be a policy priority, and there are many best-practice examples that governments could

follow. With more than half of the Internet users speaking languages with non-Latin scripts, the recent opening up of Internet domain names to non-Latin script characters is an important development that needs to be continued. This is likely to increase the demand for content in local languages and can serve as an important driver from the user side, to complement government-initiated projects.

Monitoring progress

In developed countries, most indicators show a high level of achievement, whereas in developing countries most indicators still show low levels

For each of the ten targets, the report has identified a set of measurable indicators, which could be used by countries in their monitoring efforts. The *WSIS Mid-term Review Table* (at the end of the chapter "Conclusions and the way forward') summarizes the main results of the report, including proposed revisions to the targets to facilitate measurement, the most relevant action lines, and the indicators proposed to monitor each of the targets. The table also provides an overall assessment of the status of the targets and the indicators for which data were available. It shows that, whereas in developed countries most indicators have a high level of achievement, this is not the case in developing countries, where only few indicators have reached a high level of achievement and most indicators are still at a low level.

The phrasing of the existing targets is sometimes vague, making it problematical to interpret the targets and select appropriate indicators. For measurement purposes, some revisions to the wording are desirable, including the deletion or addition of components, and the definition of more concrete targets. These suggestions may be found throughout the report.

The WSIS targets need to be revised

Some areas, although vital to the development of the information society, are not covered anywhere in the targets. The most critical of these is the use of ICTs in business, which is essential for participation in today's knowledge-based economy and is addressed in WSIS Action Line C7. The report therefore proposes that a new target be added: "Connect all businesses with ICTs." Indicators for measuring ICT use by businesses have been developed by the *Partnership on Measuring ICT for Development* and are collected by an increasing number of countries. Other areas not addressed by the targets are e-agriculture and e-environment, which are also included in Action Line C7; building confidence and security (Action Line C5); and the ethical dimensions of the information society (Action Line C10). Progress in these areas should also be monitored, and indicators defined to this end.

Governments and international stakeholders need to collect data to monitor progress towards 2015

Limited data availability has constituted a major constraint in the preparation of this mid-term review. Even the most basic indicators chosen are often not collected at the national (or international) levels, or are outdated. It was therefore not possible to make a comprehensive, global assessment of all targets.

In the absence of data, it will be difficult to assess whether the WSIS goals and targets are met by 2015. This is particularly alarming in the case of developing countries, where ICT penetration levels are lower and which are lagging behind on several of the targets. There is therefore an urgent need for governments to collect the data required for monitoring progress towards achieving the WSIS targets by 2015, and beyond.

The international community also needs to step in to assist countries in the measurement process. The indicators presented in this report can serve as a starting point, but they need to be further refined, and perhaps expanded, in consultation with the WSIS community. As a follow-up to this report, it is therefore proposed that a monitoring process be established under the framework of the *Partnership on Measuring ICT for Development*, which has been tasked by the WSIS outcome documents, as well as by the United Nations Economic and Social Council, to track progress towards the WSIS targets. In close collaboration with relevant stakeholders, a final matrix for all targets and action lines should be presented as soon as possible and disseminated widely in order to help

countries in their monitoring efforts. Data should be compiled on a continuous basis and regular quantitative updates of progress made on the goals should be prepared by the partners. A final report should then be prepared for 2015, setting forth a global assessment of progress achieved in reaching the WSIS targets.

Introduction

The *World Summit on the Information Society* (WSIS), held in Geneva (2003) and Tunis (2005), brought together governments, civil society and the business sector to discuss a broad range of subjects related to information and communication technology (ICT) for development. In the end, governments agreed on a set of commitments and actions to foster the establishment of an inclusive information society. In particular, ten targets were identified in the *Geneva Plan of Action* [ITU, 2005], along with numerous recommendations based on different action lines. The targets, to be achieved by 2015, range from connecting villages, schools, health centres, libraries and government agencies to developing content, incorporating ICTs in school curricula and providing broadcasting services to all people in the world. The action lines address issues related to — among others — ICT infrastructure, capacity building, cybersecurity, an enabling policy environment and ICT applications in agriculture, education, business or the environment. The Tunis Agenda for the Information Society [ITU, 2005] complemented the list by calling for increased financing of ICTs in the developing world as well as continued discussion of Internet regulatory issues through the newly established *Internet Governance Forum* (IGF).

In view of this broad range of topics and related programmes and policies to be implemented by national, regional and international stakeholders, assessing progress made since WSIS is a challenging task. There are several mechanisms and processes that endeavour to review implementation of the WSIS outcomes and commitments, which are discussed further below. So far, none of them has produced a systematic overview of progress made in terms of achieving the objectives, targets and goals of the Summit.

This *World Telecommunication/ICT Development Report* (WTDR) looks at the ten WSIS targets identified in the Geneva Plan of Action (Box 1). The year 2010 marks the midpoint between the Tunis phase of WSIS (2005) and the deadline for achieving the WSIS targets (2015), which is also the target date for the *Millennium Development Goals* (MDGs). This report thus provides a mid-term review of the progress made towards achieving the ten WSIS targets.

No formal monitoring process was put in place by the Summit, and no global assessment of the targets has been made to date. Similarly, there are no agreed indicators for all of the targets that countries could use for monitoring purposes. While a core list of ICT indicators has been identified by the international community (Box 2), the WSIS targets go far beyond these core indicators, covering subjects that are challenging to capture in quantitative terms, let alone to compare at the international level.

This report fills this gap and sheds some light on the issue of monitoring and evaluating the WSIS outcomes. The overall objective of this WTDR is to provide policy-makers with a comprehensive assessment of achievement of the WSIS targets to date, identify the gaps to be filled by 2015 and, based on the findings, make suggestions on the type of measures that could be taken in order to meet the targets within the time-frame.

Another goal of the report is to make policy-makers aware of the need to monitor information society targets, highlighting best international practices. The report also identifies specific quantitative indicators for tracking the targets, along the lines of the internationally agreed indicators used for tracking the MDGs.

Box 1: What are the WSIS targets?

Section B of the Geneva Plan of Action (§§ 4-7) identifies objectives, goals and targets for building an inclusive information society. It calls upon countries to establish national targets as part of national ICT strategies, which could serve as benchmarks for actions and for evaluating progress. To guide countries in setting national targets, a set of international targets were established, based on the MDGs, to "*serve as global references for improving connectivity and access in the use of ICTs in promoting the objectives of the Plan of Action, to be achieved by 2015.*"

The ten targets are as follows:

1. To connect villages with ICTs and establish community access points
2. To connect universities, colleges, secondary schools and primary schools with ICTs
3. To connect scientific and research centres with ICTs
4. To connect public libraries, cultural centres, museums, post offices and archives with ICTs
5. To connect health centres and hospitals with ICTs
6. To connect all local and central government departments and establish websites and e-mail addresses
7. To adapt all primary and secondary school curricula to meet the challenges of the information society, taking into account national circumstances
8. To ensure that all of the world's population have access to television and radio services
9. To encourage the development of content and put in place technical conditions in order to facilitate the presence and use of all world languages on the Internet
10. To ensure that more than half the world's inhabitants have access to ICTs within their reach.

Section E of the Geneva Plan of Action (§ 28) calls for realistic international performance evaluation and benchmarking to follow up implementation of the objectives, goals and targets agreed at WSIS. The only indicators that were specified are community connectivity and gender-specific indicators. No indicators directly linked to the targets (or any other outcomes) were identified, and no recommendations were made on the process of evaluation or tracking of the targets.

WSIS follow-up and implementation

Since the conclusion of the Summit at the end of 2005, the primary focus of attention (at both national and international levels) has been implementation of the WSIS outcomes, in particular the topics identified under the various action lines (Action Lines C1 – C11). Several mechanisms have been put in place to this end.

a) The Tunis Agenda identified several international organizations to facilitate the implementation of specific action lines.[1] The facilitation process started after the conclusion of the Summit, with annual meetings of "action line facilitators."[2] In 2009, the action line facilitation meetings were organized for the first time under the umbrella of the WSIS Forum, in order to ensure coherent presentation and discussion of recent developments in the information society and of implementation of the WSIS action lines. The I*nternational Telecommunication Union* (ITU) has played a key role in hosting and facilitating the annual meetings and the WSIS Forum.

b) The *United Nations Group on the Information Society* (UNGIS) meets annually, to coordinate implementation of the WSIS outcomes among UN agencies. It was mandated by the Tunis Agenda (§ 103). The group, which has been co-chaired by ITU, the *United Nations Educational, Social and Cultural Organization* (UNESCO) and the *United Nations Development Programme* (UNDP), and, recently, the *United Nations Conference on Trade and Development* (UNCTAD), is planning a number of joint activities until 2015.[3]

UNGIS member organizations follow up on the implementation of WSIS outcomes in their respective areas of work and within their intergovernmental frameworks.[4] ITU has been given a key role in the implementation of several of the WSIS action lines, and the work programme of ITU's Telecommunication Development Sector (ITU-D) reflects a large number of topics addressed by the Geneva Plan of Action.[5]

c) The Geneva Plan of Action (§ 28) proposes that a website be launched to collect best practices and success stories. Accordingly, ITU initiated the WSIS stocktaking databases, a compilation of (several thousands of) ICT-related

activities and projects carried out by governments, international organizations, civil society and businesses. The Tunis Agenda encouraged the continuation of the ITU stocktaking database (§ 120), which was updated in 2008, the next edition being planned for 2010.[6]

d) A formal follow-up of the WSIS outcomes was mandated, to be overseen by the *UN Economic and Social Council* (ECOSOC) (Tunis Agenda, § 105). At its 2006 session, ECOSOC instructed the UN *Commission on Science and Technology for Development* (CSTD) to be "*the focal point in the system-wide follow-up, in particular in the review and assessment of progress made in implementing the outcomes of the Summit.*"[7] Since then, CSTD has reviewed progress at its annual sessions, and it gathers contributions from international organizations for the UN Secretary-General's annual *Report on WSIS implementation and follow-up*.[8]

WSIS monitoring and evaluation

The above-mentioned post-WSIS mechanisms illustrate that the international community is deploying great efforts to advance the development of the information society by implementing and facilitating relevant policies and programmes. While there are several reporting mechanisms in place, they are primarily qualitative in nature, such as reviewing progress in the implementation of action lines, or collecting country and case studies and information on ongoing projects. Little attention has been paid to quantitative assessment or review of achievements based on comparable cross-country, statistical indicators. Yet policy implementation requires that results be monitored, so as to assess whether the policies have been successful.

A number of provisions of the WSIS outcome documents address the subject of quantitatively reviewing, monitoring and evaluating progress:

The Geneva Plan of Action (§ 28) calls for the establishment of comparable indicators, including community connectivity and gender-specific indicators; the regular publication of a composite index; monitoring of the digital divide; and the assessment of universal accessibility to ICTs.

The Tunis Agenda takes this a step further by providing a set of suggestions related to the "periodic evaluation" of the WSIS outcomes (§§ 112-120). In particular, it acknowledges the work of the *Partnership on Measuring ICT for Development* (Box 2) in developing a core list of indicators and building statistical capacity in developing countries for monitoring their information societies. The Tunis Agenda also requests the UN General Assembly to conduct an overall review of implementation of the WSIS outcomes in 2015.

Although some stakeholders (notably the members of the *Partnership*) have actively addressed the important issue of measurement, only a few countries have carried out a regular evaluation of progress made in their information societies. While some basic ICT data are widely available (for example, the number of fixed telephone lines, radios, TVs, mobile subscriptions), more is needed to assess the WSIS goals and targets, as well as the implementation of action lines.

The WSIS targets are not only very broad, but also do not include measurable indicators, which makes monitoring something of a challenging proposition and international comparisons almost impossible. For example, six of the targets refer to "*connecting*" villages, schools, governments, and so forth with ICTs, without however specifying what is meant by "*connectivity with ICTs*" (e.g. telephone, Internet, computer, …), who should be connected (e.g. teachers, students, …) and what the connectivity should achieve (e.g. increased knowledge, transparency, health, productivity and/or efficiency, …). While the most basic connection could be a telephone connection, in today's world Internet — and preferably broadband — is often viewed as the most important type of connection worldwide, in particular with reference to the information society.

To address these challenges, this report interprets the targets, by defining some of the terminology used, and proposes a number of indicators for benchmarking that could be collected by countries before 2015, when a final evaluation should be made. Besides access to ICTs ("connectivity" in the simplest meaning of the term), in order to maximize their impact it is critical that ICTs be actually *used* in practice by various stakeholders (people, public and private institutions). Therefore, for several of the targets, the report proposes ICT usage indicators, plus indicators related to content and applications.

Box 2: The *Partnership on Measuring ICT for Development* and WSIS[9]

Following the Geneva Summit in December 2003, the *Partnership on Measuring ICT for Development* (hereinafter the *Partnership*) was launched at UNCTAD XI (held in Brazil) in June 2004. Its members, at that time, were the three founding members (UNCTAD, ITU and OECD); the UNESCO Institute for Statistics (UIS); four UN Regional Commissions (UNECLAC; UNESCWA; UNESCAP; and UNECA); the UN ICT Task Force (whose mandate expired at the end of 2005); and the World Bank. Eurostat officially joined the *Partnership* in February 2005 and the UN Department of Economic and Social Affairs (UNDESA) in May 2009.

During the initial phase of the *Partnership*, emphasis was placed on building awareness at the national and international levels of the importance of ICT measurement for policy-making, and on developing agreed standards and methodologies to enhance the production of internationally comparable ICT statistics. The *Partnership* was an active contributor to the WSIS Tunis preparatory meetings and the Summit itself. This included the organization of a WSIS thematic meeting (February, 2005) resulting in the first core list of agreed ICT indicators; a series of regional ICT measurement events; and written inputs to the discussion and preparation of the WSIS outcome documents (Tunis Agenda). During the Tunis Summit, a parallel event was organized by the *Partnership*, to present the agreed core list of indicators to policy-makers, together with an accompanying methodological publication [Partnership, 2005a]; to debate the importance of measuring the information society for ICT policy-making and development; and to launch a publication providing an overview of the status and availability of ICT indicators worldwide [Partnership, 2005b].

As a result of this work, the Tunis Agenda recognized the need for ICT measurement (§§ 112-119), and made specific reference to the *Partnership* (§§ 114-115):

"*114. The development of ICT indicators is important for measuring the digital divide. We note the launch, in June 2004, of the Partnership on Measuring ICT for Development, and its efforts:*

a) to develop a common set of core ICT indicators; to increase the availability of internationally comparable ICT statistics as well as to establish a mutually agreed framework for their elaboration, for further consideration and decision by the UN Statistical Commission;
b) to promote capacity building in developing countries for monitoring the information society;
c) to assess the current and potential impact of ICTs on development and poverty reduction;
d) to develop specific gender-disaggregated indicators to measure the digital divide in its various dimensions.

115. We also note the launch of the ICT Opportunity Index and the Digital Opportunity Index, which will build upon the common set of core ICT indicators as they were defined within the Partnership on Measuring ICT for Development."

Following the Tunis Summit, the core list of ICT indicators was further refined and presented to the UN Statistical Commission (UNSC) in 2007 [Partnership, 2007], which endorsed the list and encouraged the *Partnership* to update it, especially with regard to measuring the use of ICT in education and in government — two areas that figure prominently in the WSIS targets; the contribution of ICT to economic growth and social development; and barriers to use of the technology. A revised core list was presented by the *Partnership* to UNSC in 2009, and published in 2010 [Partnership, 2010].

Six years after its inception, the *Partnership* is recognized as a key international player in the area of ICT statistics. Members of the *Partnership* regularly report on progress made at meetings of the WSIS Forum, CSTD, UNGIS and action line facilitators, as well as at other events and conferences not directly related to WSIS.

ITU has been an active member of the *Partnership* from the very beginning, and is part of its Steering Committee (along with UNCTAD and ECLAC). For more information about the *Partnership* and its activities, see http://www.itu.int/ict and http://measuring-ict.unctad.org.

Important ICT developments have taken place in recent years (especially since the Geneva phase of the Summit) which were not anticipated at the time of WSIS. The most striking example is the rise of mobile telephony and its associated applications. The emergence of Web 2.0 and user-created content on the Internet are also shaping today's development of the information society. On the technology side, the launch of new standards in the mobile sector, the convergence of technologies (such as broadcasting and telecommunication) and the steady expansion of high-speed communication infrastructure have significantly changed the way ICTs are accessed and used, and their economic and socio-economic impact is ever increasing. Indeed, today the Internet is largely recognized as a general-purpose technology, and broadband is regarded as a basic infrastructure, in the same way as electricity, water or

roads. Many citizens even consider the Internet as a "fundamental human right," and some countries have started to put in place legislation stipulating that access to the Internet is a human right for their citizens.[10] Such developments need to be taken into consideration when reviewing the WSIS targets and their achievement, and appropriate adjustments to the targets need to be made.

Methodology for preparing the report

Given the broad range of subjects covered by the WSIS outcome documents and the targets, this WTDR has been drafted in close collaboration with other UN agencies and stakeholders, in particular UIS (Targets 2 and 7), the World Health Organization (WHO) (Target 5) and UNDESA (Target 6). Representatives from civil society, especially the *Networks and Development Foundation* (FUNREDES), have provided substantive inputs to the chapter covering Target 9.

The data presented in this report are collected at the international level by ITU and the above-mentioned organizations. They have been supplemented by additional research on the indicators selected for each target. The report presents a mid-term review based on the latest available data, which often relate to 2008, and only some to 2009. For some targets (such as, for example, Target 9 on language diversity on the Internet, an area that is not likely to change quickly), the most recent data may go back even further.

Since many of the WSIS targets stretch beyond the currently internationally available ICT data, a questionnaire was sent to all ITU Member States between September and November 2009 (Box 3). This "*Survey on the WSIS targets*" requested quantitative information on each of the ten targets. A total of 48 countries responded to the survey. The information provided by countries is featured throughout the report.

Box 3: ITU Survey on the WSIS targets

With a view to preparing WTDR, ITU carried out a survey of its Member States in 2009. The survey requested quantitative information on each of the ten WSIS targets, although questions on indicators already collected by ITU or by other international organizations through their regular data collection processes were not included.

A total of 48 countries responded to the survey (see Annex 1 for a complete list of respondents), but not all countries replied to all questions on the different targets. An analysis of the results of the questionnaire shows that the number of replies per indicator varied between nine (on the "percentage of cultural centres with access to the Internet") and 26 (on the "percentage of public libraries and post offices with access to the Internet"). On average, each question elicited around 20 replies, which is only about ten per cent of all countries that received the questionnaire.

This relatively low response rate points to a number of factors. First, it could be an indication that only a few countries are currently tracking the WSIS targets, given that the Summit did not identify a concrete set of indicators, nor initiate a monitoring process. Second, it could mean that even if some of the data are available within a country, they are not compiled or centralized within one government agency or ministry. This may be especially true insofar as the issues covered by WSIS span a very broad range of topics that are dealt with by different ministries and government agencies. Finally, and linked to the previous point, it should be borne in mind that the questionnaire was sent to ITU's constituency, i.e. the telecommunication/ICT-related ministries and regulatory authorities. These institutions may not necessarily be aware of data collected by other government entities. As a result, it is likely that data which might be available in some countries are not reflected in this report.

Ten targets, ten chapters

The report features ten substantive chapters, each covering one of the WSIS targets. Each chapter includes:

- A discussion of how the target could or should be interpreted, its context, rationale and expected impact, its relevance for development of the information society and its link to the WSIS action lines. In some cases, proposals are formulated for more precise definitions of the target, or revisions of the target's wording.

- Information on the availability of existing indicators and data that could be used to monitor the target, their advantages and shortcomings, as well as the difficulties in identifying and tracking certain indicators.
- A concrete proposal for a limited number of quantitative indicators for monitoring the target, and the rationale behind them.
- An overview of what has been achieved so far, with regional and global data and country examples, including success stories and best-practice policies.
- An assessment of gaps, and what is being done to address them; a discussion of the likelihood of reaching the target by 2015; a set of policy recommendations and measures that could be implemented in order to meet the target by 2015.

Notes

1 See Annex to the Tunis Agenda for the Information Society [ITU, 2005].

2 More information about the meetings of the action line facilitators is available at: http://www.itu.int/wsis/implementation/.

3 For further information, see http://www.ungis.org/Default.aspx?tabid=620.

4 For example, the ITU Council Working Group on WSIS (WG-WSIS) was created in 2002, and in November 2006 the ITU Plenipotentiary Conference requested WG-WSIS to facilitate membership input and guidance on ITU's implementation of relevant WSIS outcomes and to elaborate proposals to the ITU Council that may be necessary for adapting ITU to its role in building the information society (http://www.itu.int/council/groups/wsis/).

5 See ITU/BDT Doha Action Plan 2006 [ITU, 2006], § 3.2 (IV) on inclusion of the WSIS outcomes in the ITU-D activities (p. 5 and Annex 1), at: http://www.itu.int/ITU-D/conferences/wtdc/2006/pdf/dohaactionplan.pdf.

6 http://www.itu.int/wsis/stocktaking/index.html.

7 See ECOSOC Resolution 2006/46, available at: http://www.un.org/docs/ecosoc/documents/2006/resolutions/Resolution%202006-46.pdf.

8 See http://www.unctad.org/Templates/Page.asp?intItemID=4239&lang=1 for further information on CSTD.

9 For further information, see [Partnership, 2008] and http://www.itu.int/ITU-D/ict/partnership/index.html.

10 Based on a survey of 27 000 adults in 26 countries carried out by BBC in 2010, around three-quarters of interviewees considered Internet access as a human right (see http://newsvote.bbc.co.uk/2/hi/technology/8548190.stm). Countries that have ruled that access to Internet is a human right for their citizens include Finland, France and Estonia.

References

International Telecommunication Union (2005), World Summit on the Information Society outcome documents, Geneva.

International Telecommunication Union (2006), Final Report, World Telecommunication Development Conference (WTDC-06), Geneva.

Partnership on Measuring ICT for Development (2005a), Core ICT Indicators, New York/Geneva.

Partnership on Measuring ICT for Development (2005b), Measuring ICT: The Global Status of ICT Indicators, New York/Geneva.

Partnership on Measuring ICT for Development (2007), "Report of the Partnership on Measuring Information and Communication Technologies for Development: information and communication technology statistics," Report to the UN Statistical Commission, Thirty-eighth session, http://unstats.un.org/unsd/statcom/doc07/2007-5e-ICT.pdf.

Partnership on Measuring ICT for Development (2008), The Global Information Society: a Statistical View 2008, Santiago, Chile.

Partnership on Measuring ICT for Development (2010), Core ICT Indicators 2010, Geneva.

Target 1: Connect villages with ICTs and establish community access points[1]

Introduction

Although Target 1 does not explicitly mention "rural" populations, it is implicit from the use of the word "village"[2] that the focus is on connecting people living in rural areas. In most countries, especially developing countries, there is a large gap in the availability of information and communication technologies (ICTs) between urban and rural locations, and Target 1 is important for ensuring that rural areas are not excluded from the information society. Because of their isolation, rural areas arguably stand to derive even more benefit from connectivity, since ICTs can deliver health, education and other services that might be less widely available there.

There are two activities associated with this target: 1) connecting villages with ICTs, and 2) establishing community access points. The second underpins the first, in that one of the most practical methods of providing ICTs in rural areas in many developing countries is through shared access. Given that incomes tend to be lower in rural locations compared to urban areas, and many rural households simply cannot afford ICTs, shared access is a cost-effective means of providing rural connectivity. The establishment of community access points is also related to Target 4 on connecting public locations that can be used for shared access, such as libraries and post offices, and likewise to Target 10, which sets the goal of ensuring that more than half the world's inhabitants have access to ICTs within their reach. About half of the world's inhabitants live in rural areas, and one way of getting ICTs to them is through community access.

Insofar as the majority of the population in developed countries lives in urban areas and, moreover, rural areas in those countries are in any case fairly well equipped in terms of connectivity (ITU estimates that 95 per cent of rural areas in developed countries are covered by a mobile cellular network signal), the main focus of this chapter is necessarily on developing nations. It does not, however, address exclusively developing countries, since even developed nations still face some of the challenges of bringing ICTs to rural areas, particularly in terms of Internet and broadband access.

Target 1 is related to all the WSIS action lines, since connecting the places where people live with ICTs is one of the most basic requirements for creating an information society. In some cases, there is a direct linkage:

- Action Line C2 (Information and communication infrastructure: an essential foundation for the information society) highlights that "*infrastructure is central in achieving the goal of digital inclusion, enabling universal, sustainable, ubiquitous and affordable access to ICTs by all, … to provide sustainable connectivity and access to remote and marginalized areas at national and regional levels*."[3] This action line also calls on governments to provide ICT connectivity for schools, libraries, post offices, community centres and other institutions accessible to the public. This is directly related to the establishment of community access points, which is part of the target. The action line further calls for strengthening national broadband network infrastructure, which is critical for rolling out high-speed Internet access to rural areas. It also advocates national e-strategies to cater for disadvantaged and vulnerable groups, who are often found in rural areas, and refers to unused wireless capacity, including satellite, for providing access in remote areas.

- Action Line C3 (Access to information and knowledge) is directly linked to Target 1 as it states that "*Governments, and other stakeholders, should establish sustainable multipurpose community public access points, providing affordable or free-of-charge access for their citizens to the various communication resources, notably the Internet. These access points should, to the extent possible, have sufficient capacity to provide assistance to users, in libraries, educational institutions, public administrations, post offices or other public places, with special emphasis on rural and underserved areas....*"[4]

- Action Line C4 (Capacity building) is directly linked to Target 1, in that basic ICT literacy skills are essential for making use of the connectivity supplied to villages and via community access. Indeed, it explicitly refers to this potential: "*Promote e-literacy skills for all... taking advantage of existing facilities such as libraries, multipurpose community centres, public access points*"... It also calls for the empowerment of "*local communities, especially those in rural and underserved areas, in ICT use and promote the production of useful and socially meaningful content for the benefit of all*."[5]

Another important issue is to ensure that once villages are connected with ICTs, they deliver relevant applications and content for people in rural areas. The availability of relevant applications and content is addressed in Action Lines C7 (ICT applications) and C8 (Cultural diversity and identity, linguistic diversity and local content), as well as C9 (Media), which makes reference to the need to reduce regional imbalances in infrastructure and to use "*traditional media to bridge the knowledge divide and to facilitate the flow of cultural content, particularly in rural areas*."[6]

Measuring Target 1 — Proposed indicators[7]

Like other WSIS targets, Target 1 is vague in terms of the type of ICTs to which it refers. Five indicators are proposed for measuring and tracking Target 1 (Table 1.1). Three of these will help track the availability of ICTs in rural areas,

Table 1.1: Indicators for measuring Target 1

Aspect measured	Proposed indicator	*Partnership* core indicator
Rural connectivity	1. Percentage of rural population covered by a mobile cellular telephone network, broken down by technology (2G, 3G)	A7
	2. Proportion of rural households with a telephone, broken down by type of network (fixed and/or mobile, mobile only, fixed only)	HH3
	3. Proportion of rural households with Internet access, broken down by type of access (narrowband, broadband)	HH6
Community connectivity	4. Percentage of localities with public Internet access centres (PIACs), broken down by size of locality, or by urban/rural	A10
	5. Location of individual use of the Internet in the last 12 months	HH8

and two will serve specifically to track the prevalence and use of community access. All of these indicators are being collected by ITU, directly from countries, under the *Partnership on Measuring ICT for Development*.[8] They include mobile cellular and Internet technologies, and cover both access to and use of these ICTs.

Measuring rural connectivity

As mentioned, "Connect villages with ICTs" is essentially aimed at rural areas. However, the use of the word villages poses statistical challenges, since the term "village" is rarely used as a unit of measurement in national statistical systems. When data are presented by administrative division, it is usually at the second administrative level (e.g. region, province or state).

In order to measure this target based on villages, the number of villages would have to be determined. There is no international standard defining what constitutes a village. Some countries report the number of localities broken down by population size. However, such information is not widely available, and even if it were it does not solve the problem of what size of locality should constitute a village. It would be logical to associate a village with a certain population size considered as rural, but definitions vary widely. In many instances, other factors besides population size are used to define "urban" and "rural," such as administrative divisions or employment outside agriculture.[9] In the European Union, "rural" is not defined by the size of localities but by the population density (number of inhabitants per km^2).[10]

Apart from the methodological issue of what constitutes a village, not all countries publish the number of localities they contain. In addition, factors such as migration, nomadic populations, civil war and resettlement also have an impact on the ability to determine precisely where people live and how many localities there are in a country.[11] Although, in 2008, ITU did estimate the number of localities based on several proxy indicators (for example the number of enumeration areas used by statistical offices for census and surveys), in order to track the availability of ICTs in villages [ITU, 2008], it seems very difficult to track this information on a regular basis. Even for countries that publish some information on the number of villages, there are large gaps in continuity and data are often only updated every ten years, at the time of a census.

Another methodological challenge with Target 1 is that it refers to *connectivity*, which is a broad term. The target does not specify which technology should be available in villages. Fixed-line telephony is the service for which data, when available, have historically been gathered, and most universal service plans remain geared to the provision of fixed telephone lines. Yet many countries do not produce data on the availability of fixed-line telephone service according to size of community (of any magnitude, including cities) or population covered. Also, globally, the number of fixed lines is stagnating and even decreasing in many countries, as fixed lines are increasingly replaced by mobile telephony. It therefore does not seem appropriate to include an indicator for fixed lines to track Target 1.[12]

It would, however, be very useful to track Internet — and, specifically, broadband — access in villages, since these are critical ICTs for full participation in the information society. Therefore the *number of villages with Internet access* (broken down by urban/rural locality and narrowband/broadband access) is an important indicator. This is largely covered by a very similar indicator, on public Internet access centres (PIACs), which will be discussed later in this chapter, in the section on *Measuring community connectivity*.

If Target 1 cannot be tracked with "villages" as a denominator, it is analytically useful to present other indicators based more broadly on rural areas, measuring for example rural access, coverage and use. Although these indicators may not conform strictly to the letter of the target in terms of the exact wording ("villages"), they certainly convey information that reflect its intent, which is to monitor ICT connectivity in rural areas. Furthermore, they are arguably more relevant, since they cover popular technologies such as mobile cellular, and units of measurement directly related to universal service (which refers to ICTs in households). Another major advantage is that indicators of rural access and coverage are widely available, may be more comparable and feature historical data upon which to gauge trends. Finally, indicators based on population coverage and households provide greater statistical reliability and are usually more up-to-date.

Today, mobile communications has become the most prevalent form of communications in almost every country in the world. Mobile networks support voice communications as well as text messaging and Internet access (at increasingly higher speeds, including broadband). Therefore, it is indispensable to factor in mobile networks in any analysis of rural access to ICTs. Considering that a single mobile antenna may serve numerous localities depending on how far they are apart, more localities enjoy mobile service than fixed telephone access. Although the availability of mo-

bile coverage could be analysed by locality, this kind of data are not widely available. Instead, the common way of expressing mobile coverage is in terms of population (or territory) within range of a signal. This indicator has been adopted by the international statistical community as a core indicator: *percentage of population covered by a mobile cellular telephone network*. The indicator refers to "*the percentage of a country's inhabitants that live within areas served by a mobile cellular signal, irrespective of whether or not they choose to use it*."[13] It therefore refers to the theoretical ability to use mobile cellular services if a person has a cellular telephone and a subscription. It also refers to terrestrial mobile coverage.[14]

National mobile population coverage figures are available for many countries and published by both regulators and operators. Mobile population coverage could be dissected into urban and rural coverage, though data are not typically compiled in this manner. For the purposes of this report, *the percentage of rural population covered by a mobile cellular telephone network* has been calculated on the assumption that at least all urban areas are covered, with any remaining coverage assigned to rural areas.[15]

Another way of measuring rural ICT accessibility is at the household level. Household telephone penetration is the basic measure of *universal service* and is an unambiguous measurement, since a household is a well-defined statistical concept and the maximum penetration level is 100 per cent. Household penetration is also useful for gauging how theoretical access in localities or mobile coverage translate into practical ICT use.

A growing number of countries measure the availability of at least some ICTs in households. In addition, data are increasingly disaggregated by urban and rural location. This makes household ICT penetration an attractive complement to other indicators for measuring rural access. Tracking household penetration is increasingly relevant to middle-income nations that are making the transition from universal access to universal service. In low-income countries, policies should be more focused on universal access aimed at enhancing coverage and providing community services. It should be noted that a country's income level need not be the sole criterion influencing whether emphasis should be placed on universal access or universal service. The link between income level and some types of ICT penetration has become increasingly tenuous over the years, particularly for mobile telephony, which has low barriers to entry (e.g. declining handset prices, prepaid).

In the context of the target, relevant household indicators would be

1. *Proportion of rural households with a telephone, broken down by:*
    - *fixed and/or mobile telephone*
    - *mobile only*
    - *fixed only*

2. *Proportion of rural households with Internet access, broken down by:*
    - *narrowband access*
    - *broadband access*

These indicators have been adopted by the *Partnership on Measuring ICT for Development.*[16]

Measuring community connectivity

While deploying ICT infrastructure to villages or rural areas is a first step, rural inhabitants then need a way to actually use those ICT services in practice; hence the importance of "establishing community access points." Target 1 recognizes the importance of providing shared services where citizens do not have access to ICTs at home, as is the case in many low-income countries, especially LDCs.

The *Partnership* has defined the following type of community access point, which can be used to measure this target:

A *public Internet access centre (PIAC) is a site, location, or centre of instruction at which Internet access is made available to the public, on a full-time or part-time basis. PIACs include telecentres, digital community centres, Internet cafés, libraries, education centres and other similar establishments, whenever they offer Internet access to the general public. All such centres should have at least one public computer for Internet access*.[17]

The *Partnership* proposes the indicator A10: *Percentage of localities with public Internet access centres* (PIACs). The indicator is computed by dividing the number of localities with at least one PIAC by the total number of localities in

the country, and then multiplying by 100. The indicator should be broken down by size of locality, or by urban/rural localities. It reflects how many (urban/rural) localities in a country have a PIAC.

A related indicator would be the *Partnership* indicator HH8: *Location of individual use of the Internet in the last 12 months*, since two of the proposed range of locations are a "*Community Internet access facility*" or a "*Commercial Internet access facility*." This indicator is useful for measuring the demand side of public Internet facilities.

The community access target is also related to Target 4, particularly in regard to connectivity in public locations such as libraries and post offices, which can serve as public access locations. The establishment of community access points can also help to achieve Target 10, namely ensuring that half of the world's inhabitants have access to ICTs within their reach.

Status of Target 1

Given the problems with defining the term "village" and the lack of data on village connectivity, it is very difficult to track the target in terms of the proportion of villages with ICTs. In 2008, ITU published some data on the percentage of localities with different ICTs, by region. It found that in sub-Saharan Africa, for example, only 12 per cent of localities had telephone access and 1.4 per cent had access to the Internet [ITU, 2008].

One of the problems is that the data on which these estimates are established date back to between 2000 and 2006, and only very few countries in the world collect data by locality. Two exceptions are China and India. China recently announced that by the end of 2009, "*voice telephony services were available to 99.86% of the country's administrative villages (up from 98% a year earlier), while internet access covered 91.5% (up from 89%), according to data from the regulator MIIT*."[18] India has pursued a longstanding goal of providing its reported 593 485 villages with a telephone. By December 2008, no fewer than 539 448 villages (91 per cent) had a telephone [TRAI, 2008]. While this means that the world's two largest developing nations — China and India — have largely attained Target 1 when measured by telephone access in villages, most other countries do not track village connectivity, even though many have initiated projects to connect rural areas. [19]

Nor is the success of fixed lines likely to be replicated in many of the world's least developed countries. Fixed telephone line growth has stagnated in most countries, overtaken by wireless communications. The cost of installing wireless systems in rural areas is far less than that of fixed telephony, so it does not make economic sense to equip villages with fixed telephone lines.

Given the rapid growth of wireless communications, a more appropriate indicator for measuring progress towards Target 1 is the percentage of rural population *within reach of a mobile cellular signal*. Existing data on the percentage of the rural population covered by a mobile cellular telephone network suggests that almost three quarters of the world's rural inhabitants were covered by a mobile cellular signal by the end of 2008 (Table 1.2). The highest coverage is in Europe, where practically all inhabitants of rural areas enjoy a mobile signal. Although the lowest rural coverage is in Africa, 2008 was a watershed year, with over half of the continent's rural citizens now covered by mobile telephony. Africa also recorded the biggest increase in rural mobile population coverage between 2000 and 2008 (Chart 1.1).

Based on recent trends, it seems possible that almost all regions will achieve full mobile coverage of rural populations before 2015. The one exception is Africa, but even there rural coverage could exceed 90 per cent by 2015. Complete mobile coverage of all rural areas around the world by 2015, or even earlier, would appear achievable with the right policy emphasis.

Given the increase in the number of wireless broadband networks and subscriptions, the indicator should be broken down by technology (2G, 3G, and eventually 4G). Many operators and an increasing number of regulators, including France's ARCEP and the United Kingdom's Ofcom (Table 1.3), are tracking 3G population coverage, particularly in order to track network coverage commitments.[20] ITU is planning to add a new indicator to track 3G/4G mobile population coverage to its list of indicators.

While an increasing number of developing countries are starting to collect data on the *proportion of households with a fixed and/or mobile telephone* through official household surveys, some developed countries do not (or no longer)

Table 1.2: Rural population covered by a mobile cellular signal, 2008

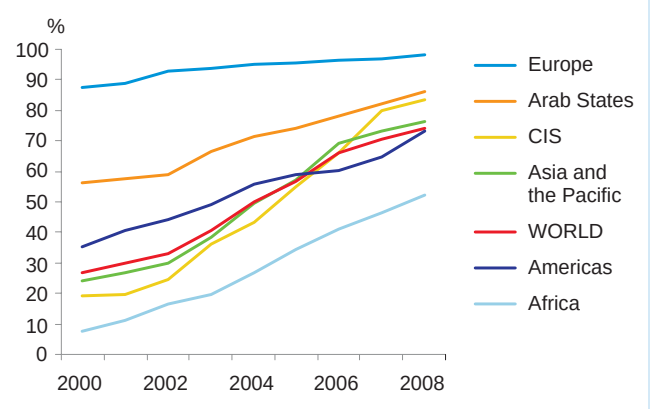
	Overall mobile cellular coverage (%)	Rural population covered (%)	Rural population covered (millions)	Rural population not covered (millions)
Africa	69	52	253	230
Americas	93	73	136	50
Arab States	94	86	115	18
Asia and the Pacific	85	76	1 720	533
CIS	94	83	83	17
Europe	99	98	159	3
WORLD	**86**	**74**	**2 466**	**852**

Note: The rural population covered by a mobile cellular signal is calculated by the following formula:

$$\text{Proportion of rural population covered by a mobile cellular signal} = \frac{(\text{Proportion of total population covered by a mobile cellular signal} \times \text{Total population}) - \text{Urban population}}{\text{Rural population}}$$

Source: ITU.

Chart 1.1: Rural population covered by a mobile signal, 2000-2008, by region



Source: ITU.

track this indicator. The European Union collected data on households' share of main telephone lines for a number of years, but discontinued the series as far back as 2006. It has never collected data on rural household access to telephones.

The latest available household survey data suggest that in most countries there are more rural households with mobile phones than fixed lines. The exceptions are Canada, Kyrgyzstan and Bosnia and Herzegovina, where more households have a fixed telephone than a mobile phone (Charts 1.2 and 1.3). One explanation is that fixed telephone calls in these countries are relatively cheap or even free, as is the case in Canada, so people have a strong incentive to keep their landline. In several countries from the Americas region, including Paraguay, El Salvador, Chile, Guatemala, and Nicaragua, household access is dominated by mobile phones, and less than five per cent of households have a fixed telephone. The mobile phone is also very dominant in a number of low-income developing countries in Africa, including Burkina Faso, Uganda and Cameroon, and in Asia and the Pacific, confirming that mobile cellular technology is playing a crucial role in expanding communication networks (Box 1.1).

Overall, the proportion of rural households that have a mobile telephone ranges from as low as four per cent in the Democratic Republic of the Congo to 95 per cent in Japan (Chart 1.2). Existing data, which are available for almost 40 countries at very different stages of development and across all regions, show that while low-income developing countries tend to have relatively few households with a mobile telephone, many developing countries, including Armenia, Egypt, Ecuador, the Dominican Republic, Ukraine and the Philippines have reached penetration levels above 50 per cent. Fixed telephone penetration, on the other hand, remains very limited in most rural households, with

Table 1.3: Population covered by a mobile signal in 2008 across the United Kingdom and nations

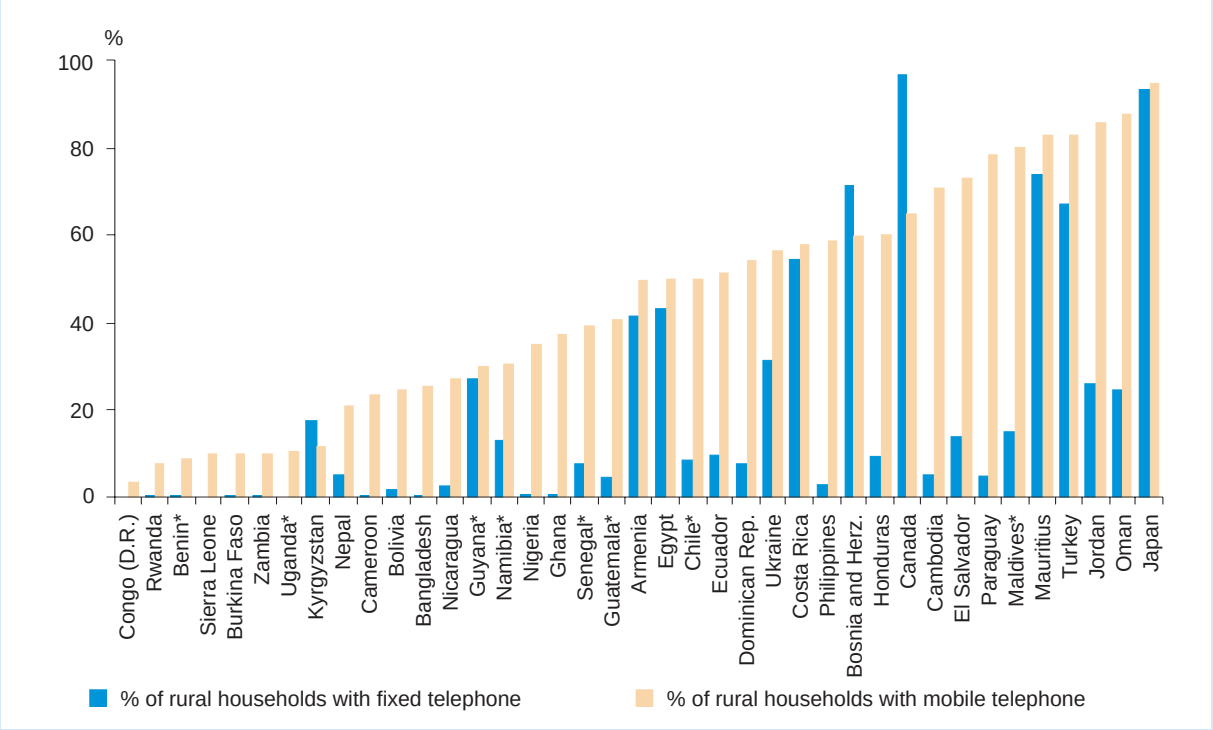
	2G %	3G%
United Kingdom-wide	98	87
England	99	91
Wales	92	67
Scotland	89	67
Northern Ireland	92	43

Note: Figures show the percentage of population within postcode districts where at least one or more operators had at least 90% 2G and 90% area coverage.
Source: Ofcom. Mobile Evolution. Ofcom's mobile sector assessment. December 2009.

penetration levels as low as 0.1, 0.4 and two per cent in the Democratic Republic of the Congo, Burkina Faso and Nicaragua, respectively.

Chart 1.3, which shows the proportion of rural households that have only *either* a mobile phone *or* a fixed telephone confirms these findings. Except for Canada, Kyrgyzstan and Bosnia and Herzegovina, rural households tend to rely more on mobile telephony as their sole means of communication. Compared to Chart 1.2, it also highlights that in

Chart 1.2: Proportion of rural households with telephone by type, 2007-08

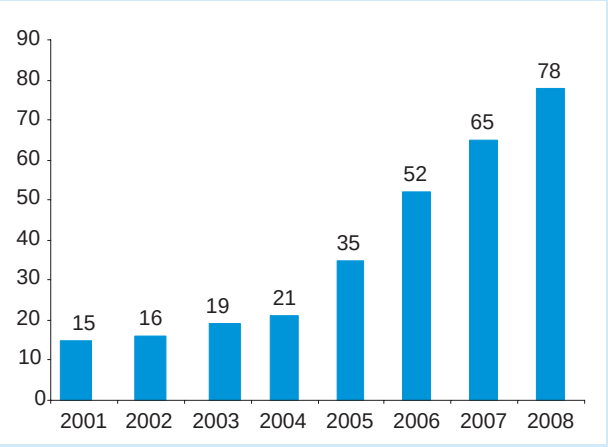


Note: * Data refer to 2006.
Source: ITU World Telecommunication/ICT Indicators database.

Box 1.1: The spread of mobile telephony in rural areas: an example from Paraguay and Jordan

Arguably the biggest ICT success story is the continuing spread of mobile cellular networks into rural areas. This has been driven by liberalization of the telecommunication sector worldwide, with particular emphasis on developing competition in the mobile cellular market. In the developing world, the far greater reach of mobile cellular networks compared to fixed-line networks would most likely not have been possible without competition. Indeed, traditional monopoly fixed-line networks in most developing countries have far less population reach than mobile networks, even though they have been in operation for much longer. Likewise, although a number of countries have created universal service funds to stimulate investment of mainly fixed lines in rural areas, for the most part they have been far less successful in expanding access than mobile cellular companies.

Chart 1 Box 1.1: Percentage of rural households with a mobile telephone, Paraguay



Note: Data between surveys have been estimated.
Source: Adapted from DGEEC (Encuesta Permanente de Hogares).

Although there are numerous examples of this mobile revolution in rural areas, two in particular serve to illustrate the impact of mobile communications on rural universal service. Paraguay is a landlocked South American nation with 6.2 million inhabitants, 41 per cent of whom live in rural areas. It launched its first mobile network in 1992, with a second following in 1998 and a third in 1999. By the turn of the millennium, Paraguay had more mobile subscriptions than fixed lines. A fourth operator entered in 2001, making Paraguay one of the most competitive mobile markets in Latin America. This high level of competition has led to widespread infrastructure investment in mobile networks, boosting population coverage. By the end of 2008, a mobile signal was available in practically all inhabited areas of the country.

The manner in which mobile has penetrated into rural households is astounding given that a third of the country's population lives below the poverty line, with many in small towns and villages. By 2008, over three quarters of rural households had a mobile telephone compared to 15 per cent in 2001 (Chart 1 Box 1.1). Only five per cent of rural households have a fixed line. Wireless is moving beyond voice in Paraguay, with the operators having launched 3G broadband mobile service. One of the mobile operators has launched a wireless WiMAX network and has the largest market share in the broadband market.

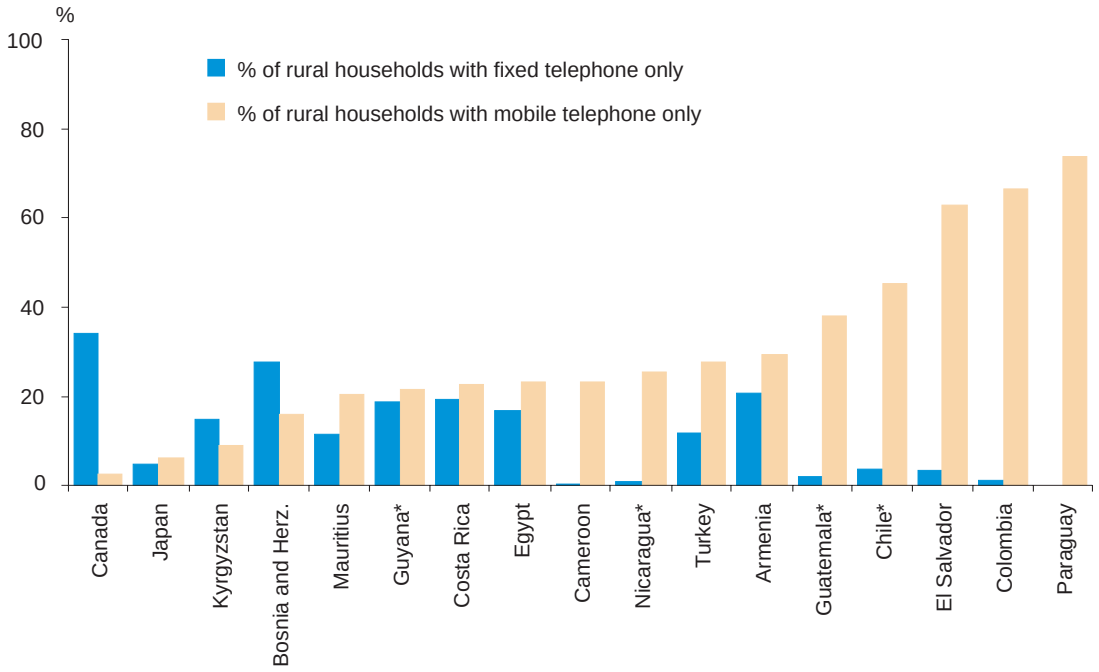
Another example is Jordan, a Middle Eastern country with 5.7 million inhabitants. In 2002, only two in five rural households had a mobile phone. By 2007, this ratio had risen to more than four in five. Like Paraguay, Jordan is characterized by a highly competitive market with four mobile operators.

Source: ITU.

several (mainly high-income) countries, only very few households have only a fixed or a mobile phone. In Japan, for example, only five and six per cent of rural households have only a fixed or only a mobile phone, respectively, whereas overall Japanese households have over 90 per cent household penetration for both phones. Mauritius also has relatively few households (11 per cent with fixed only and 20 per cent with mobile only) that have only one telephone. Although this might be surprising since Mauritius is a developing country, it has a relatively high GNI per capita level, particularly compared to other African nations.

Another indicator proposed to monitor Target 1 is the *proportion of rural households with Internet access*. What is striking about the data for this indicator is the complete lack of Internet access in rural homes in many of the developing countries, including for example Niger, Nicaragua, Mongolia and Colombia (Chart 1.4). In other countries, including Bhutan, Armenia, Egypt, Chile and Thailand, home Internet access in rural areas remained below five per cent by the year 2007-08. While these data are somewhat outdated, given that the Internet continues to spread rapidly, including to rural areas, they suggest that Internet connectivity in rural areas remains very limited. Although the reasons why so few rural households have Internet access are not known, these findings suggest that public access in rural areas is very important in these countries. The proportion of rural households with Internet access at home exceeds the 50 per cent mark only in developed and high-income economies, including New Zealand, Israel and Japan. The Republic of Korea displayed the highest penetration rate, at 90 per cent. Two countries, Israel and

Chart 1.3: Proportion of rural households with only a fixed or only a mobile telephone, 2007-08



Note: * Data refer to 2006.
Source: ITU World Telecommunication/ICT Indicators database.

Mauritius, stand out for actually having relatively more rural than urban households with Internet access. Mauritius is a very rural country, with 94 per cent of the population living in rural areas.[21] In Israel, on the other hand, only seven per cent of the population live in rural areas, yet household Internet access stood at 69 per cent, compared to 59 per cent in urban areas.

A comparison of urban versus rural households shows that, in developing countries, home Internet access levels remain much higher in urban areas. In Mongolia, 4.9 per cent of urban households have Internet access, compared to only 0.1 per cent of rural households. In Colombia, the difference is 16.4 per cent of urban households as against 0.4 per cent in rural areas. The rural digital divide is much less pronounced in developed countries, as highlighted by Japan, Canada and New Zealand (Chart 1.4).

Fewer countries collect Internet household data broken down by type of access, but existing data suggest that broadband access in rural households remains very limited in developing countries and by 2007-08 did not exceed ten per cent in any developing country for which data are available (Chart 1.5). At the same time, there are important differences between the developed and high-income economies, with penetration levels ranging from a relatively low 22 per cent in New Zealand to 71 per cent in the Republic of Korea. More and more developed and developing countries, including the United States, Europe and Malaysia (Box 1.2), are recognizing the importance of high-speed Internet access and have modified (or are in the process of modifying) universal service and access frameworks to include the provision of broadband services in rural areas.

Chart 1.5 also compares the difference between home broadband access in urban versus rural areas and shows that there are important variations in penetration rates. In Chile and in Thailand, for example, the penetration rate is around nine times as high for urban as for rural areas and in Egypt urban broadband penetration in households stood at twelve per cent compared to only two per cent in rural areas. Differences remain relatively high, even in devel-

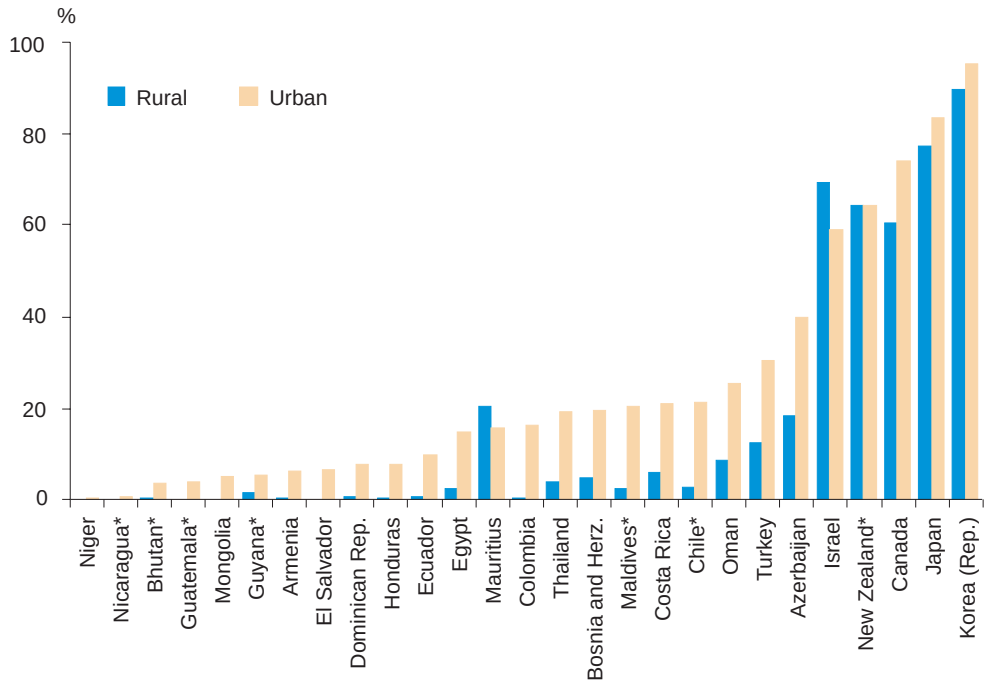
oped countries, such as Canada and Japan. In New Zealand, household broadband penetration in urban areas in 2008 stood at 35 per cent, compared to 22 per cent in rural areas. These data confirm the need to address the urban-rural broadband divide in both developed and developing countries.

Indeed, extending broadband access in rural areas remains a policy focus even in developed nations, where low population density, landscape topography and vast geographic areas can often pose an ongoing challenge.[22] The United States, for example, recently allocated billions of dollars for expanding rural broadband as part of the economic stimulus Recovery Act[23], and one of the conclusions of the US National Broadband Plan reads as follows: "*Broadband, … is a modern necessity of life, not a luxury. It ought to be found in every village, in every home and on every farm in*

Box 1.2: More broadband, please: Malaysia adapts universal service regulation

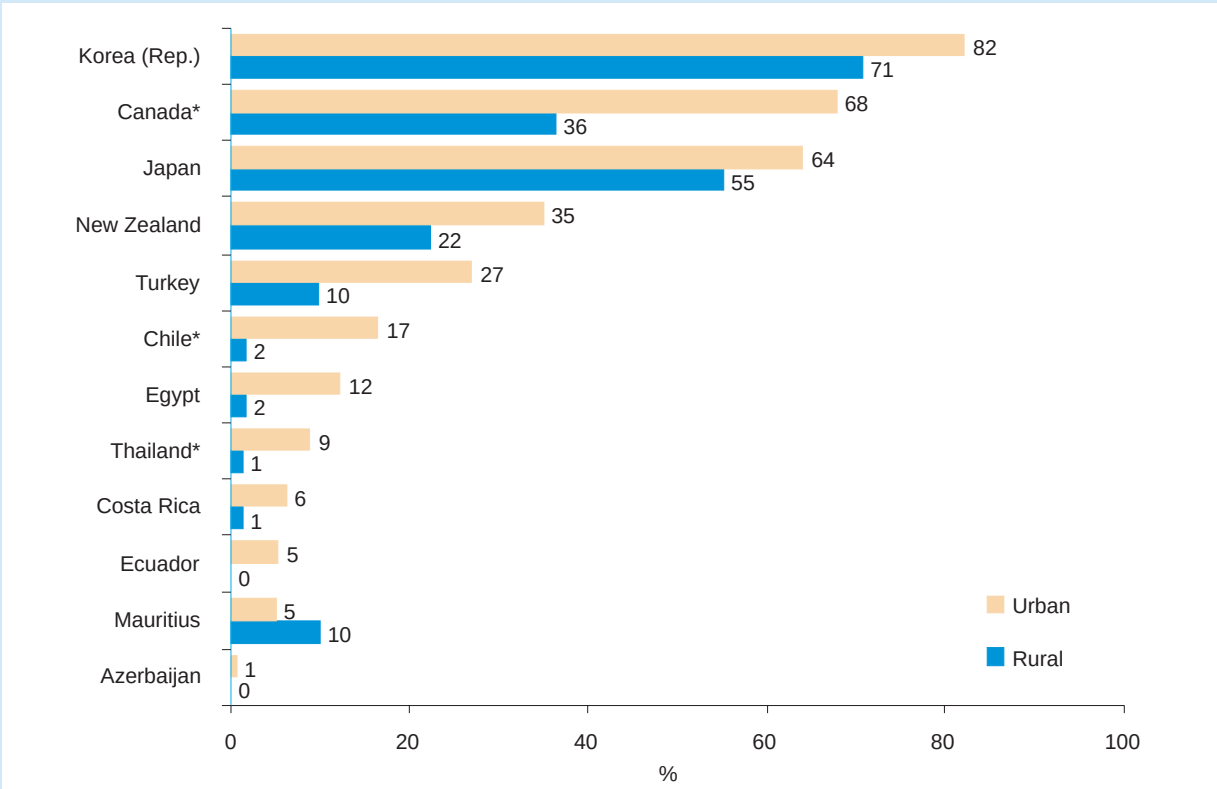
Malaysia's universal service framework requires the country's ICT regulator, the Malaysian Communications and Multimedia Commission (MCMC/SKMM), to designate areas of the country which are to benefit from government assistance for developing infrastructure through the universal service fund. MCMC/SKMM has designated areas where telephone penetration is 20 per cent below the national average, and other localities where it finds that services are not widely available to the community. Its most recent analysis identified 86 localities as deficient in access compared to other regions of the country.[25] The universal service regulations have been modified to incorporate broadband, with the aim of reaching a household broadband access penetration of 50 per cent by 2010. By the end of 2008, these initiatives had resulted in the establishment of 85 community broadband centres and 105 community broadband libraries. In addition, 42 rural Internet centres have been established through another programme. Mobile cellular coverage has also been included in universal service, whereby operators are given assistance for the roll-out of networks to rural areas. This will raise mobile population coverage from 92 per cent to 97 per cent by the end of 2010. [26]

Chart 1.4: Proportion of rural and urban households with Internet access, 2007-08



Note: * Data refer to 2006.
Source: ITU World Telecommunication/ICT Indicators database.

Chart 1.5: Proportion of rural and urban households with broadband Internet access, 2007-08**



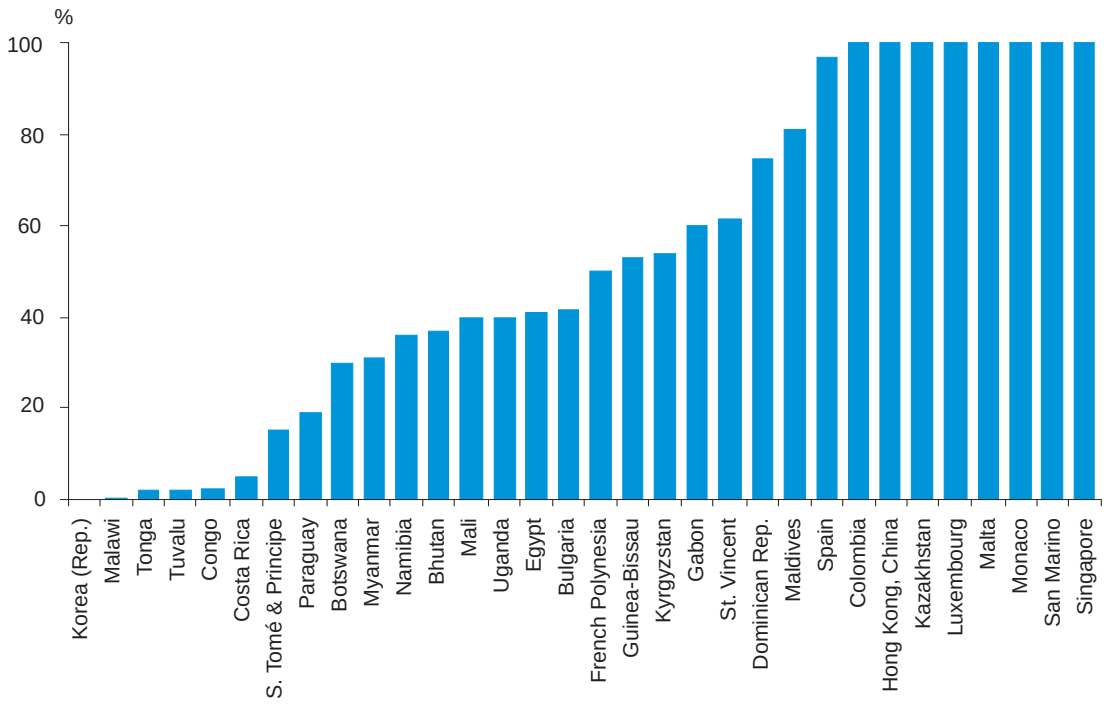
Note: * Data refer to 2006. ** Broadband refers to both wireless and fixed (wired) broadband access.
Source: ITU World Telecommunication/ICT Indicators database.

every part of the United States" [FCC, 2010]. Similar proposals exist in Europe, and the European Commission recently announced plans to update the current telecom universal services law from 2002, which ensures access to fixed telephone and Internet services for all European Union citizens, regardless of their location. A revised law would expand these services to include broadband access.[24]

The relatively low proportion of rural households in developing countries that have Internet access and the even lower broadband penetration rates highlight, first, the importance of connecting more homes and, second, the need to provide public Internet access — preferably high-speed — in rural areas. While the main reasons why people do not have Internet access at home are not clearly known, it is likely that people cannot afford the home Internet connection, or the computer, which continues to be the most popular access device. Since people in rural areas tend to live on relatively lower incomes, the high price of Internet services, and particularly broadband, is obviously a barrier to higher penetration levels.[27] Depending on national circumstances, including geographic and demographic conditions, many rural areas also lack the basic infrastructure. The recent growth of mobile broadband is expected to have a major impact on broadband connectivity, particularly in rural and previously underserved areas. To track the uptake of mobile broadband it is therefore suggested that countries collect data on households with broadband access, both mobile and fixed.

There are insufficient data to provide a comprehensive picture of the current spread of community access centres in localities or villages. According to data received by ITU from 60 respondents to a questionnaire in 2004, some 37 per cent of localities had a community access point. In rural localities, however, where public access is arguably most needed, the figure dropped to under five per cent. ITU also carried out research on the number of localities with Internet. The data were compiled in 2008 from a number of sources, such as government records, projects for installing community Internet access and the number of points-of-presence of large ISPs, using data from between 2000 and

Chart 1.6: Proportion of localities with public Internet access centres (PIACs), 2007-08



Source: ITU World Telecommunication/ICT Indicators database.

2006. Except for Europe and the CIS, country averages for Internet access were very low. In the Americas, around one in six communities had Internet access, compared to one in ten in the Asia and the Pacific region. Elsewhere, the country average was below five per cent. Africa stood out with very low levels of access. For the developing world as a whole, ITU estimated that eight per cent of localities had Internet access. Considering that this covered any type of Internet access, the figure for localities with broadband access is lower.[28] The data used to make these estimates were from between 2000 and 2006, and it is not possible to track more recent changes. Secondly, most developed countries and some developing countries are more focused on pushing Internet access into the home (universal service) rather than to localities (universal access). Thirdly, the growing use of mobile cellular networks to access the Internet has an impact on the analysis: as already discussed, a mobile signal can span multiple localities and coverage is typically expressed in terms of population or land area covered rather than localities.

Some countries do track data on the proportion of localities with PIACs, and while these more recent (2007-2008) data do not show the number of localities by population size or broken down by urban/rural area, they provide some indication of the availability of public Internet access services nationwide (Chart 1.6). There are large differences in terms of the proportion of localities with PIACs. Most developed or high-income economies have public access in all localities. In a number of countries, including Tonga, the Republic of the Congo and Costa Rica, public Internet access is not widely available, with five per cent of localities, or less, covered. Public access is particularly important in countries and regions with low household penetration rates, since for some people it may be the only way to access the Internet.

A number of governments of developing countries, including Colombia (Box 1.3), have created programmes aimed at providing Internet access through community centres in rural areas. Specific government projects, but also grassroots initiatives, typically supported by non-governmental organizations and the academic sector, have had a major impact on Internet access in some countries. There are also projects to leverage growing mobile coverage in order to provide Internet access using cellular networks.

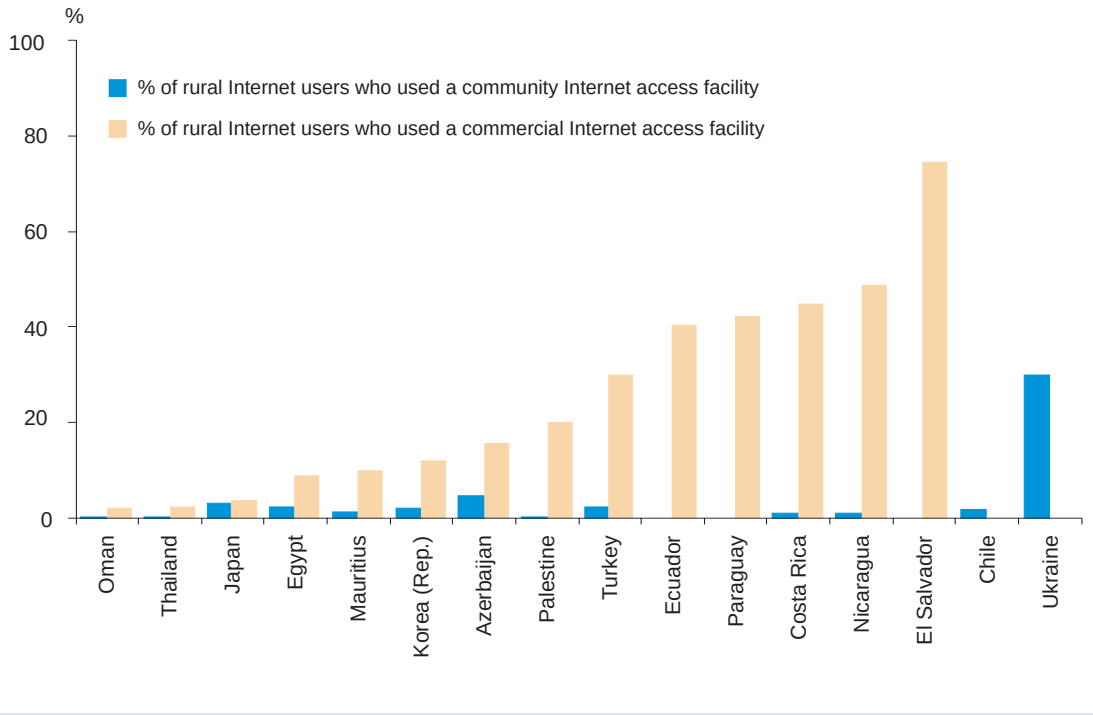
Box 1.3: Connect and inform every Colombian

Colombia's Compartel programme,[29] financed from telecommunication operator contributions to the universal fund, has a number of different projects for expanding access to ICTs and fulfilling the government's vision that every Colombian "*is to be connected and informed*."[30] The programme has expanded from its initial focus on rural telephony to the provision of Internet in community centres ("telecentres") and broadband connectivity in public institutions such as schools, municipal offices and libraries. The community telecentres also provide training and other services and are expected to receive a high degree of community input and support. There were 1 490 telecentres by mid-2008 serving some five million people, with plans for increasing the number to 10 000 by 2010.[31] Community access is also extended through 140 educational institutions that provide after-school Internet access to the general public and 221 public libraries with broadband Internet.

The importance of public access is also highlighted by available data on the percentage of rural Internet users of community and commercial Internet access facilities (Chart 1.7). In most of the developing countries in the Americas which track this indicator, including in El Salvador, Nicaragua, Costa Rica, Paraguay and Ecuador, 40 per cent or more of rural Internet users access the Internet at commercial or public Internet access facilities. Peru's *cabinas públicas* (public booths) have made a major contribution to expanding Internet access, especially to rural areas (Box 1.4). In the Ukraine, about one third of the rural Internet users go to public Internet access facilities.

Unfortunately, too few governments track this indicator and no official data are available from Africa. However, between 2007 and 2008, Research ICT Africa (RIA) carried out household surveys across 17 African countries, including

Chart 1.7: Proportion of rural Internet users who use the Internet at public access facilities, 2007-08

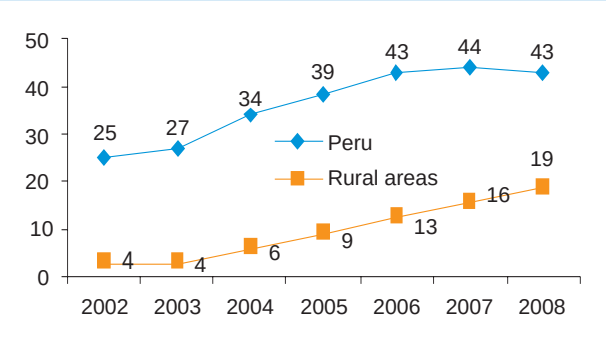


Note: Community Internet access facilities refer to public libraries, publicly provided Internet kiosks, non-commercial telecentres, digital community centres, post offices, other government agencies; access is typically free and is available to the general public.
Source: ITU World Telecommunication/ICT Indicators database.

Box 1.4: Public Internet access in Peru

The *Red Cientifica Peruana* (Peruvian Scientific Network) pioneered a public Internet access model that has been extremely successful. RCP was formed in 1991 as a non-profit organization to promote Internet access in Peru. It was one of the country's first ISPs, starting out by mainly providing access to the education sector and NGOs. Its founder, Jose Soriano, had the idea of creating a network of public Internet access facilities modelled on the country's public telephone booths. These Internet points thus became known as *cabinas públicas* ("public booths"). They developed rapidly, with RCP creating a franchise model, assisting with financing and providing training.[33] One measure of the success of this venture is that today *cabina pública* is the term used in Peru to refer to any public Internet facility, even though most have since developed outside the auspices of RCP. This critical mass of public Internet facilities has fed on itself, not only creating a "public booth" culture but also resulting in intense competition, leading to low costs (prices are USD 0.15 - 0.30 per hour[34]) with beneficial results for users and growth of the Internet in Peru.

Chart 1 Box 1.4: Percentage of households with at least one member who used a *cabina pública*, Peru



Source: Adapted from INEI.

The success of the public booths is reflected in Internet usage statistics. In 2008, some 20.4 per cent of the population used public booths to access the Internet, and they were the most frequent place of access.[35] The expansion of public booths beyond urban areas is also visible. In 19 per cent of rural households there was at least one member who used a public booth in 2008, up from just four per cent in 2002 (Chart 1 Box 1.4). It is worth noting that urban access from Internet cafés has been declining in the last few years, as more homes get their own Internet access. However, in rural areas it has continued to climb and the gap with the national average has shrunk between 2002 and 2008.

to collect data on the "points of access" used by Internet users. The survey clearly showed that the large majority of Africans access the Internet at cybercafés or Internet cafés. In Benin, Burkina Faso, Cameroon and Côte d'Ivoire, 85 per cent or more of Internet users used such facilities.[32]

Regardless of data constraints, there are developments that should increase the availability of Internet access in rural areas over the coming years. One barrier to greater Internet broadband usage in rural areas has been a lack of access to backhaul high-speed transmission networks. A number of countries are developing national backbones to connect to undersea fibre-optic cables. As a consequence, fibre-optic is reaching beyond metropolitan areas and passing underserved parts of countries, which can then be connected to the fibre to obtain broadband capacity. One example is East Africa (Box 1.5), where countries are extending backhaul transmission networks, bringing broadband connectivity to more rural areas.[36]

Another development that is expected to increase rural connectivity and bring ICTs to villages is the spread of wireless broadband access. Wireless technology is cheaper and faster to implement than fixed broadband. A number of developing nations are leveraging existing mobile networks to introduce broadband 3G Internet access. ITU reported that mobile broadband subscriptions overtook fixed broadband subscriptions in 2008, highlighting the huge potential for the mobile Internet.[40] The challenge will be to extend these benefits into rural areas, including through innovative projects as the Grameenphone's *community information centres* (Box 1.6).

Box 1.5: More bandwidth for rural areas in East Africa

The benefit of national fibre-optic backbones recently bore fruit with the launch of the SEACOM undersea fibre-optic cable in July 2009. A 1 500km fibre-optic cable links the SEACOM landing station in Mombasa, Kenya to Nairobi and on from there to landlocked Uganda.[37] Kenya Data Networks built the fibre link from Mombasa via the capital Nairobi to the Ugandan border. In Uganda, the ISP Infocom leases the electricity utility's spare fibre capacity from the border to the capital Kampala. Meanwhile, landlocked Rwanda can also access this international bandwidth via a 400 km fibre-optic cable running from the capital Kigali to the Ugandan border. Communities all along these fibre routes can theoretically tap into the high-speed capacity it provides. The role of the Kenyan government in facilitating the roll-out of fibre-optic cable was recognized by the GSM Association, which awarded it the annual Government Leadership Award.[38]

Kenya is leveraging the roll-out of its national fibre-optic backbone through plans to install thousands of rural community Internet access centres throughout the country. The Digital Villages Project or "pasha centres" (*pasha* means "to inform" in Swahili) will be operated by local entrepreneurs, who will receive training and financial assistance from the government. The first group of pasha centres was launched in August 2009 and will undergo an evaluation phase to fine-tune operations before proceeding with large-scale roll-out.[39]

Box 1.6: Grameenphone in Bangladesh: From (just) mobile to mobile broadband

Grameenphone, a mobile operator in Bangladesh, has had a widely successful and replicated experience with the provision of telephone services in villages using mobile phones. In December 2006 it embarked on a new initiative to install community information centres (CIC) in order to provide Internet access in rural areas. A CIC is designed to be commercially sustainable and is operated by village entrepreneurs as a type of franchise. They purchase a CIC "kit," consisting of a computer, a printer, a scanner and a wireless modem for Internet access. The initial investment in a typical CIC ranges between BDT 70 000 and 100 000 (US 1 000 to 1 425) with financing available from Grameen.[41] The CIC operator charges users and pays a small fee to Grameen. The Society for Economic and Basic Advancement has partnered with Grameen to select and train the CIC operators and handle marketing.

By 2008, there were 525 CICs installed in 425 *upazilas* (a sub-district, the lowest level of administrative government in Bangladesh of which there are 481 in total) and some 20 million people have potential access. According to one report:

> "*The services have really improved the lives of the villagers, who previously would have had to travel around 35 kilometres to use the Internet.*"[42]

Internet access for CICs uses Grameenphone's third-generation enhanced data rates for GSM evolution (EDGE) mobile network.[42] One advantage of EDGE is that it uses the operator's existing spectrum so it does not require a new licence. Grameenphone's EDGE network, launched in 2005, covers 98 per cent of the population, so almost every Bangladeshi has potential access to the Internet. Grameenphone has over 4.5 million EDGE subscribers, making the company the largest Internet service provider in the country.[44]

Conclusions and recommendations

Current data suggest that by the end of 2008 almost three quarters of the world's rural inhabitants were covered by a mobile cellular signal, which is a useful indicator to monitor rural connectivity. Complete mobile coverage of all rural areas around the world by 2015, or even earlier, should become a clear policy target and would appear achievable with the right policy emphasis. Nevertheless, despite the likelihood of a high level of mobile signal coverage, policy-makers cannot become complacent, since coverage does not equate with usage. While it is estimated that over half of rural areas in Africa are covered by a mobile signal, existing data suggest that only few rural households in the region possess a mobile subscription (let alone a fixed one). Governments must strive to ensure that solutions are found to make mobile service affordable for people living in rural areas.

Anecdotal evidence suggests that access to the Internet using mobile phones is a growing trend, including in many developing countries and regions such as Africa.[45] Providing mobile broadband access can be an attractive solution

for rural areas since it requires less investment than installing fixed broadband connections. Mobile broadband coverage, or the percentage of the population within reach of a 3G mobile cellular signal, will therefore be an important indicator to monitor.

The importance of mobile communication networks is also highlighted by data on the proportion of households with a fixed and/or mobile telephone. Data show that mobile telephony is playing a key role in expanding communication access to rural areas. Rural households in developing countries rely more on mobile than on fixed telephony, and while fixed telephone penetration in rural households often remains below five per cent, mobile penetration rates are much higher, reaching 50 per cent or more in a number of developing countries that collect this information.

Data on the availability of Internet access in rural households, on the other hand, paint a somewhat different picture. In many developing countries, there is still some way to go before rural households enjoy conventional access to the Internet. Whereas in many developed countries rural connectivity is on a par with urban connectivity, elsewhere Internet access in rural households is not available at all, and a number of low-income developing countries actually have zero per cent of rural households with Internet access. A lack of electricity and the high price of computers and Internet access are major barriers.

Only very few developing countries collect data on the proportion of rural households with broadband Internet access, but figures suggest that in most cases penetration levels remain extremely low in the majority of developing countries, and particularly in low-income economies. Measuring rural household access to the Internet and broadband is important not only in order to understand how well connected rural households are but also to enable policy-makers to make informed policy decisions. Especially where rural household Internet access is very low, governments need to focus on establishing community access points, which ideally should have broadband connectivity.

A growing number of countries are indeed moving ahead with the installation of public Internet facilities in rural areas, often financed through universal access contributions or licence conditions. Only a very small number of countries collect data on the availability of community access points, however, and even fewer provide a breakdown by population size or by rural and urban areas. This makes it difficult to draw definitive conclusions about progress in rural connectivity outside the home. By including a question on the location of individual use of the Internet as an item in household surveys, a number of countries are able to gauge the importance of public Internet access from the response category "community/commercial Internet access facilities." While there are still too few countries that track this indicator through official household surveys, existing data suggest that in many developing countries public Internet access facilities remain one of the most important access locations for people in rural areas. This finding highlights the need for governments to ensure that public access is provided throughout rural areas.

One difficulty in making recommendations for how countries can achieve Target 1 is the interrelationship between community access and home access. Over time, it is expected that, as incomes rise and electricity becomes available, households will opt for the convenience of using ICT services at home. Therefore, as household access increases, community access is expected to fall. Policy-makers need to keep this linkage in mind and policies to promote community access in rural areas need to move in tandem with facilitating home ICT access. As incomes rise, the emphasis should shift towards facilitating rural household access.

One development with widespread implications is the spread of mobile phone use and the deployment of 3G networks in rural areas. This has far-reaching repercussions for the future, given that, in addition to voice communications, mobile phone networks can also provide text messaging and Internet access.

Based on these findings, there are a number of strategies that countries can pursue to achieve greater mobile access and use in rural areas and to ensure that Internet and broadband access becomes more widely available:

- Introduce as much competition in the mobile sector as possible. The more operators the better, since they will compete to gain incremental customers and hence extend coverage into rural areas. In Thailand, where there is intense competition in the cities with up to five operators, mobile companies have been expanding into rural areas to gain new subscribers.[46]

- Modify universal service policies to incorporate mobile deployment. Although mobile operators typically contribute to universal service funds, they generally receive little of the funding for mobile network expansion, even though it is cheaper to deploy wireless networks than fixed lines in rural areas. Furthermore, most of

these funds have yet to be spent and sit unused. According to the GSM Association, if these unspent funds plus the funds to be collected by the end of the decade were spent on extending mobile networks, then nearly the whole world would have mobile coverage within four years.[47]

- Set targets in licences for the percentage of the population to be covered by a mobile cellular network. Some countries have not exploited the regulatory tool of imposing licence conditions on operators so as to expand coverage. This can be rectified when licences come up for renewal or when additional or new spectrum is awarded. Some countries have also been lax in enforcing coverage requirements, even though enforcement costs are far less than what it would cost to extend access through universal service funding schemes.

- Encourage local partnerships to develop mobile access and applications. The Bangladesh village phone model shows how the combination of microfinance banking and mobile operators can be leveraged to provide access to mobile communications in rural areas. This model can be widely replicated to support the link between coverage and access. The development of rurally relevant mobile applications such as information about commodity prices or transport schedules delivered via text messaging can help to drive demand.

- Build out electricity. A lack of electricity is arguably the biggest barrier to extending mobile coverage and increasing access to other ICTs, including the Internet. The Bangladesh village phone programmme is currently limited to villages with electricity. Furthermore, electricity shortages force many mobile operators to use expensive diesel generators, which drives up costs, making service less affordable for generally lower-income rural dwellers. At the same time, a lack of electricity makes it difficult to recharge phones. Though car batteries and other alternatives can be used for this purpose, they tend to be more expensive than grid electricity.

- Foster wireless broadband access. Many non-voice applications are available over mobile networks and can be delivered to mobile handsets without the need for a computer. Broadband wireless networks are also growing in developing countries — both fixed (WiMax) and 3G mobile. These developments can help boost Internet and broadband access in rural areas. Policy-makers should facilitate the development of wireless broadband and consider incentives for rural deployment. Indicators to measure and monitor supply (such as rural wireless broadband coverage as a percentage of the rural population) and demand (such as subscribers in rural areas or surveys on wireless broadband usage in rural areas) should be compiled to track this important development.

- In order to make services more affordable and increase the spread of the Internet and broadband, governments need to encourage greater market liberalization in the Internet market, and ensure particularly facilities-based competition. While many countries have encouraged the entry of Internet cafés or ISPs, true competition is constrained due to high prices for essential backbone infrastructure such as international gateways and leased lines. There are many rural households that would opt for Internet connectivity but cannot because of a lack of options and high prices.

- In countries where universal Internet service is not feasible, governments need to promote the installation of public Internet facilities in rural areas. These can be financed through universal access contributions or licence conditions. Another approach is to use funding from e-government programmes to install public facilities for citizens to access information. This is essential to avoid an e-government digital divide whereby the rural public are unable to use government-to-consumer applications. Given the right market conditions, cooperative models together with the private sector can help deliver community access. There are a number of examples, including the Bangladesh community information centres and the Peruvian *cabinas publicas* described in this chapter. Lessons may also be learnt from ITU's *Connect a School, Connect a Community* initiative[48], a public-private partnership effort to promote broadband school connectivity to serve both students and the community.

- Finally, policy-makers need to achieve the right mix between universal access and universal service strategies. Getting infrastructure to rural areas is just the first step. The population then needs to have access to services. While initially this might be through the public telephone service (whether mobile or fixed), eventually households will want to have their own access. Policy-makers must find the right balance between public access and facilitating home access.

Notes

1 Substantial inputs to this chapter have been provided by Michael Minges.

2 Villages have been defined as "a group of houses and other buildings, such as a church, a school and some shops, which is smaller than a town, usually in the countryside." See Cambridge Advanced Learner's Dictionary at http://dictionary.cambridge.org/.

3 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c2.

4 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c3.

5 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c4.

6 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c9.

7 This section draws substantially on [ITU, 2009].

8 The *Partnership on Measuring ICT for Development* is a multistakeholder partnership launched in 2004. To achieve its main objective — namely, to increase the availability and quality of internationally comparable ICT data — it has developed a core list of ICT indicators. For more information on the *Partnership* and its core list of indicators, see: http://www.itu.int/ITU-D/ict/partnership/index.html.

9 Markandey Rai. "Operational Definitions of Urban, Rural and Urban Agglomeration for Monitoring Human Settlements." http://www.scorus2006.ue.wroc.pl/modules/Downloads/presentations/Markandey_Rai.pdf.

10 The European Union follows the OECD definition, while noting that: "The OECD definition is based on the share of population living in rural communes (i.e. with less than 150 inhabitants per km^2). This is the only internationally recognised definition of rural areas. However, in some cases, it does not fully take into account the population living in more densely populated rural areas, particularly in peri-urban zones..." See: 2006/144/EC: Council Decision of 20 February 2006 on Community strategic guidelines for rural development (programming period 2007 to 2013) available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006D0144:EN:NOT.

11 Villages can also be uninhabited or "non-revenue generating." This is the case in India, where there are ongoing revisions to the figure reported in the 2001 census. See: [TRAI, 2008].

12 In 2008, ITU published a report on the availability of ICTs in villages and rural areas [ITU, 2008). This report included estimates on the number and proportion of villages with a fixed telephone line. In view of the data constraints for this indicator, various proxies were used to make estimates about the number of localities with a fixed telephone line, such as the number of post offices (on the assumption that they would have telephone service) or the number of telephone exchanges (on the assumption there is one per locality).

13 Partnership on Measuring ICT for Development, 2010.

14 There are several Global Mobile Personal Communications by Satellite (GMPCS) service operators providing worldwide coverage. One application they are used for is providing service in rural and remote areas, often where there is no terrestrial mobile cellular signal. In Mauritania, GMPCS licences were awarded at no cost but the service providers are obligated to provide payphone service in all localities with more than 1 000 inhabitants. See: M. Mohamed Salem OULD LEKHAL. "*Comment favoriser l'accès aux services de communications électroniques pour le plus grand nombre?*," 5th annual meeting of FRATEL, Montreux, Switzerland, 7 - 9 November, 2007. http://www.fratel.org/espace_public/IMG/presentation_ARM_.pdf.

15 Many regulators or operators provide national mobile population coverage. Assuming that urban areas are covered first, rural coverage can be estimated by subtracting the urban population from the total population covered by a mobile signal. The formula is:

$$\text{Proportion of rural population covered by a mobile cellular signal} = \frac{(\text{Proportion of total population covered by a mobile cellular signal} \times \text{Total population}) - \text{Urban population}}{\text{Rural population}}$$

16 The *Partnership* encourages countries to include "...geographic ... classificatory variables if they are able to, as the output can provide very useful policy information." See: ITU, *Manual for measuring ICT access and use by households and individuals*. [Geneva: ITU, 2009] at http://www.itu.int/ITU-D/ict/publications/hhmanual/2009/index.html.

17 Partnership on Measuring ICT for Development, 2010.

18 Telegeography, China improves rural coverage, January 2010, see: http://www.telegeography.com/cu/article.php?article_id=31529&email=html.

19 The e-Cambodia Development Plan foresees connecting all districts, communes and eventually villages with ICTs, including telephony, Internet, videoconferencing, radio and video. See, for example, slide 4 of the presentation *Regional Workshop on Community e-Centre for Rural development* by Mr Noy Shoung, Deputy Secretary General, National ICT Development Authority , Cambodia, at the the UN ESCAP Regional Workshop on Community e-Centres for Rural Development , 29-30 October 2009, New Delhi , India, at: http://www.unescap.org/idd/events/2009_Delhi_WS/index.asp, as well as: http://ifap-is-observatory.ittk.hu/node/7.

20 See, for example Telecompaper: *Orange France, SFR warned over 3G network coverage*, December 2009, at: http://www.telecompaper.com/news/article.aspx?cid=710603 and also the Austrian operator Optus' online information on its 3G population coverage, including a coverage map, at: http://www.optus.com.au/portal/site/aboutoptus/menuitem.26a56e3a0149a03327b868108c8ac7a0/?vgnextoid=0aa730ece1197010VgnVCM10000029867c0aRCRD.

21 For a definition of 'rural areas' in Mauritius, see the Mauritius Central Statistical Office, at: http://www.gov.mu/portal/site/cso.

22 See: http://www.oecdobserver.org/news/fullstory.php/aid/2663/Widening_broadband_s_reach.html.

23 See: http://wireless.fcc.gov/outreach/index.htm?job=recovery.

24 Total Telecom, EU to revise broadband law to guarantee access to all, 02 March, 2010, at: http://www.totaltele.com/view.aspx?C=0&ID=453595.

25 See: http://www.skmm.gov.my/link_file/what_we_do/usp/USP%20Notification2003.pdf.

26 See: http://www.skmm.gov.my/link_file/what_we_do/usp/pdf/keynote2.pdf.

27 The ITU's *Measuring the Information Society Report 2010* highlighted the relatively high price for basic broadband access in many developing countries [ITU, 2010].

28 See: [ITU, 2008], and http://www.itu.int/ITU-D/ict/newslog/Report+Measuring+ICT+Availability+In+Villages+And+Rural+Areas+Available+Now.aspx.

29 See: http://www.compartel.gov.co/.

30 Colombia, Ministry for Information and Communications Technologies, "The Colombian ICT sector and its perspectives: Bridging the digital divide while fostering private investment." Presented on 5 October, 2009. Geneva, Switzerland.

31 Colombia, Ministry of Communications: "Programa Compartel," July 2008.

32 Respondents had the possibility to choose several access points. See page 28 of [Gillwald, Alison and Stork, Christoph, 2008].

33 Elkin, Noah, "eMarketer: RCP bridges the digital divide in Latin America." *EIU ebusiness forum*, 8 March, 2001. http://globaltechforum.eiu.com/index.asp?layout=rich_story&doc_id=2669&categoryid=&channelid=&search=bridges.

34 [Curioso, *et al*., 2007].

35 See: http://www.inei.gob.pe/web/BoletinFlotante.asp?file=8175.pdf.

36 The World Bank is supporting a number of these initiatives through the Africa Regional Communications Infrastructure Programme, see: http://go.worldbank.org/1UNCU3TTM0.

37 See: https://communicationsdirectnews.com/do.php/120/37175.

38 See: http://www.gsmworld.com/newsroom/press-releases/2010/4641.htm.

39 See: http://newsroom.cisco.com/dlls/2009/prod_080409.html.

40 See: http://www.itu.int/ITU-D/ict/material/Telecom09_flyer.pdf.

41 See: http://www.telenor.com/en/resources/images/016-024_GrameenphoneCIC_tcm28-36855.pdf.

42 GSMA Development Association, *Case study: Grameenphone community information centres, Bangladesh*. (2008). http://www.gsmworld.com/documents/GrameenPhone_bangladesh_hires.pdf.

43 Although an ITU 3G mobile standard, actual speeds with initial EDGE implementation were less than broadband (<200 kbps). Improvements have seen speeds increase to around 200 kbps. A newer version of EDGE (Evolution) can achieve broadband speeds of up to 1 Mbps with average throughput of around 400 kbps.

44 Grameenphone, *Grameenphone launches new vision for the Internet*. Press Release, 11 February , 2009, at: http://www.grameenphone.com/index.php?id=474.

45 For example Opera, an Internet browser for mobile phones, reported that the number of its users grew 154% between November 2008 and November 2009, with triple digit mobile Internet usage growth in Africa. See: http://www.opera.com/smw/2009/11/.

46 Nokia Siemens Networks, *DTAC wins the rural market with Nokia Connect eRefill solution*. (2007). http://www.nokiasiemensnetworks.com/NR/rdonlyres/D13517E1-B3B2-4E4C-93A1-3648EBAC4A5B/0/DTAC_eRefill.pdf.

47 "If the unspent USD 4.4 billion universal service fund levies and the further USD 3.8 billion that will be collected between now and the end of the decade were spent on extending mobile networks, mobile coverage would be near 100% within 3.5 years." See: [GSM Association, 2006].

48 See: http://www.itu.int/ITU-D/connect/flagship_initiatives/connecting_children/index.html.

References

Curioso, W. H., M. M. Blas, B. Nodell, I. E. Alva, and A. E. Kurth (2007), "Opportunities for Providing Web-Based Interventions to Prevent Sexually Transmitted Infections in Peru," PLoS Med, February 2007.

Federal Communications Commission (FCC) (2010), Connecting America. *The National Broadband Plan*.

GSM Association (2006), *Universal access: How mobile can bring communications to all.*

ITU (2010), *Measuring the Information Society 2010*, Geneva, 2010.

ITU (2009), *Manual for measuring ICT access and use by households and individuals*, Geneva, 2009.

ITU (2008), *Measuring information and communication technology availability in villages and rural areas*, Geneva, 2008.

Partnership on Measuring ICT for Development (2010), *Core ICT indicators*, Geneva, 2010.

Gillwald, A. and C. Stork, (2008), Research ICT Africa (RIA), *Towards evidence-based ICT policy and regulation. ICT access and use in Africa*, Volume 1, 2008 — Policy Paper two.

Telecom Regulatory Authority of India (TRAI) (2008), *Indian telecom services performance indicators October– December 2007*, April 2008.

Target 2: Connect universities, colleges, secondary schools and primary schools with ICTs[1]

Introduction

Governments are increasingly recognizing the multiple benefits of providing access to information and communication technology (ICT) infrastructure within education systems. Connectivity provides a platform for students to obtain information technology and communication skills, and can reduce costs associated with printing and the distribution of books. Outside school hours, connected schools can also be used to provide connectivity for the community, including marginalized groups, such as the elderly, minorities, the unemployed and people with disabilities.[2]

The benefits of integrating ICTs in education can have a multiplier effect throughout the education system by:

- improving teaching and learning processes and allowing students to acquire new sets of skills required for the information society (Box 2.1);
- providing learners with access to Internet resources and computers as pedagogical tools;
- supporting teacher training through ICT-enabled distance-education programmes;
- improving the administration of educational institutions in order to enhance the quality and efficiency of service delivery.

Target 2 is closely related to WSIS Action Line C2 (Information and communication infrastructure):

"*In the context of national e-strategies, provide and improve ICT connectivity for all schools, universities, health institutions, libraries, post offices, community centres, museums and other institutions accessible to the public, in line with the indicative targets*."[3]

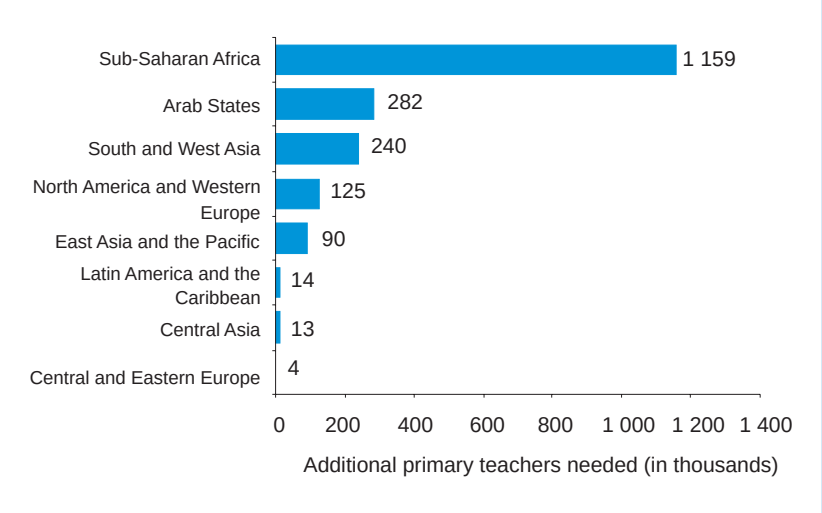
It is also significant in the context of Action Line C7, in respect of e-learning, and Action Line C4 (Capacity building), which enumerates a number of policies such as integrating ICTs in education and promoting e-literacy skills for all:

Box 2.1: The benefits of connecting educational institutions for learners and teachers

In order to prepare students for the changing needs of labour markets and knowledge-based societies, education systems must adapt their curricula to include ICT-assisted instruction. An ICT skill that is essential for participating in knowledge-based societies is information literacy, which can be used in conjunction with other problem-solving and communication skills.[5] In using the wealth of electronic resources available for pedagogical purposes via the latest Internet-based tools and digital technologies, learners can quickly expand their information literacy skills set. In essence, achieving full connectivity as sought by WSIS Target 2 is a precondition for attaining Target 7: "*To adapt all primary and secondary school curricula to meet the challenges of the information society, taking into account national circumstances*" .

At the same time, ICTs can act as a catalyst for alleviating bottlenecks in education systems, particularly teacher shortages. According to forecasts, a global total of 10.3 million teachers have to be recruited between 2007 and 2015 to meet the goal of universal primary education [UNESCO-UIS, 2009a], but the lack of trained teachers is a key challenge in achieving this goal. Sub-Saharan Africa has by far the greatest need for additional teachers, as shown by Chart 1 Box 2.1. Three quarters of countries (27 out of 45) in the region face a significant teacher gap, estimated at 1.2 million teachers.

Chart 1 Box 2.1: Increases in teacher stocks needed by 2015



Source: UIS.

Since for many countries the conventional method of course delivery is not a viable option, ICT-enabled distance-education programmes can be used to reach a greater number of primary-school age pupil populations, by complementing and enhancing existing teaching practices as well as providing additional content and delivery options, particularly in remote or rural areas where teachers are scarce. They may also be used for teacher training. Setting up relevant curricula at a distance based on an ICT-enabled environment has the advantage of flexibility, while achieving economies of scale in the dissemination of teacher-training content. Pedagogical content can thus be disseminated to potential populations at a declining unit cost, while also achieving a potential multiplier effect across the target populations.

Teacher training can take place through ICT-enabled distance-education programmes, which exploit ICTs to deliver all or a significant proportion of the teaching to learners who are removed in space and time. Distance education can take various forms, such as Internet-based distance learning, whereby content can be transmitted either synchronously or asynchronously. National circumstances will dictate the most effective technological solutions for the purpose of pedagogical training and course delivery. Self-learning using CD or DVD-ROM, in which the learner interacts with content on a computer or other integrated device, is another practical tool for delivering training. Broadcast-based education, in which content is delivered via radio or television, is very effective in delivering content to a mass of potential teachers.

To reap the full benefits and potential that Internet-based distance-education programmes have to offer, greater investment is required in infrastructure that can support broadband Internet services. As more web-based curriculum materials are developed using high-bandwidth applications, consumers of distance-education programmes in these new formats require access to the supporting infrastructure. Since many of the web-based applications make use of interactive media and streaming content in the delivery of distance-education programmes, users with broadband Internet access can take full advantage of these applications. One of the dilemmas that persist is that investment in such technologies can only occur when there is a minimum customer base that will consume the broadband Internet services. Given the high fixed costs associated with supporting such services, a sustainable customer base is essential for guaranteeing the viability of a market in the long run. The systematic deployment of any web-based distance education programmes or government policy to support such initiatives must therefore take this into consideration in delivering the curriculum.

Source: UIS.

"Everyone should have the necessary skills to benefit fully from the information society. Therefore capacity building and ICT literacy are essential. ICTs can contribute to achieving universal education worldwide, through delivery of education and training of teachers, and offering improved conditions for lifelong learning, encompassing people that are outside the formal education process, and improving professional skills."[4]

Measuring Target 2 — Proposed indicators

In order to monitor ICT in education from an international perspective, it is necessary to establish a consensus on the conceptual framework. Moreover, the approach must emphasize that educational institutions (or schools) are the main units of data collection, with aggregation at the country level. This method of data collection guarantees international comparability for the effective monitoring of ICT infrastructure in education systems.

The UNESCO Institute for Statistics (UIS) is leading a process for the development and pilot testing of cross-nationally comparable core indicators of ICT for education (ICT4E), under the auspices of the *Partnership on Measuring ICT for Development.* The *Partnership* is mandated to establish international standards, indicators and benchmarks for statistical monitoring of the WSIS global policy goals.

A set of core ICT in education indicators that measure aspects of e-readiness and access to ICT in education systems were submitted by the *Partnership* to the United Nations Statistical Commission (UNSC) at its 40th session in February 2009 [Partnership, 2010]. As a response to the need to expand the initial core list, UIS has established the international Working Group for ICT Statistics in Education (WISE). The purpose of the working group is to bring together statisticians (national focal points) from ministries of education (or national statistical offices) from 25 countries around the world to pilot the international *Questionnaire on Statistics of ICT in Education*. The four indicators suggested to monitor Target 2 in the following sections are the result of this initiative [UNESCO-UIS, 2009b].

Apart from the efforts of UIS and the *Partnership* to monitor ICT in education at an international level, there have been no other global initiatives to identify indicators or to provide data on school connectivity.[6] Periodic surveys on school connectivity have been carried out in Europe, usually under a project of the European Commission,[7] and a number of studies exist for other regions, including Latin America and the Caribbean. Mostly, however, data on ICT in education are not comparable across countries and are based on different sets of indicators and definitions. Some countries have collected ICT in education data through statistical reports or one-time studies, especially to address policy needs. Often these data are available only for one country, for one year, and/or are limited to a specific school level. While the results of the UIS survey presented in this chapter provide important insights into the status of school connectivity, the survey is limited to 25 countries, including several developed countries. Not all data sets are available for all 25 countries. The UIS survey results were complemented through data received from ITU's *Survey on the WSIS Targets*, as well as some official data from regional or national sources. Despite the fact that a number of countries and regions, including Africa, have set specific targets on ICT in education (Box 2.2), relatively few countries seem to be actually able to track them.

Although Target 2 does not specifically say how many educational institutions should be connected, it could be interpreted as meaning "all" universities, colleges, secondary schools and primary schools. Nor does it specifically state precisely which ICTs it refers to. Clearly, however, ICT-assisted instruction must encompass technologies that are consistent with national circumstances and realities. In this sense, technologies and supporting infrastructure may include older or more conventional ICT tools such as radio and television broadcasts (live and off-air) as well as the latest digital technologies such as broadband Internet and computer software.

The type of indicators selected to measure Target 2 will depend to some extent on a country's development status and ICT-readiness. Countries that are in the early stages of introducing ICTs have different information needs from countries that have longer experience with the technology. For instance, when introducing computers or Internet-assisted instruction in education, it is important that teachers and learners have access to hardware and software to acquire basic computer skills. Countries whose education systems have reached this level of ICT integration can be characterized as being at the e-readiness stage (see Figure 2.1). As Target 2 aims to measure the overall presence of ICT infrastructure and connectivity, key e-readiness indicators must be identified for this purpose.

Countries in the more advanced stages of ICT use in education have other priorities — such as the management of pedagogical innovation, adaptive and inclusive curricula, organizational change, sustainable technical support, and

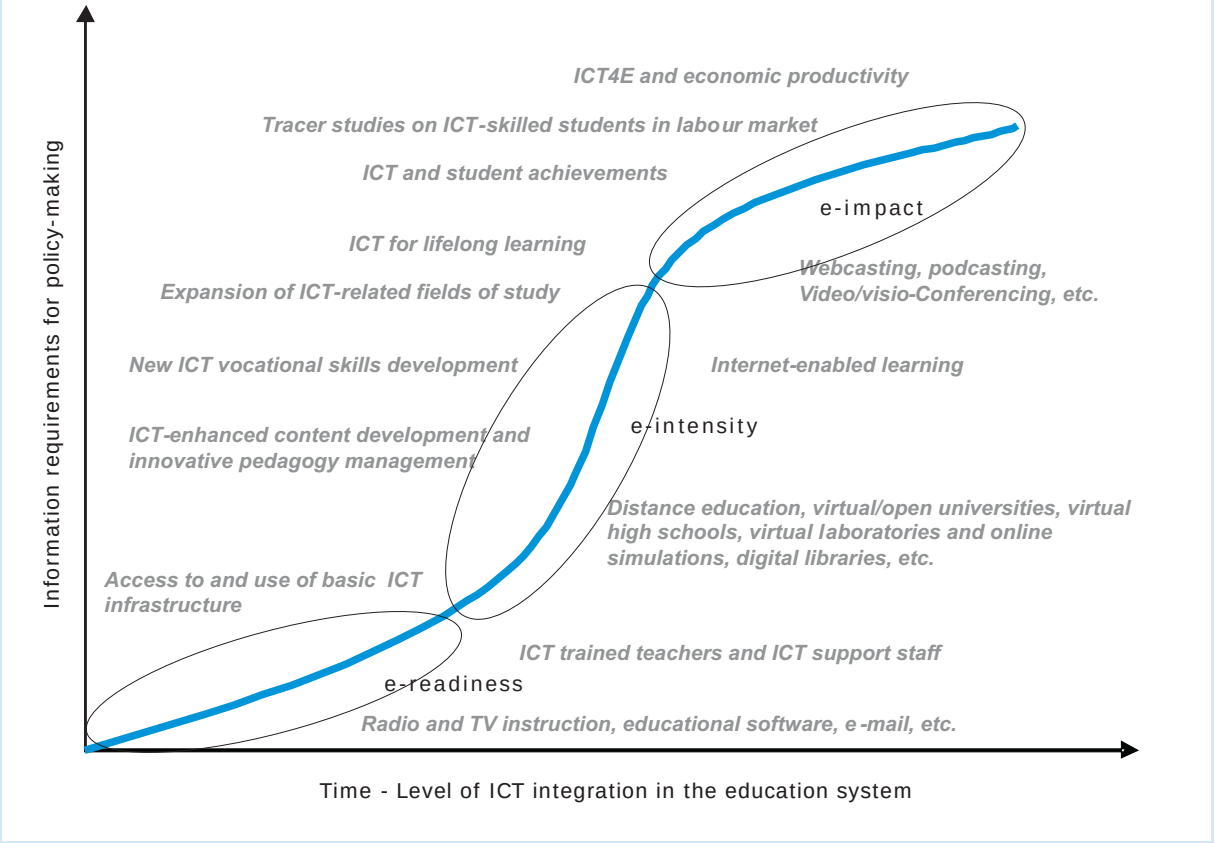
Box 2.2: Setting targets: Examples from the Americas, Africa and Australia

While Target 2 does not specify the percentage of schools that should be connected to ICTs, some regions and countries have set their own targets, usually in terms of Internet connectivity:

- In Latin America and the Caribbean, *eLAC 2010* established a target to connect 70 per cent of public educational institutions by 2010, preferably via broadband, otherwise tripling the current number of public schools connected to the Internet.[8]
- The New Partnership for Africa's Development (NEPAD) *e-Schools Initiative* was announced in 2003 at the Africa Summit of the World Economic Forum, for implementation until 2013. One of its goals was to equip "*all African primary and secondary schools with ICT apparatus such as computers, radios and television sets, phones and fax machines, communication equipment, scanners, digital cameras, copiers, etc., and to connect them to the Internet.*"[9]
- In 2009, Australia committed funding to provide 90 per cent of all schools with optical fibre progressively over the next eight years and to achieve a 1:1 learner-to-computer ratio for secondary schools by 2011.[10] Schools connected will have access to broadband speeds of up to 100 Mbit/s. These initiatives are among the many that recognize the positive impact that ICTs have on education.

Source: ECLAC; E-Africa Commission; Australian DBCDE.

Figure 2.1: Information needs at different levels of ICT penetration in educational systems



Source: UIS, adapted from [UNCTAD, 2007].

continued staff development. Thus, the concerns of policy-makers and their information needs shift over time. For some, measuring the impact of the implementation of ICT in education means gathering information on access, use and learner outcomes. For others, in the early days of implementation, attention centres more on creating an ICT infrastructure in order to provide schools with access to newer technologies, before moving on to focus on appropriate ways to use ICT in order to achieve intended educational outcomes.

The notion of e-readiness in an educational setting depends largely on the availability of ICT infrastructure. At higher levels of education, particularly in the contexts of colleges and universities, tracking Internet connectivity is less relevant from the international monitoring perspective. In an advanced pedagogical setting, measuring the degree of ICT intensity and use provides more meaningful information. For the purpose of international comparability and for monitoring the availability of ICT infrastructure, the indicators discussed in this chapter will focus on connecting primary and secondary schools with ICTs. Connecting learners early on will create the foundations required for the progression into more advanced levels of education.

The four indicators identified to monitor connectivity in primary and secondary schools are the following:[11]

1. Proportion of schools with a radio used for educational purposes (for ISCED levels 1-3)

2. Proportion of schools with a television used for educational purposes (for ISCED levels 1-3)

3. Learners-to-computer ratio (for ISCED levels 1-3)

4. Proportion of schools with Internet access (for ISCED levels 1-3), by type of access (narrowband, broadband)

These indicators cover both “older” and “newer” ICTs. All of these indicators are part of the *Partnership on Measuring ICT for Development’s* core list of indicators and, at the international level, are under the responsibility of UIS. A detailed discussion of each indicator and an overview of available data will be presented in the following section.

Status of Target 2

Radios and TV

Radio- and television-assisted instruction represents an effective solution for delivering educational content, particularly in remote areas where investing in infrastructure to support telephony and Internet services may be costly. While there are numerous benefits to be gained from spreading Internet connectivity throughout education systems, many developing countries may see broadcast technologies as a viable alternative to these newer technologies. Live radio broadcasts and off-air radio cassettes as well as television broadcasts and offline video-assisted technologies are still considered valid and cost-effective modes of education delivery. In terms of delivering educational content, they could be just as effective as the more interactive computer/Internet-based virtual education or online distance learning.

A high value (or percentage) for indicators (1) and (2) implies that radio- and television-based technologies are a widespread mode of instruction within schools in the country concerned, while a low value indicates the contrary. It should be noted that these indicators only reflect the degree of radio and television availability in schools, and not the actual intensity of use. By comparing them to the proportion of schools providing other ICT facilities as a delivery mode, one can assess the relative predominance of the different technologies used for pedagogical purposes within a country or across countries. Besides their use for international comparison, these indicators can also be calculated and analysed by geographical region, urban/rural area and public/private institution in order to detect patterns and potential discrepancies.

For the purpose of measuring radio-assisted instruction, a radio is defined as being a stand-alone device (in working condition) capable of receiving broadcast radio signals, using popular frequencies (such as FM, AM, LW and SW).

Radio-assisted instruction includes both radio broadcast education and interactive radio instruction. Radio broadcast education may be an audio lecture or lesson, with printed material for learners to follow it. Any teacher, not nec-

essarily qualified in the subject matter, can use the radio programme as a primary instructional source. Broadcast programmes follow the traditional model of education and can cover every subject in many different languages, depending on the target audience.

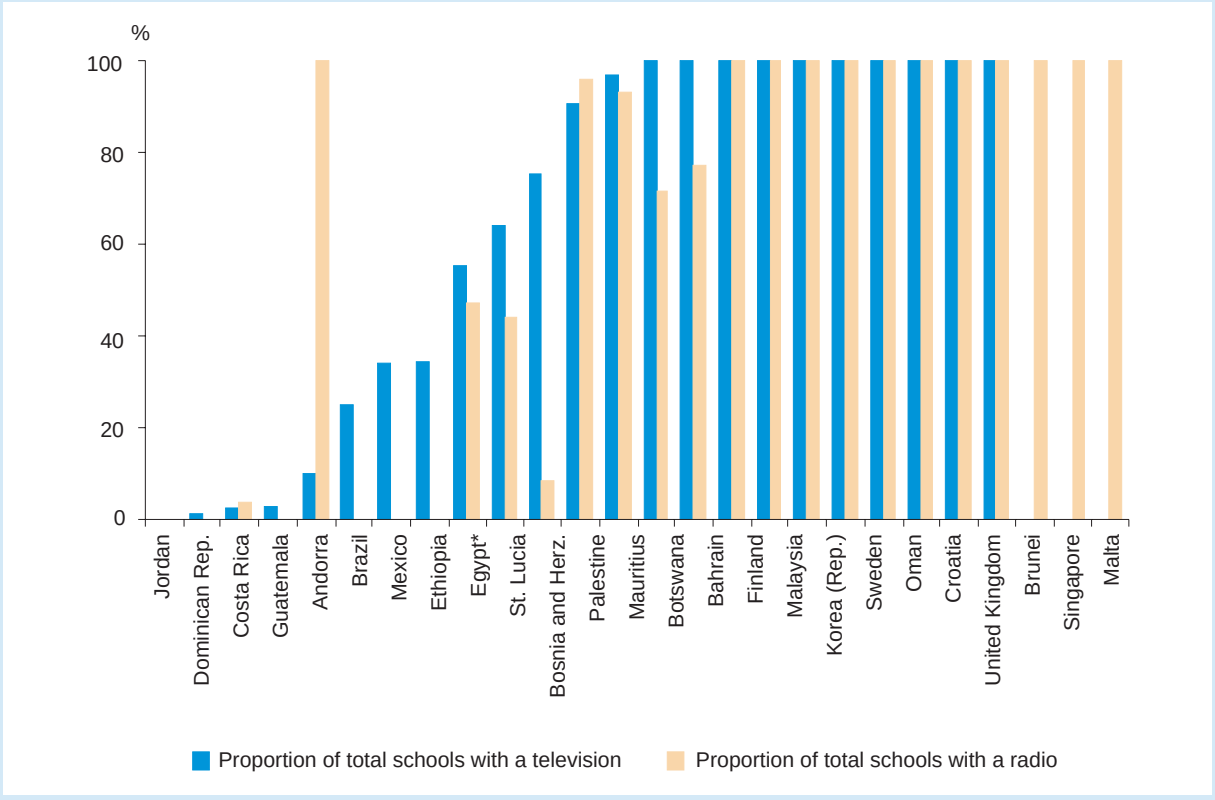
Interactive radio instruction turns a typically one-way technology into a tool for active learning inside and outside the classroom. It requires that learners react to questions and exercises through verbal responses to radio-programme contributors, group work and physical and intellectual activities while the programme is on air. For both teacher and learner, the lesson becomes an immediate hands-on practical guide [UNESCO, 2009c].

For the purpose of measuring television-assisted instruction, a television is defined as a stand-alone device (in working condition) capable of receiving broadcast television signals using popular access means (such as over-the-air, cable and satellite).

Television-assisted instruction is similar to radio broadcast education, with the additional benefit of video. It helps to bring abstract concepts to life through clips, animations, simulations, visual effects and dramatization. It can also connect a classroom to the world, but shares the same rigid scheduling and lack of interactivity as radio broadcast education.

Chart 2.1 shows that, in many countries (including Bahrain, Finland, Malaysia, Republic of Korea, Sweden and Oman), television- and radio-assisted instruction is present throughout the entire education system, with 100 per cent of primary and secondary schools having this type of instruction. In other countries, such as Jordan, there has been a deliberate policy shift away from radio- and television-assisted instruction to focus on other types of ICT-assisted

Chart 2.1: Proportion of schools with a television or radio used for educational purposes (for ISCED levels 1-3), 2008-09**



Note: * Refers to public schools only. **Or latest available year.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education; ITU Survey on the WSIS Targets; national sources.

instruction [UNESCO, 2009b]. This suggests that in some countries connecting schools to older ICTs is an alternative when newer ICTs are not available.

Computers

Depending on the measurement objective, indicator (3) — *the learners-to-computer ratio* — may be calculated in several ways. The most basic method involves the ratio of total learners to total available computers in particular schools, irrespective of the intended use of the computers. A high value for this ratio depicts a situation where, on average, there are many learners for each available computer in the schools. In a country which, in theory, enjoys full-scale deployment of computer-assisted instruction (CAI), this may signal either a low overall level of computer availability in the schools in question, or the existence of digital gaps, which can be identified when calculating and analysing this indicator by geographical region and individual school. Alternatively, the learner-to-computer ratio can be calculated for schools where CAI is deployed. A high value in this case signals that a greater number of learners must share a fixed number of computers. Pedagogically speaking, this may imply that the available computers are inadequate to serve the learning and practice needs of the learners.

In both circumstances a computer refers to a programmable electronic device that can store, retrieve and process data, as well as share information in a highly structured manner. It performs high-speed mathematical or logical operations according to a set of instructions. In collecting international data on the number of computers, a computer will include personal computers (PCs), laptops, notebooks, terminals connected to mainframes and minicomputers that are intended for shared use and are in working condition. Other additional criteria may be applied, such as the age of the computer, its configuration and capacity, the kinds of software available, etc. From a statistical perspective, the criteria for "working condition" of computers are left to the countries' discretion, taking into consideration their own pedagogical requirements for schools, their technological environment and their financial capacities [UNESCO, 2009c].

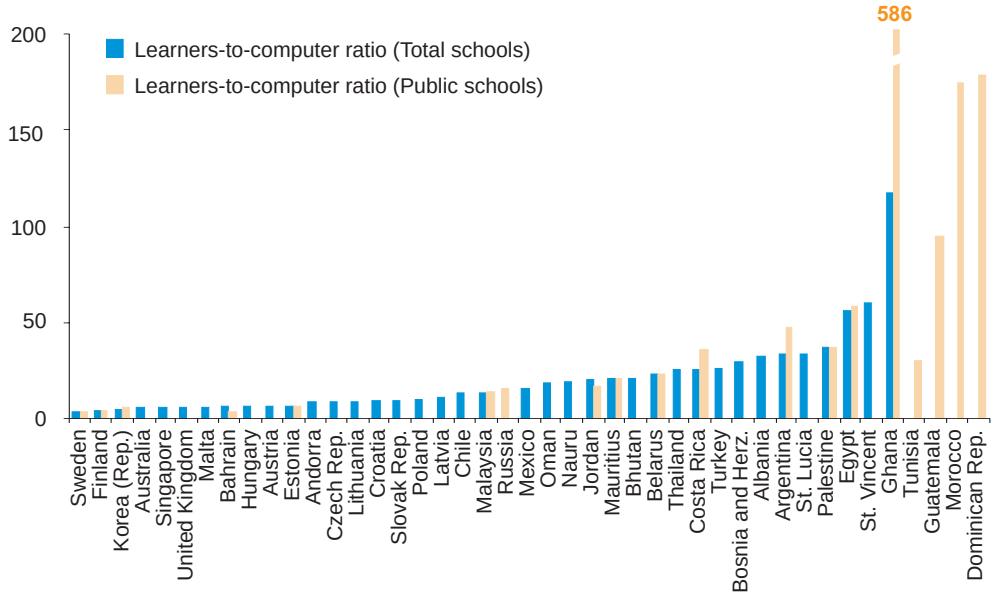
In the absence of national norms defined by pedagogues, a ratio of one learner to one computer suggests a perfect adequacy in the provision of a computer to all learners officially entitled to benefit from a computer in schools that offer CAI. However, except in cases where everyone has a privately owned computer, a perfect 1:1 match does not necessarily constitute an ideal target, since sharing a school-owned computer might equally reflect cost-efficient management of the resource. Not all subjects in curricula require the support of computers during the totality of class time scheduled in a week, a month or a year. This indicator also needs to be analysed in the context of parallel use of other, non-computer ICTs in schools.

Where national standards exist, a learner-to-computer ratio higher than the official norms implies that more efforts are required from policy-makers to equip schools with computers in order to ensure equitable opportunity for all entitled learners across the country. By frequently updating this indicator, one can monitor and ensure that all schools meet the required standard. Further methodological work will be required to test more robust measures than simple averages (e.g. median, percentiles) in order to improve cross-country comparisons. The ratios are a measure neither of actual use of computers in schools nor of the time learners actually spend using computers [UNESCO, 2009c].

The basic learner-to-computer ratio is an aggregate measure of the digital divide, irrespective of the type of school or intended use of computers. Chart 2.2 shows that the variation in the learner-to-computer ratio is very high across countries. Countries such as Sweden have a computer for every three learners in public primary and secondary schools, while some developing countries have very high ratios, namely Morocco (174:1), Dominican Republic (179:1) and Ghana (586:1). Belarus is an example of a developing country which has decreased its learner-to-computer ratio from 41:1 in 2000 to 24:1 in 2008 (Box 2.3). Based on the available data for 20 countries, the median leaner-to-computer ratio for public schools is 27:1.

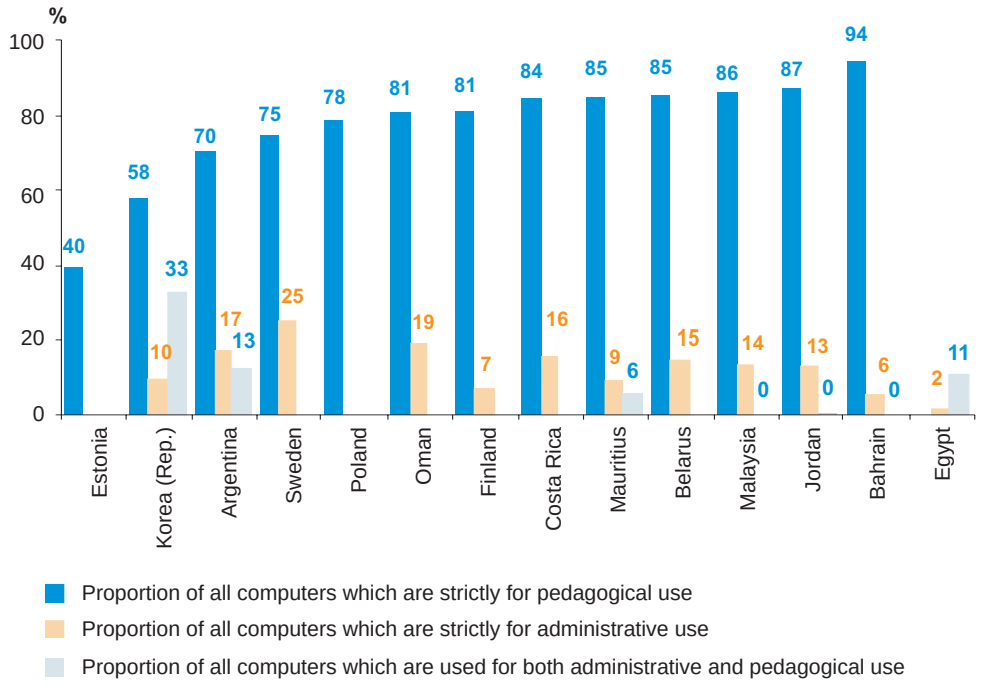
Whereas Chart 2.2 shows aggregate access to computers, there is a caveat in the sense that not all learners and teachers may have access to all of the available computers. Chart 2.3, on the other hand, shows the intended use of the computers in all primary and secondary schools. A high proportion of Sweden's computers are used for administrative purposes (25 per cent), whereas a relatively high proportion of the Republic of Korea's computers are put to both administrative and pedagogical use (33 per cent). Bahrain has the highest proportion of computers assigned for pedagogical use (94 per cent) while the proportion of computers for administrative use is relatively low, at six per cent.

Chart 2.2: Learner-to-computers ratio (for ISCED levels 1-3), 2008-09*



Note: * Or latest available year. Includes estimates.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education; ITU Survey on the WSIS Targets; national sources.

Chart 2.3: Proportion of computers available by intended use (for ISCED levels 1-3), 2008-09*

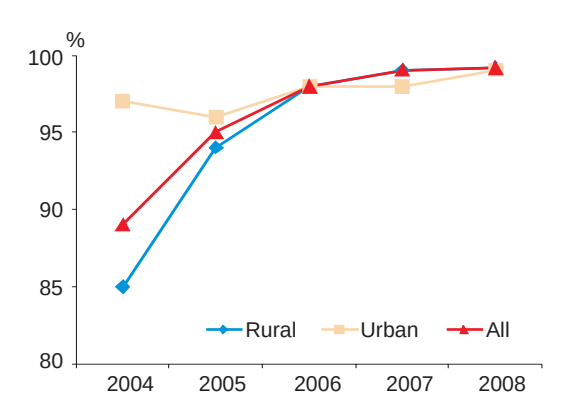


Note: *Or latest available year.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education.

Box 2.3: Measuring progress — Case of Belarus[12]

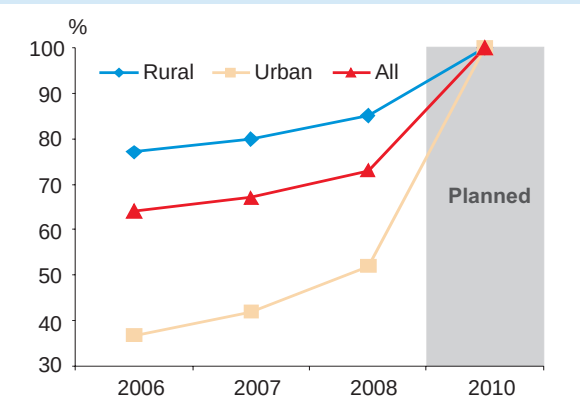
Since 1998, the integration of ICTs in education in Belarus has been carried out under special state programmes. Indicators monitoring ICTs in schools are calculated annually, and targets are tracked closely. To achieve universal connectivity, the objective has been to set up computer labs that provide Internet access across educational institutions. By 2008, practically all schools (99.2 per cent) were equipped with at least one computer lab (Chart 1 Box 2.3). Since in larger schools (those with 650 or more learners) one computer lab was considered insufficient to meet curricula needs, the Ministry of Education set a new target: less than 31 learners to one computer for all schools by 2010. The target is being closely tracked, and differences in urban and rural schools are getting smaller (Chart 2 Box 2.3).

Chart 1 Box 2.3: Proportion of schools with a computer lab, Belarus



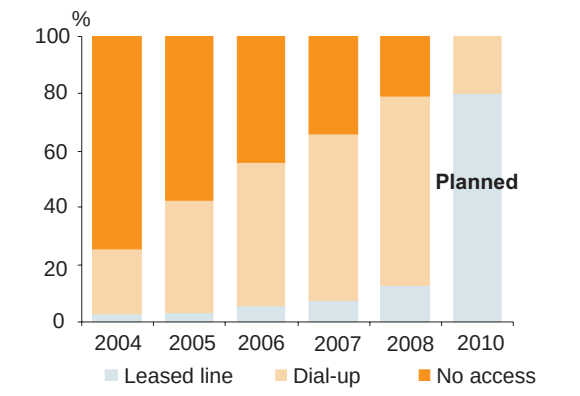
Source: Ministry of Education, Belarus.

Chart 2 Box 2.3: Proportion of schools with a ratio of less than 31 learners for one computer, Belarus



Source: Ministry of Education, Belarus.

Chart 3 Box 2.3: Proportion of schools with Internet access, Belarus



Source: Ministry of Education, Belarus.

By 2008, the learner-to-computer ratio in the country was 24, and all outdated computers had been replaced by modern computers.[13] Approximately 80 per cent of schools had Internet access and 67 per cent had dial-up Internet access, used mainly for administrative purposes. The objective for 2010 is to connect all schools with Internet access, and 80 per cent of schools with broadband access via cable or DSL to allow the use of the Internet for pedagogical purposes (Chart 3 Box 2.3).

In order to evaluate the implementation of national policies for ICT in education, the Ministry of Education developed an *ICT-Readiness Index for Schools* (ICT-R). The index ranks schools' ICT-readiness by region, and is composed of three indices which describe, respectively: readiness to use ICT for the development of ICT-literacy (*Computing*); quality, availability and improvement of educational services (*Other subjects*); and efficient educational management and planning (*Administrative work*). Each of the three component indices is in turn composed of subsidiary technical, programme and staff-related readiness indices. For the current 2007-2010 programme, 16 indicators have been selected to calculate the index. The weightings used in the aggregation reflect the relative importance of appropriate goals and objectives determined in the state's national ICT in education programme. Indicators and weightings are reviewed periodically when new programmes are under consideration. The ICT-R, which showed, for example, that in the capital region of Belarus, Minsk, schools' ICT-readiness is 24 per cent higher than the average for the rest of the regions, is used for policy purposes. The values for the index and its component indices and subsidiary indices help authorities to make informed decisions regarding investment in ICTs and the allocation of human resources in order to improve the efficiency of educational service delivery in schools.

Internet

Indicator (4), the *proportion of schools with Internet access*, is central to understanding connectivity at the primary and secondary level and hence to assessing Target 2. It measures the overall level of access to the Internet in schools, and the opportunities or limitations in terms of the use of computers in primary and secondary schools. Access may be through multiple wired or wireless devices (PCs, laptops, PDAs, smartphones, etc.). Given the paramount importance of broadband access, connectivity is also tracked by the type of Internet access. The *proportion of schools with fixed broadband Internet access* provides a good indicator of the quality of Internet connections and the potential to use ICTs for pedagogical purposes.[14] Broadband (as opposed to narrowband) Internet access is particularly important to exploit the Internet's full potential, for example in providing students access to Internet resources or in supporting online teacher training.

A high value or percentage for the proportion of schools with Internet access implies a high degree of access to the Internet among the schools in a given country, while a low value indicates the contrary. The percentages by type of Internet access can inform policies and decisions to expand and/or upgrade Internet connections in schools. The indicator measures only the availability of Internet access in schools, and not intensity of use or the actual amount of time that learners spend on the Internet for educational purposes. The type of Internet connection and access in schools may also depend on existing national and subnational telecommunication infrastructures, which can be constrained by electric power (Box 2.4) and other technological limitations in a developing context.

Data to monitor Internet and broadband access in schools exist for many developed countries and a number of developing countries (see Charts 2.4 and 2.5). They suggest that, by 2010, practically all schools in developed countries will be connected to the Internet. Many developed countries have in fact stopped tracking ICT infrastructure in schools, since connectivity was approaching 100 per cent, and in most developed countries broadband penetration in schools is either approaching or has already reached 100 per cent. For example, according to a report released by the European Union in 2006, the majority of schools in Europe had Internet access and in many countries, including Croatia, Sweden and the United Kingdom, 100 per cent of schools were already connected with broadband.[15] In the United States, all public schools were connected to the Internet as of 2006, and 97 per cent had a broadband connection. In Canada, 97 per cent of schools were connected to the Internet as early as 2004.

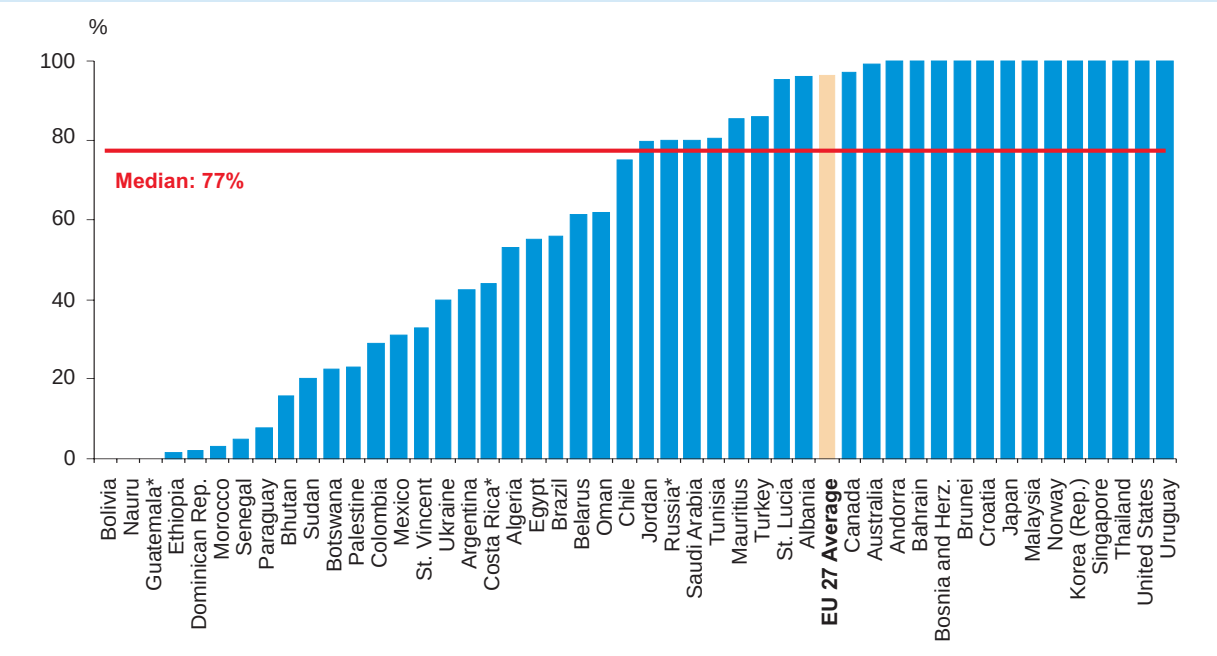
By comparison, the level of school connectivity is lower for middle-income and developing countries in the Americas. Between 2007 and 2009, Argentina, Costa Rica, Mexico and St Vincent and the Grenadines have come close to equipping half of their schools with Internet access, whereas Brazil and Chile have surpassed the 50 per cent mark. By 2009, Chile had connected three quarters of its schools to the Internet, of which 67 per cent had broadband (Box 2.5). Uruguay has successfully provided all of its schools with broadband Internet access in a relatively short time, mainly through a government-driven project (Box 2.6).

The developed economies in Asia and the Pacific display high levels of school connectivity, with all schools having Internet access in Brunei, Japan, the Republic of Korea, Malaysia, Singapore and Thailand. Of these, Brunei, the Republic of Korea, Singapore and Thailand offer 100 per cent broadband connectivity across schools. Australia had almost achieved full Internet connectivity in all schools as far back as 2003, and one objective of its new super fast National Broadband Network project is to connect 90 per cent of schools to a fibre-optic connection with speeds up to 100 Mbit/s.[23] Unfortunately, data on ICTs in education are lacking for both India and China, the two most populated nations in the region.[24]

Available data from between 2007 to 2009 for the Arab States show that several Arab countries, including Jordan, Saudi Arabia and Tunisia, have connected over three quarters of their schools to the Internet. Bahrain has connected all of its schools with broadband Internet access as well as a radio and a television set for educational purposes. This can be attributed in part to policies pursued by the Ministry of Education aimed at enhancing and elevating the level of education in Bahrain by integrating ICTs. The King Hamad's School of the Future project, launched in 2004 to connect and link all schools in the kingdom to the Internet, is an example of such an initiative [UNESCWA, 2009]. Broadband penetration in schools is also relatively high in Jordan (73 per cent).

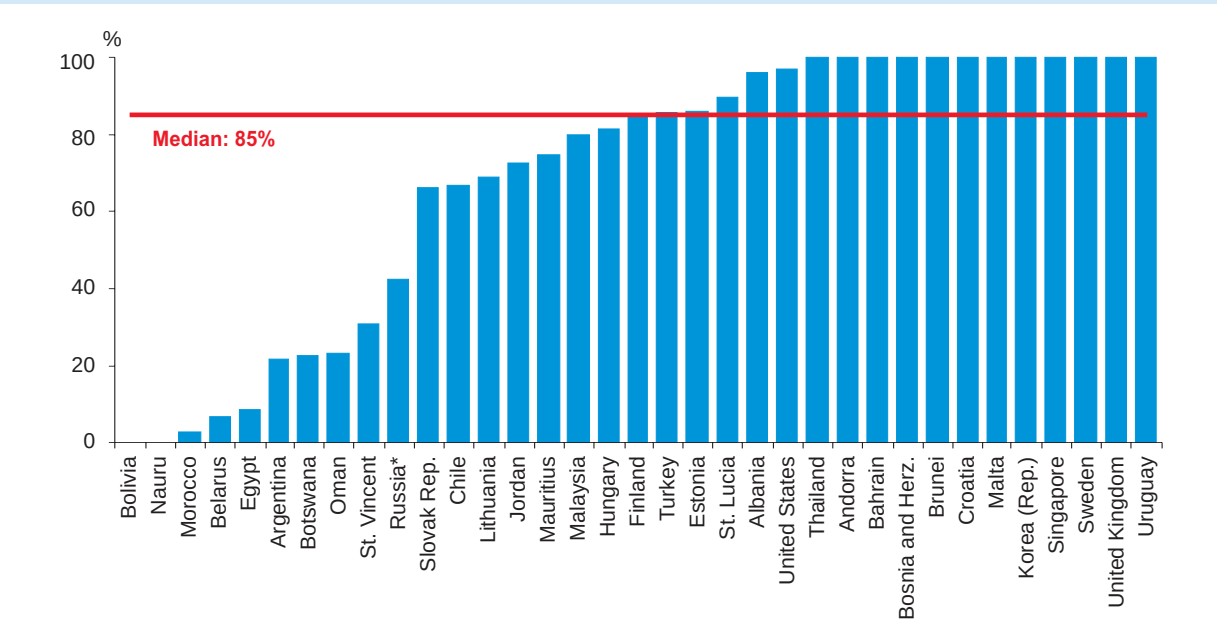
Data on ICTs in education are particularly scarce in Africa and what data do exist suggest that there is much room for improvement. In Ethiopia and Senegal, less than ten per cent of schools are connected to the Internet, and only

Chart 2.4: Proportion of schools with Internet access (for ISCED levels 1-3), 2008-09**



Note: **Or latest available year. Includes national estimates. *Refers to public schools only.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education; ITU Survey on the WSIS Targets (including data for Egypt, which was also part of the UIS Pilot Questionnaire); national sources.

Chart 2.5: Proportion of schools with broadband Internet access (for ISCED levels 1-3), 2008-09**

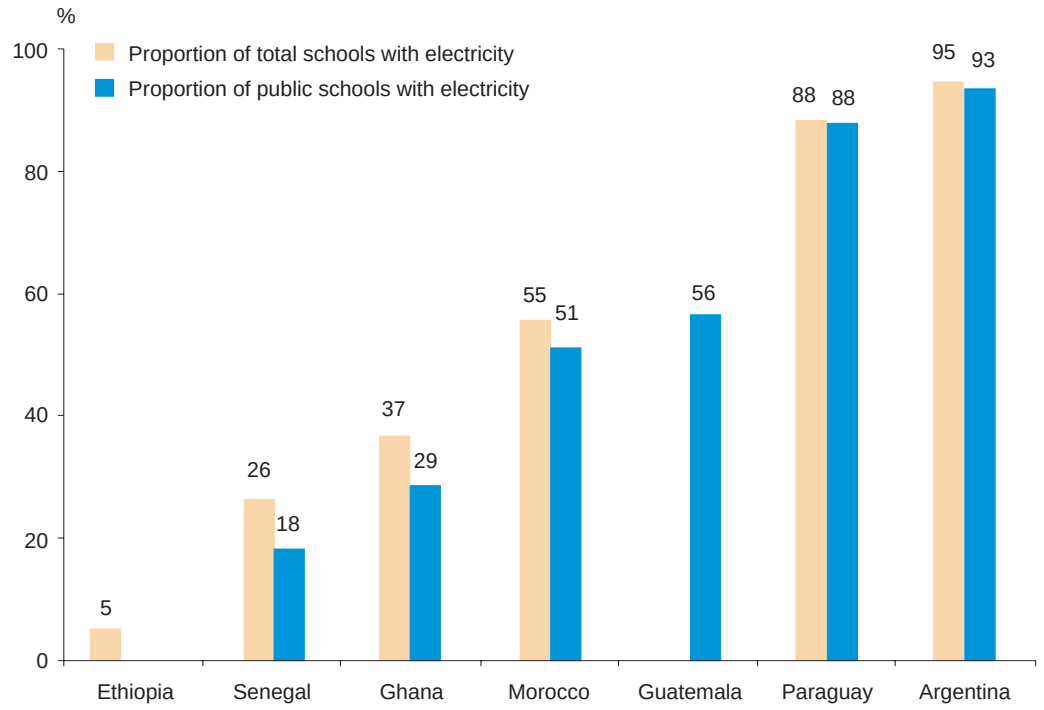


Note: **Or latest available year. Includes national estimates. *Refers to public schools only.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education; ITU Survey on the WSIS Targets (including data for Egypt, which was also part of the UIS Pilot Questionnaire); national sources.

Box 2.4: Electricity before broadband?

While the promise of broadband and wireless technologies heralds effective solutions for many education systems wishing to reap the benefits of ICT for their curricula, the relative scarcity of basic electric power in schools in many developing countries is an obstacle to accessing many of the technologies that support pedagogical objectives. Since high-income countries have full access to electric power in their educational institutions, monitoring this phenomenon is not seen as relevant. However, for the selection of countries for which data are available in Chart 1 Box 2.4, measuring progress in this area still has value. In some developing countries, such as Ghana (37 per cent, 29 per cent), Senegal (26 per cent, 18 per cent) and Ethiopia (5 per cent), only a minority of primary and secondary schools have electricity.

Chart 1 Box 2.4: Proportion of primary and secondary schools with electricity (for ISCED levels 1-3), 2009*



Note: *Or latest available year. Includes national estimates.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education

Botswana and Mauritius have data on both the percentage of schools connected to the Internet (23 and 85 per cent, respectively) and the percentage of schools with broadband (23 per cent and 75 per cent).

Conclusions and recommendations

Setting targets and measuring progress in the area of ICTs in education involves a balancing act between identifying quantifiable information to monitor international goals, on the one hand, and taking into account the heterogeneity of national circumstances, on the other. The four suggested indicators to track Target 2 serve to reconcile these two conflicting aspects by monitoring the digital gap and the overall convergence between developing countries and

Box 2.5: The Chilean model — Partnering to connect schools

In Chile, close collaboration between the Ministry of Education and *Enlaces*[16] has long been considered a model of good practice by many policy-makers. What initially started as a pilot project to connect schools has evolved over time into a national initiative to systematically integrate ICTs in subsidized state schools.[17] With the help of *Enlaces*, the Chilean Centre for Education and Technology has provided Internet access to approximately 75 per cent of schools. No fewer than 67 per cent of schools have a broadband connection.[18]

From the point of view of many middle-income and developing countries, implementing a national connectivity initiative of this magnitude can be quite cost-intensive. *Enlaces* has used a variety of financing sources and mechanisms to fulfil its mandate. In 1998, the Ministry of Education reached an agreement with the *Compania de Telecomunicaciones de Chile* through which the operator agreed to provide free unlimited Internet service to all schools in the country for a period of ten years. As part of its efforts to promote broadband access, *Enlaces* has been negotiating agreements with telecommunication operators since 2004 in order to obtain preferential rates for educational facilities, and subsequently established a fund through which schools could apply for subsidies totaling 50 to 100 per cent of their broadband connection fee.[19]

Chile's innovative thinking made it look beyond just connectivity towards teacher development and digital content long before other middle-income countries recognized the value added from educational technologies. At present, *Enlaces* is working with the *Fondo de Desarrollo de Telecomunicaciones*, the country's universal service fund, to develop a project that will roll out fibre-optic cable to Chile's largest schools.[20]

Box 2.6: Uruguay closes the digital gap

Uruguay's government, through its *El Ceibal* project, has made a strong commitment to making ICTs available in its schools, and to teachers and students, including the youngest ones.[21] By 2008, Uruguay had connected all of its primary and secondary schools to the Internet, via a broadband connection. It further fulfilled its commitment to provide all primary school children and all teachers with a free laptop computer by the end of 2009.

Closely linked to the *One Laptop Per Child*[22] project, which manufactures the low-cost XO computer specifically designed for children in developing countries, *El Ceibal* seeks to link education with social networking. Beyond introducing ICTs for teaching and learning, the programme also aims at providing free broadband Internet access for schools and communities at large through servers located in schools and other access points, using students' XO computers. Since the XOs are laptop computers capable of interconnecting with each other, they act as servers and form a wireless network.

The project is founded on three pillars: to provide equal access, to enhance teaching and learning, and to integrate ICTs in schools in tandem with the environment outside school. For policy-makers, the priority is to provide equal opportunities for all primary school children and for various segments of society, a strategy designed to accelerate Uruguay's integration in the information society.

The findings of a preliminary study on monitoring and evaluation of *El Ceibal* [Salamano et al, 2009] detected some positive outcomes associated with the use of computers and Internet connectivity for teaching and learning. In particular, it showed an increase in computer literacy among children (grades 1 to 6) and among their parents, and a closing of the intergenerational ICT gap.

countries at advanced stages of ICT integration in education. Furthermore, the selected indicators aim to do justice to an array of technologies with applications in an educational context. By monitoring both "old" and "new" technologies, there is a recognition that technological infrastructures and circumstances at the national level vary at any given time across countries, as well as over time.

To make the target as concrete and measurable as possible, it is suggested that the word "all" be added in order to seek to connect 100 per cent of educational institutions to either "old" or to "new" ICTs (or both) depending on national circumstances, at least in the short term. At the same time, governments need to recognize the potential

of broadband access, and aim to equip educational institutions with high-speed Internet access, which opens up full access to educational material and firmly grounds schools in the information society.

It is further suggested that Target 2 be amended to reflect that it is designed to track the availability of ICTs in primary and secondary schools only. Monitoring ICT infrastructure is less relevant for higher-education institutions, since they are expected to have basic access.

Target 2 would then read: "Connect all secondary schools and primary schools with ICTs"

Given today's data limitations, it is not possible to provide a comprehensive review of progress towards achieving the target. Based on available data, it is nevertheless possible to draw some conclusions for the most developed countries and regions, especially in terms of Internet access in schools, the indicator which is currently tracked by the greatest number of countries. The data presented in this chapter highlight that while schools in developed countries are largely connected, and indeed to high-speed broadband networks, penetration levels in developing countries vary considerably. Internet and especially broadband penetration in schools remains a major challenge in many developing countries across the world. A number of developing countries which have initiated projects to bring ICTs to schools and have set clear targets have attained high levels of Internet and even broadband penetration. This highlights the importance of strong government policies and clear commitments and targets in the area of ICTs in education.

Existing data on the learner-to-computer ratio show that there are sizeable variations between countries, with relatively many computers for few students in most developed and high-income economies and less favourable ratios in the developing world. While in general it must be seen as advantageous to have more computers for fewer students, it is not clear what an ideal ratio might be. The "ideal" ratio will depend a lot on national circumstances and on how computers are used, and it has been suggested that more research should be conducted in respect of this indicator.

Only relatively few countries collect and publish data on the proportion of schools with "older" ICTs, namely TVs and radios. Penetration levels vary between developed and developing countries, but also among countries within each category, suggesting that national policies and objectives vary. While some countries may try to achieve full penetration for both older and newer ICTs, others may see broadcasting technologies as a relevant alternative only if newer technologies are not available or affordable. Bringing radios and TVs into schools could therefore be understood as a short- to medium-term target that should be complemented by Internet access in the long term.

Notes

1 Substantial inputs to this chapter have been provided by Mr Patrick Lucas from the UNESCO Institue for Statistics (UIS), Mr Claude Akpabie (UIS), M. Beatriz Valdez-Melgar (UIS) and Dr Katsiaryna Miniukovich (Ministry of Education of Belarus). These inputs are greatly acknowledged.

2 There are a number of examples of schools, which provide access to the Internet for the community at large after school hours. ITU's *Connect a School, Connect a Community* initiative (http://www.itu.int/ITU-D/connect/flagship_initiatives/connecting_children/index.html) is an example of an effort to benefit both students and the communities in which they live by promoting broadband access in schools.

3 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c2.

4 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c4.

5 Information literacy is defined as the capacity of people to recognize their information needs, locate and evaluate the quality of information, store and retrieve information, make effective and ethical use of information and apply information to create and communicate knowledge. See [UNESCO, 2008].

6 The World Bank measured the percentage of schools connected to the Internet in its 2006 *Information and Communications for Development Report*, but the data presented were only available for selected countries, and for the year 2004.

7 The latest is: European Commission, Information Society and Media Directorate. August 2006. *General Benchmarking Access and Use of ICT in European Schools 2006: Final Report from Head Teacher and Classroom Teacher Surveys in 27 European Countries*. Available at: http://ec.europa.eu/information_society/eeurope/i2010/benchmarking/index_en.htm.

8 "San Salvador Commitment," in Second Ministerial Conference on the Information society in Latin America and the Caribbean, LC/R.2144, (San Salvador, 2008).
http://www.eclac.org/socinfo/elac/default.asp?idioma=IN.

9 http://www.eafricacommission.org/projects/127/nepad-e-schools-initiative.

10 See "Australia's Digital Economy: Future Directions," Department of Broadband, Communications and the Digital Economy (2009).
http://www.dbcde.gov.au/__data/assets/pdf_file/0006/117681/DIGITAL_ECONOMY_FUTURE_DIRECTIONS_FINAL_REPORT.pdf.

11 ISCED refers to the *International Standard Classification of Education* and is used to define the levels and fields of education. ISCED levels 1, 2, and 3 refer to primary, lower secondary and (upper) secondary education. For more information, see [UNESCO 1997].

12 The content of this box was contributed by by Dr Katsiaryna Miniukovich, Leading mathematician, Central Information and Analytical Centre at the Ministry of Education of Belarus. See [Ministry of Education of Belarus, 2009].

13 Modern computer is considered as IBM-compatible with 32-bit operating system supporting graphic interface.

14 Fixed broadband Internet refers to high-speed connectivity for public use of at least 256 kbit/s or more in one or both directions (download and upload). It includes cable modem Internet connections, DSL Internet connections of at least 256 kbit/s or higher, fibre and other fixed broadband technology connections (such as satellite broadband Internet, ethernet LANs, fixed-wireless access, wireless local area network, WiMAX, etc.). See [Partnership, 2010].

15 By 2006 already, 71% of schools in the EU 27 countries were connected to broadband Internet access.

16 *Centro de Educacion y Tecnologia (Enlaces), Ministerio de Educacion*, available at:
http://www.enlaces.cl/index.php?t=44&i=2&cc=1273&tm=2.

17 The education system in Chile is decentralized with municipal governments and private schools responsible for most administrative and financing aspects. Private institutions account for 43% of primary and secondary students. Some municipal schools are subsidized by the federal government. The Enlaces programme only applies to subsidized municipal schools. See http://www.chile-usa.org/education.html.

18 *Enlaces en Cifras*, available at: http://www.enlaces.cl/index.php?t=44&i=2&cc=230&tm=2.

19 *Enlaces: 15 Años Integrando Tecnologia a la Educacion Chilena*, page 64, available at:
http://www.enlaces.cl/tp_enlaces/portales/tpee371c23bs52/uploadImg/File/libro_enlaces.pdf.

20 *En Marzo Habra Banda Ancha Real para Escuelas, La Nacion*, October 2008, available at:
http://www.lanacion.cl/prontus_noticias_v2/site/artic/20081021/pags/20081021215239.html.

21 See: http://www.ceibal.edu.uy/.

22 For more information on this project, see: http://www.laptop.org.

23 See Joint Media Release by the Prime Minister, the Treasurer, and the Ministers for Finance and for Broadband, 7 April 2009, Canberra, at: http://www.minister.dbcde.gov.au/media/media_releases/2009/022.

24 InfoDev is coordinating a survey of the use of information and communication technology for education in India and South Asia, including data on the connectedness of schools, see:
http://www.infodev.org/en/Project.103.html.

References

Ministry of Education of Belarus (2009). Ministry of Education database — Central Information and Analytical Centre

Salamano, I., P. Pagés, A. Baraibar, H. Ferro, L. Pérez and M. Pérez, (2009), *Monitoreo y evaluacion de impacto social del Plan CEIBAL. Metodología y primeros resultados a nivel nacional*.

Partnership on Measuring ICT for Development (2010). Core ICT indicators, Geneva.

UNCTAD (2007). Manual for the Production of Statistics on the Information Economy. New York/Geneva: UNCTAD.

UNESCO (1997). International Standard Classification of Education. UNESCO, Paris, 1997.

UNESCO (2008). Towards Information Literacy Indicators. UNESCO, Paris, 2006.

UNESCO-UIS (2008). Proposal for internationally comparable core indicators on ICT in education. Montreal: UNESCO Institute for Statistics.

UNESCO-UIS (2009a). Projecting the Global Demand for Teachers: Meeting the Goal of Universal Primary Education by 2015. Montreal: UNESCO Institute for Statistics.

UNESCO-UIS (2009b). Pilot Questionnaire on Statistics of ICT in Education.

UNESCO-UIS (2009c). Guide to Measuring Information and Communication Technologies (ICT) in Education. Montreal: UNESCO Institute for Statistics.

UN ESCWA (2005). National Profile for the Information Society of Bahrain.

WSIS (2003). Geneva Plan of Action. Geneva: ITU.

Annex 2.1: ICTs in schools (ISCED levels 1-3), 2009**

Country	% of schools with radio		% of schools with TV		% of schools with Internet		% of schools with broadband		Learners to one computer	
Africa										
Botswana	77	2009	100	2009	23	2009	23	2009	...	
Ethiopia	...		35	2008	2	2008	...		...	
Ghana	...		...		...		...		117	2009
Mauritius	93	2008	97	2008	85	2008	75	2008	20	2008
Senegal	...		...		5	2008	...		...	
Arab States										
Algeria	...		...		53	2008	...		...	
Bahrain	100	2008	100	2008	100	2008	100	2008	6	2008
Egypt	47*	2008	55	2009	55	2009	9	2009	56	2008
Jordan	0.1	2009	0.1	2009	80	2009	73	2009	20	2009
Morocco	...		...		3	2008	2	2008	174*	2008
Oman	100	2008	100	2008	62	2008	23	2008	19	2008
Saudi Arabia	...		...		80	2007	...		...	
Sudan	...		...		20	2005	...		...	
Tunisia					81	2008			30*	2008
Asia and the Pacific										
Australia	...		...		99	2003	...		5	2007
Bhutan	...		...		16	2008	...		21	2008
Brunei Darussalam	100	2009	...		100	2009	100	2009	...	
Japan	...		...		100	2005	...		...	
Korea (Rep.)	100	2008	100	2008	100	2008	100	2008	5	2008
Malaysia	100	2008	100	2008	100	2008	80	2008	13	2008
Nauru	...		...		0	2009	0	2009	19	2009
Singapore	100	2009	...		100	2009	100	2009	5	2009
Thailand	72	2008	100	2008	100	2008	100	2009	25	2008
CIS										
Belarus	...		...		61*	2008	7*	2008	23*	2008
Russia	...		...		80*	2008	43*	2008	15*	
Ukraine	...		...		40	2007	...		...	
Europe										
Albania	...		...		96	2009	96	2009	32	2009
Andorra	100	2009	10	2009	100	2009	100	2009	9	2009
Austria	...		...		100	2007	...		6	2008
Belgium	...		...		97	2006	...		...	
Bosnia and Herzegovina	9	2008	75	2008	100	2008	100	2008	30	2008
Croatia	100	2009	100	2009	100	2009	100	2009	9	2009
Cyprus	...		...		95	2006	...		...	
Czech Republic	...		...		99	2006	...		9	2008
Denmark	...		...		100	2009	...		...	
Estonia	...		...		97	2008	86	2008	6	2008
Finland	100	2008	100	2008	100	2008	85	2008	4	2008
France	...		...		90	2006	...		...	
Germany	...		...		98	2006	...		...	
Hungary	...		...		99	2009	...		6	2009
Ireland	...		...		98	2006	...		...	
Italy	...		...		98	2006	...		...	
Latvia	...		...		100	2009	...		11	2009
Lithuania	...		...		69	2009	69	2009	9	2009
Luxembourg	...		...		96	2006	...		...	
Malta	100	2009	...		100	2009	100	2009	6	2009
Norway	...		...		100	2009	...		...	
Poland	...		...		93	2006	...		10	2008
Portugal	...		...		92	2006	...		...	
Slovak Republic	...		...		100	2008	66	2008	9	2008
Slovenia	...		...		100	2006	...		...	
Spain	...		...		95	2006	...		...	
Sweden	100	2008	100	2008	100	2008	100	2008	3	2008
The Netherlands	...		...		100	2006	...		...	
Turkey	...		...		86	2009	86	no yr.	26	2009
United Kingdom	100	no yr.	100	2009	100	2009	100	2009	5	2009

Annex 2.1: ICTs in schools (ISCED levels 1-3), 2009** (continued)

Country	% of schools with radio		% of schools with TV		% of schools with Internet		% of schools with broadband		Learners to one computer	
The Americas										
Argentina	...		...		42	2007	22	2007	34	2007
Bolivia	...		...		0	2008	0	2008	...	
Brazil	...		25	2009	56	2009	...		...	
Canada	...		...		100	1999	...		...	
Chile	...		...		75	2009	67	2009	13	2009
Colombia	...		...		29	2008	...		...	
Costa Rica	3	2008	2	2008	44*	2008	...		25	2008
Dominican Republic	...		1	2008	2	2008	...		179*	2008
Guatemala	0.2	2009	3	2009	0*	2009	...		95*	2009
Mexico	...		34	2008	31	2008	...		16	2008
Paraguay	...		...		8	2008	...		...	
St. Lucia	44	2009	64	2009	95	2009	90	2009	34	2009
St. Vincent and the Grenadines	...		...		33	2009	31	2009	60	2009
Uguguay	...		...		100	2008	100	2008	...	
United States	...		...		100	2005	97	2005	...	
Other economies										
Palestinian Authority	96	2009	91	2009	23	2009	...		37	2009

Note **Or latest available year. Includes estimates. Existing data are presented for total schools (public and private), unless marked by an * which indicates only public schools. "...": data not available.

Source: UIS Pilot Questionnaire on Statistics of ICT in Education; ITU Survey on the WSIS Targets; national sources.

Target 3: Connect scientific and research centres with ICTs[1]

Introduction

According to the *Geneva Plan of Action*, WSIS Target 3 aims "*to connect scientific and research centres with ICTs*." The nature of this information and communication technology connectivity is undefined; however, further guidance is provided in WSIS Action Line C7 (ICT applications), in regard to e-science, which states that stakeholders should "*promote affordable and reliable* ***high-speed Internet connection*** *for* ***all universities and research institutions*** *to support their critical role in information and knowledge production, education and training, and to support the establishment of partnerships, cooperation and networking between these institutions*."[2] It is therefore clear that the ICT connectivity of interest is ***high-speed Internet connectivity*** facilitating collaborative research.

Target 3 is thus of relevance not only to WSIS Action Line C7, but also to Action Lines C2 (Information and communication infrastructure) and C3 (Access to information and knowledge), as well as to WSIS Target 2 (which originally included connecting universities).

Universities and research centres have been closely connected with the Internet since its inception. In some developing countries, the major universities or academic network even acted as the first or main Internet service provider (ISP). Today, universities and research centres continue to pioneer advances in ICTs in respect of network infrastructure, services and applications, and the latest developments in grid and cloud computing. Advanced research and education networks not only serve to further knowledge and facilitate scientific discoveries — they can also help build human capital and promote economic development. It is thus essential to monitor access to ICTs by scientific and research centres and to track the power and reach of academic and research networks around the world, as acknowledged by Target 3.

This chapter focuses on *public* research centres, and reviews the indicators required for monitoring Target 3. It seeks to illustrate what has been achieved so far in different regions of the world, and outlines possible policy options for

achieving the target by 2015, in order to give policy-makers some ideas for formulating policies that take account of the speed, quality and reliability of telecommunication infrastructure for scientific research purposes.

Scientific and research centres

Scientific research is constantly evolving, matched by advances in data analysis and networking technologies. For example, particle physics has only existed as a separate discipline for the last century, and modern bioengineering for a mere two decades, but the data-computing requirements of advanced bioengineering are set to outstrip those of particle physics during the next three years, at current growth rates. Advances in computing power and ICTs are shaping modern science, and driving new forms of collaborative research and networking between institutions.

It is important to identify the set of scientific and research institutions within a country. Scientific and technical research has been defined by UNESCO.[3] Further UNESCO definitions delimit fundamental research (pure and oriented) and applied research and development (R&D).[4] Modern definitions of research frequently distinguish research according to the agents and funding (public or private) involved, which may often influence the knowledge outcomes. The definition of tertiary education institutes (including universities) is provided by UNESCO's International Standard Classification of Education (ISCED).[5] Most universities should be included in the set of scientific and research centres for Target 3, but not all — not all universities offer science degrees, and not all universities conduct research.

These UNESCO definitions are important, as they determine the overall set of *scientific and research centres* to be connected with ICTs under Target 3. This set of research institutions is likely to be known to the national government, and may have been endorsed by UNESCO. Having said that, the categorization of a research institution does not necessarily give an idea of its role in education or research, the nature of its research or the extent of collaboration with other institutions.

It is also essential to define the nature of the ICT connectivity. For some research institutions, basic connectivity to the Internet and online access to scientific journals may be sufficient for many of their research needs. WSIS Action Line C7, in particular § 22 thereof on e-science, prescribes that the ICT access should comprise an affordable and reliable high-speed Internet connection. However, the WSIS outcome documents do not specify what the Internet connectivity should be used for, other than "*information and knowledge production, education and training, and to support the establishment of partnerships, cooperation and networking*." In addition to simply ensuring access to the Internet, "*connecting research centres*" could also be interpreted as meaning establishing links and networks between them.

For modern scientific and research purposes, the existence of a *national research and education network* (NREN) is one indicator of the use of ICTs by the research and education community, and thus, by inference, constitutes an indicator of a country's ability to participate in international research (see Box 3.1 — What is an NREN?). As scientific research continues to evolve, connection to and participation in an NREN will become increasingly important. Europe's *Delivery of Advanced Network Technology to Europe* (DANTE)[6] notes that NRENs perform two main functions in relation to scientific research:

- NRENs act as high-capacity ICT infrastructures to support the work of researchers, promote collaboration, transfer data and share information or confirm experiments;

- NRENs can also facilitate new research in their own right, by providing platforms and experimental test-beds for testing new services and advanced networking technologies.

A list of 120 known NRENs is presented in Annex 3.1, revealing substantial regional disparities (Chart 3.1). There are a total of 14 NRENs located in Africa, 20 in the Americas, 25 in Asia and the Pacific, 12 in the Commonwealth of Independent States (CIS) and 38 in Europe. The CIS is notable for being the only region where all countries have established NRENs. The technologies used by an NREN are an important factor, as not all types of connectivity are equal, and fibre-based networks are likely to be more "future-proof" than some other types of technology.

Box 3.1: What is a national research and education network (NREN)?

A *national research and education network* (NREN) is a specialized Internet service provider dedicated to supporting the needs of the research and education communities within a country. It usually administers and supports a high-speed backbone network, often offering dedicated channels for individual research projects. The term "NREN" was originally a service mark of the U.S. government, registered with the U.S. Patent and Trademark Office. However, since then, the term has come to be applied to refer to national research and education networks more widely and, by inference, their regional and international connectivity.

NREN in the United States had four original purposes, some of which are mirrored in other countries:

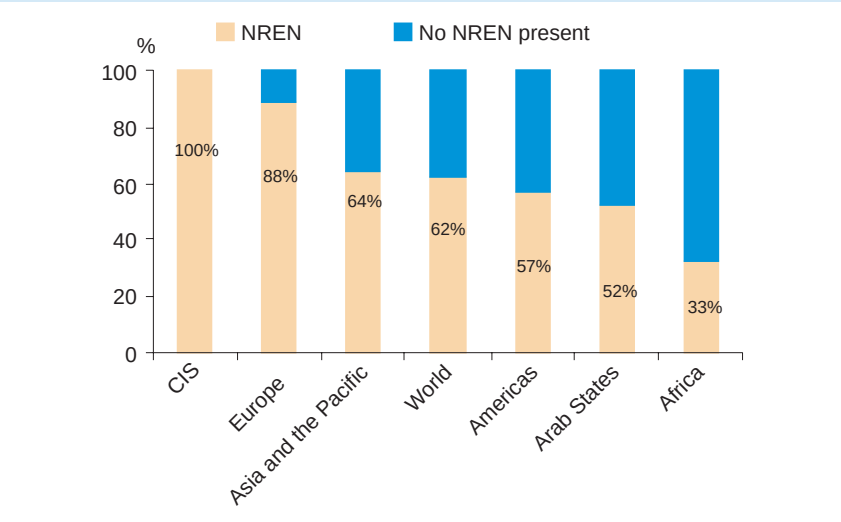
- To encourage widespread use of high-capacity networks by the research and education communities to access high-performance computing systems and research facilities
- To develop advanced high-performance networking technologies and accelerate their deployment and evaluation in research and education environments
- To stimulate the widespread availability at reasonable cost of advanced network products and services from the private sector for the general research and education communities
- To catalyse the rapid deployment of a high-speed general-purpose digital communications infrastructure for the nation.

Another example is India's three educational networks — the *Education and Research Network* (ERNET), *BIOGRID* (a VPN of the Department of Biotechnology, Government of India) and GARUDA (grid computing initiative). Each serves its respective client bases — ERNET is the exclusive provider of international connectivity to all higher-education institutes. All the networks deliver network connectivity (including Internet access) to universities, technology institutes and various government agencies on a national basis. Private-sector operators provide further international connectivity via cable and satellite for personal and commercial consumption.

Several points emerge from these examples. Firstly, the network administrator often acts as an ISP and is closely identified with the network it oversees. Secondly, such NRENs usually offer a mix of dedicated channels and public Internet access, often through a combination of dedicated backbones, leased lines or private-sector operators. Thirdly, such networks connect a range of different institutions, often with different needs. In order to provide services to diverse clients, high capacity is often important.

Source: NREN definition from http://www.nitrd.gov/pubs/implementation/1995/section.4.3.html and http://en.wikipedia.org/wiki/National_research_and_education_network. "High Performance Computing Networks for Research, Education, Science and Technology in India," available at: http://garudaindia.in/pdf/papers_presentations/India-High%20Performance%20Computing%20Networks%20&%20NRENS.pdf.

Chart 3.1: Countries with a national research and education network (NREN), by region, 2010



Source: ITU (see also Annex 3.1).

Measuring Target 3 — Proposed indicators

For the purposes of measuring Target 3, the focus is on public research centres; privately-owned or privately-funded infrastructures used for scientific research are not considered, since they are proprietary and may be difficult to measure (this is consistent with DANTE's definition of research networking as the provision of data communications for the use of the research and academic community).[7] Nor is the target concerned with day-to-day operational network performance indicators.

The following indicators are proposed to monitor this target:

1. Percentage of public scientific and research centres[8] with access to the Internet, by type of access

2. Presence of a national research and education network (NREN), by bandwidth (Mbit/s)

3. Number of national research and education network (NREN) nodes

4. Percentage of universities connected to the national research and education network (NREN), by type of connection (narrowband, broadband)

5. Percentage of public scientific and research centres connected to the national research and education network (NREN), by type of connection (narrowband, broadband).

The main emphasis of Target 3 is on "ICT connectivity." However, connectivity alone does not provide any information as to what the Internet access is likely to be used for — basic Internet connections may be utilized for e-mail only, and not collaborative research or data processing which can sometimes require vast capacity. In fact, depending on the speed, even a broadband Internet connection may still be insufficient for advanced research, data transfer and processing.

The scale and connectivity of NRENs differ greatly. The number of NREN nodes in a country depicts the size of the NREN, but such nodes are usually not all scientific and research centres and often include other institutes, such as schools, museums, libraries, hospitals or government departments.

The *Trans-European Research and Education Networking Association* (TERENA) collects data on various aspects of NRENs, mainly in European countries but also for some other networks (see Box 3.2, and Annex 3.2 for an extract of their questionnaire).

Classification of NRENs and the collection of data on NRENs and NREN bandwidth come up against several measurement challenges, however. Firstly, it is not always clear how "sovereignty" can be attributed to an international network. For example, the European Organization for Nuclear Research (CERN) is an international organization comprising twenty countries, and it is not possible to ascribe its bandwidth to Switzerland or France as its host territories. There may also be a risk of double-counting of bandwidth for trans-border links — i.e. both countries may report the bandwidth of a single link, which may thus end up being counted twice.

The main focus for many NREN managers is on collecting information on network performance, including performance of the NREN and its connectivity to other NRENs through the backbone. Indeed, beyond initial installation and expansion, their concern will be monitoring the real-time status of the network in terms of traffic volumes, reliability, security and quality of service (QoS). Network performance indicators include link usage data (e.g. average traffic volumes per day, month, year); achieved data rates; latency and jitter statistics (e.g. one-way delay, delay variation); packet-loss rates; number of outages and/or breaches; and security concerns (e.g. the number of people authorized to access the network at any point in time). Methods used for collecting and analysing performance data vary between research and education network domains,[9] from simple data on levels of link usage and traffic-volume statistics to detailed protocol analysis.[10] However, such detailed performance data are unlikely to prove relevant for the purposes of monitoring the growth in capacity of international scientific and research networks.

Box 3.2: Data collected by the Trans-European Research and Education Networking Association (TERENA)

The TERENA Compendium — TERENA's main reference document — defines a point of presence (PoP) as a point on the NREN backbone which can connect client networks or aggregations of client networks or external networks [TERENA, 2009]. Institutions can be connected through a direct PoP on the NREN backbone, or through a metropolitan access network (MAN) or radio access network (RAN), or, alternatively, served through a connected site.

The TERENA Compendium asks for:

- the total number of PoPs on the NREN;
- the number of places for core networking routing;
- the number of managed sites (where routing or switching equipment is managed); and
- the number of circuits carrying production traffic.

In addition, TERENA also poses questions relating to the availability of optical PoPs and total length of dark fibre in kilometers, replacing a previous question asking for an estimate of bandwidth multiplied by distance, which NRENs found increasingly difficult to answer. TERENA asks for the typical core usable backbone capacity of the NREN, although questions on capacity distinguish between usable capacity, maximum capacity (excluding back-up routes) and total capacity (for different point-to-point IP links). The total capacity of the network does not apply to each institution that connects to it, and this distinction is made clear by these definitions. The TERENA Compendium distinguishes between lower, upper and typical access speeds to different types of institutions, in implicit recognition of their different needs.

These indicators reveal the potential capacity of an NREN, the traffic volumes and transmission speeds of any research network, and its actual connectivity. They also enable growth in the extent, speed and capacity of networks to be monitored over time.

Status of the target

ITU conducted an ad-hoc survey in 2009 in the context of monitoring the WSIS targets. This survey included questions on Internet access in research centres (Table 3.1) and on NRENs (Table 3.2).

Every country for which data are available reported that scientific and research centres have Internet access, almost always with a broadband connection (Table 3.1). The number of reported scientific and research centres varies greatly across countries, but this might reflect differences in definitions, not to mention differences in country size, population, development and education levels.

Several countries also reported information on the presence of an NREN. An NREN exists in the majority of reporting countries, but the bandwidth of the network varies greatly, from 1.55 Mbit/s and 2 Mbit/s in Mexico and Albania, respectively, to 40 000 Mbit/s in the United Kingdom (Table 3.2). The survey did not include questions on whether the NREN was linked to other countries or other regional networks, but this information would be useful to collect in the future.

The number of nodes and countries covered are common indicators reported by any international collaborative research network — for example, APAN covers 16 countries, TEIN2 covers 10 Asian countries, GÉANT2 and LHCG cover 34 countries, CLARA covers 15 countries, *EUMEDCONNECT2* covers seven and NORDUNet five. According to DANTE, the speed of the fastest links in pan-European networks has increased by a factor of 5 000 over the last decade, while the number of European countries connected has more than doubled over the same period.[11]

Table 3.1: Public scientific and research centres with access to the Internet, 2009*

Country	Number of public scientific and research centres	Number of public scientific and research centres with Internet access (any type of connection)	% of public scientific and research centres with Internet access (any type of connection)	Number of public scientific and research centres with Internet access (broadband connection only)	% of public scientific and research centres with Internet access (broadband connection only)
Albania	50	50	100	48	96
Andorra	2	2	100	2	100
Bhutan	5	5	100	...	100
Bolivia	148	...	...	...	...
Bosnia and Herzegovina	16	16	100	16	100
Botswana	3	3	100	3	100
Brunei	0	0	...	0	...
Bulgaria	139	139	100	139	100
Croatia	51	51	100	51	100
Denmark	73	73	100	73	100
Djibouti	1	1	100	1	100
Egypt	455	455	100	455	100
Hungary	57	57	100	57	100
Korea (Rep.)	27	27	100	27	100
Latvia	126	126	100	126	100
Lithuania	111	...	...	...	...
Morocco	22	22	100	22	100
Myanmar	...	40	...	...	...
Nauru	0	0	...	0	...
Netherlands	100	100	100	100	100
New Zealand	16	...	...	...	...
Paraguay	4	...	...	...	...
Singapore	21	21	100	21	100
United Kingdom	153	...	...	...	...

Note: *Or latest year available. "...": data not available.
Source: ITU Survey on the WSIS Targets.

TERENA also collects data on connection policy, e.g. which institutions are formally permitted to connect to the NREN, and the extent to which connection is achieved (Table 3.3). All NRENs allow universities, research institutes and, with four exceptions, higher-education institutes to connect to the network. For other institutions, there are significant differences in policy between NRENs. For example, some NRENs may only connect government departments that are directly related to research and education [TERENA, 2008].

In many countries, all universities are connected to the NREN, although in some countries the proportion of universities connected to the NREN may be much lower, even 50 per cent or less, e.g. Georgia (50 per cent), Belarus (35 per cent), Israel (25 per cent), Ukraine (22 per cent), Macedonia (20 per cent) and the Czech Republic (7 per cent). The proportion of research institutes connected to the NREN tends to be lower than the proportion of universities connected to the NREN, except in Georgia, Macedonia, Moldova and Ukraine.

The bandwidth of NRENs[12] in EU and EFTA countries grew significantly between 2001 and 2008, and further increases are expected in the near future (Table 3.4). For the EU/EFTA countries, the average bandwidth doubled over the period.

Table 3.2: NRENs, 2009*

Country	Does your country have a national educational and research network?	Name of the network	Website of the network	Bandwidth of the network (Mbit/s)
Albania	Yes	Albanian Academy Network	Under construction	2
Andorra	No	-	-	-
Bhutan	No	-	-	-
Bolivia	No	-	-	-
Bosnia and Herzegovina	No	-	-	-
Botswana	No	-	-	-
Brazil	Yes	Rede Nacional de Esino e Pesquisa	www.rnp.br	...
Brunei Darussalam	No	-	-	-
Bulgaria	Yes	Bulgarian Network and Research Network (NREN-BG)	www.nren-bg.eu	1 000
Croatia	Yes	Croatian Academic and Research Network — CARNet	www.carnet.hr	10 000
Czech Republic	Yes	CESNET 2	www.cesnet.cz	10 000
Denmark	Yes	Forskningsnettet	www.forskningsnettet.dk	...
Egypt	Yes	Egyptian universities network (EUN)	www.eun.org	310
Finland	Yes	Funet	www.csc.fi/english/institutions/funet/index_html	...
Haiti	No	-	-	-
Hungary	Yes	NIIF/Hungarnet	www.niif.hu	10 000
Korea (Rep.)	Yes	KOREN, KREONET	www.koren.kr, www.kreonet.re.kr	...
Latvia	Yes	SigmaNet	www.sigmanet.lv	2 500
Lithuania	Yes	LITNET, Academic and Research Network in Lithuania	www.litnet.lt	...
Mexico	Yes	CUDI	www.cudi.edu.mx	1.55
Morocco	Yes	MARWAN	www.marwan.ma	100
Nauru	No	-	-	-
New Zealand	Yes	Research and Education Advanced Network New Zealand Ltd (REANNZ)	http://reannz.co.nz/home/	10 000
Singapore	Yes	Singapore Advanced Research and Education Network SingAREN	www.singaren.net.sg	10 200
Slovak Republic	Yes	SANET — Slovak Academic Network	http://www.sanet.sk	...
Slovenia	Yes	ARNES	www.arnes.si	...
Sweden	Yes	SUNET	http://basun.sunet.se	...
Thailand	Yes	UNINET and ThaiREN	www.uni.net.th/UniNet/Eng/index_eng.php www.thairen.net.th/NewThaiRen/Thai/index_th.php#	...
Turkey	Yes	ULAKBIM	http://www.ulakbim.gov.tr/eng/ulaknet	3 000
United Kingdom	Yes	JANET	www.ja.net/company/about.html	40 000

Note: *Or latest year available. "...": data not available.
Source: ITU Survey on the WSIS Targets.

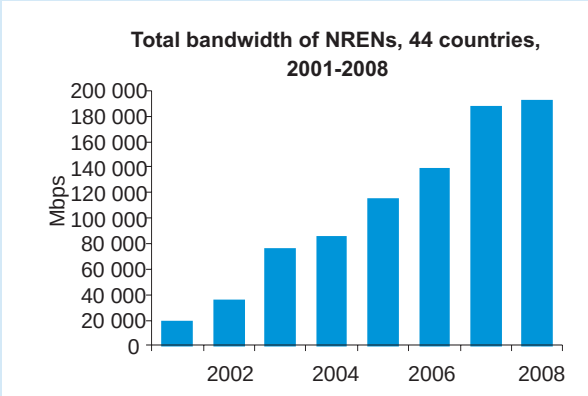
The growth in average bandwidth masks significant differences, however. For some NRENs, bandwidth remained roughly the same, whereas for others (e.g. CyNet and ARNES), it increased a hundredfold or more. The highest average NREN bandwidth capacities in Europe in 2008 were 20 Gbit/s, as against 10 Gbit/s in 2006. In comparison, CANARIE of Canada had a bandwidth capacity of 50 Gbit/s in 2007. The evolution of bandwidth capacity in the "Other" countries in Table 3.4 reflects the effect of the introduction of affordable Gigabit ethernet technology, which is now used by many countries. In most countries, bandwidth capacity will evolve to multiples of 10 Gbit/s. Furthermore, even though many EU/EFTA countries already have high capacities, they foresee further upgrades in the next two years. Many other countries also expect to upgrade to Gigabit capacities.

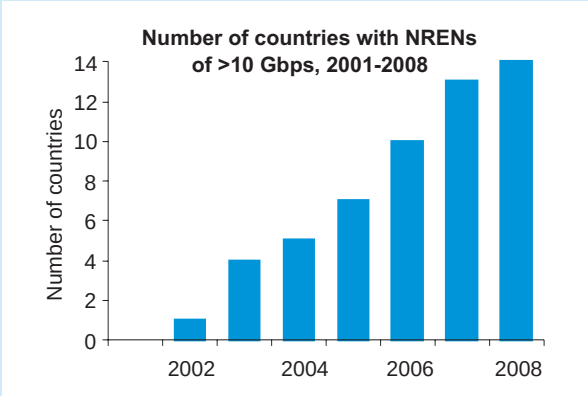
TERENA also notes a clear trend in the bandwidth of universities [TERENA, 2008]. In 2003, the "average" university was connected to the NREN at Megabit capacity; by 2008, that had increased to Gigabit capacity. TERENA's data show a clear growth in total core capacity for NRENs in 44 countries over the period 2001-2008 (Chart 3.2, left). Over the same period, the number of countries with NRENs with capacity of 10 Gbit/s or more also grew considerably (Chart 3.2, right). The trend is less pronounced in the countries outside the EU/EFTA area. Furthermore, the increases tend to occur in steps, as new technologies are introduced. However, the organizational set-up of universities and other institutes may vary significantly across countries, which can have an effect on university bandwidth requirements. For example, research institutes may be part of universities, but not in all countries. There may also be substantial differences among countries in terms of the number and/or size of universities. A university may have a single link to the NREN, or multiple links, for example, to faculties or schools that form part of it, but are geographically at different locations. In terms of total access capacity, in the EU/EFTA countries for which data are available, more than 80 per cent of the access bandwidth capacity on average (weighted) is used for the tertiary education sector.

In addition to connecting universities and research centres to NRENs, it is also important to connect NRENs to each other, for example through regional networks. The *Observatory for the Information Society in Latin America* (OSILAC) collected data on the characteristics of NRENs in Latin-American countries, including whether they were connected to the regional network *RedCLARA* (see Annex 3.3.) [OSILAC, 2007]. Almost all regions now enjoy positive spillovers from access to advanced research and education networks — for example, CERN's *Global Lambda Interchange Facility* includes connectivity to all global regions except Africa.

In some regions, NRENs are being aggregated into pan-regional networks — for example, the CARINE network being set up across the CIS countries. The extension of high-capacity connectivity to a region often prompts countries that did not previously have a research and education network to establish one — this happened, for example, in the case of the ALICE project to connect Central and Latin American research institutions to European research institutions. The growth of these networks is usually project-driven and funded on an individual project basis.

Chart 3.2: Selected characteristics of NRENs in Europe, 2001-2008





Source: ITU (see also Annex 3.1).

Table 3.3: Types of institutions for which connection to the NREN is allowed (%)*, selected countries, 2008

Country	NREN	Universities	Institutes of higher/ further eduction	Research institutes	Secondary schools	Primary schools	Libraries, museums, national archives	Hospitals (other than university hospitals)	Government departments (national, regional, local)	Others
EU/EFTA countries										
Austria	ACOnet	100	50	50	+	+	20	20	10	-
Belgium	BELNET	95	5	80	30	35	5	5	10	+
Cyprus	CYNET	100	10	100	-	-	-	-	-	+
Czech Republic	CESNET	7	3	6	36	7	9	8	12	+
Denmark	UNI-C	100	80	50	-	-	5	10	-	+
Estonia	EENet	82	34	49	57	57	11	+	1	-
Finland	Funet	100	-	48.1	-	-	10	-	1	+
France	RENATER	100	+	+	+	-	+	+	+	-
Germany	DFN	98	98	93	+	+	+	+	+	-
Greece	GRNET S.A.	100	100	100	100	99.8	1	-	1	+
Hungary	NIIF/HUNGARNET	100	80	100	5	0.2	85	30	1	+
Iceland	Rhnet	100	90	65	+	-	10	-	-	-
Ireland	HEAnet	100	100	60	96	96	1	-	2	+
Italy	GARR	100	100	98	0.5	1	7	12	5	+
Latvia	SigmaNet	70	5	19	2.5	-	3.2	1.8	+	+
Lithuania	LITNET	100	85	92	78	16	16	11	5	+
Luxembourg	RESTENA	100	100	100	100	80	50	90	3	-
Malta	UoM, IT Services	100	50	+	+	+	+			+
Netherlands	SURFnet	100	95	80	2	0.5	15	1	-	+
Norway	UNINETT	100	90	50	8	13	30	-	-	+
Poland	PIONIER	100	+	100	+	+	+	+	+	+
Portugal	FCCN	95	90	90	100	100	-	-	2	-

Table 3.3: Types of institutions for which connection to the NREN is allowed (%)*, selected countries, 2008 (continued)

Country	NREN	Universities	Institutes of higher/ further eduction	Research institutes	Secondary schools	Primary schools	Libraries, museums, national archives	Hospitals (other than university hospitals)	Government departments (national, regional, local)	Others
Slovak Republic	SANET	100	100	100	10	5	10	-	10	-
Slovenia	ARNES	100	98	80	95	80	50	-	-	-
Spain	RedIRIS	100	-	95	-	-	3	35	5	+
Sweden	SUNET	100	+	+	-	-	+	-	+	+
Switzerland	SWITCH	100	5	15	5	+	10	+	10	+
United Kingdom	JANET(UK)	100	100	100	95	100	+	-	+	+
Romania	RoEduNet	100	80	85	75	20	70	-	25	-
Bulgaria	BREN	75	10	90	100	6	1	-	-	-
Other countries										
Belarus	BASNET	35	+	31	+	+	14	2	1	-
Croatia	CARNet	100	100	100	50	50	1	0.5	0.5	+
Georgia	GRENA	50	40	75	30	-	1	0.5	0.5	+
Israel	IUCC	25	-	3	-	-	+	+	-	-
Macedonia	MARNet	20	+	38	+	+	34	+	10	+
Moldova	RENAM	62	25	80	+	+	30	5	5	+
Montenegro	MREN	70	-	50	20	20	20	-	10	-
Morocco	MARWAN	100	96	50	+	+	10	+	3	-
Russian Federation	RBNet/RUNNet	70	2	40	10	-	4	-	1	-
Serbia	AMRES	95	5	40	2	+	5	5	5	+
Turkey	ULAKBIM	95	-	60	-	-	1	-	1	-
Ukraine	UARNET	22	45	34	+	+	5	-	12	

* Note: + means it is allowed but the percentage is not reported, - means it is not allowed. The percentages in the table show the percentage of the total number of institutions connected to the NREN. Public institutions connected to the NREN by other ISPs are not taken into account.

Source: TERENA Compendium 2008, Table 2.2.1, pp 25-26.

Table 3.4: Bandwidth of NRENs, Mbit/s, 2001-2008, and expected change for 2010

Country	NREN	2001	2002	2003	2004	2005	2006	2007	2008	2010
EU/EFTA countries										
Austria	ACOnet	155	1 000	1 000	1 000	1 000	1 000	1 000	1 000	Multi 10 Gbit/s Vienna Core, 10 Gbit/s Austrian Backbone
Belgium	BELNET	622	1 000	4 976	4 976	4 976	10 000	10 000	10 000	Between 10 and 20 Gbit/s
Bulgaria	BREN	...	...	2	100	10	155	100	100	2.5 - 10 Gbit/s
Cyprus	CyNet	...	...	2	34	2	2	1 000	1 000	1 Gbit/s Ethernet network
Czech Republic	CESNET	2 488	2 488	2 500	2 488	2 488	10 000	10 000	10 000	10 - 40 Gbit/s
Denmark	UNI-C	622	622	622	1 000	2 488	2 488	2 000	2 000	DWDM ring with multiple 10 G
Estonia	EENet	24	60	100	100	1 000	1 000	1 000	1 000	10 Gbit/s
Finland	Funet	2 488	2 488	2 488	2 488	2 488	2 488	2 500	2 500	10 G in most cases (IP service); lighpath availability to most PoPs
France	RENATER	2 488	...	2 488	2 488	2 488	2 488	2 500	2 500	10 Gbit/s
Germany	DFN	622	2 488	10 000	10 000	10 000	10 000	10 000	10 000	Similar
Greece	GRNET	...	310	310	2 488	2 488	2 488	2 500	2 500	n x 10 Gbit/s
Hungary	NIIF/HUNGARNET	155	2 488	2 488	2 488	10 000	10 000	10 000	10 000	10 Gbit/s
Iceland	Rhnet	...	1 000	1 000	1 000	1 000	1 000	1 000	1 000	10 Gbit/s
Ireland	HEAnet	155	310	310	1 000	1 000	1 000	10 000	10 000	n x 10 Gbit/s
Italy	GARR	...	2 488	7 500	2 488	2 488	10 000	10 000	10 000	40 Gbit/s
Latvia	SigmaNet	100	100	100	100	2 488	10 000	1 000	1 290	3500 Mbit
Lithuania	LITNET	4	155	155	155	310	310	1 000	1 000	...
Luxembourg	RESTENA	10	1 000	1 000	1 000	1 000	1 000	1 000	1 000	10 Gbit/s
Malta	UoMallta	...	...	...	100	45	1 000	1 000	1 000	2 Gbit/s
Netherlands	SURFnet	2 488	10 000	10 000	10 000	10 000	10 000	20 000	20 000	40 Gbit/s
Norway	UNINETT	2 488	2 488	2 488	2 488	2 488	2 488	2 500	2 500	10 Gbit/s
Poland	PIONIER	155	155	622	10 000	10 000	10 000	20 000	20 000	40 Gbit/s
Portugal	FCCN	180	180	1 200	1 200	2 488	2 488	10 000	10 000	40 G
Romania	RoEduNet	...	...	34	155	310	310	1 000	1 000	10 Gbit/s
Slovak Rep.	SANET	4	1 000	1 000	1 000	1 000	1 000	1 000	1 000	Whole backbone 10 GE or n x 10 GE
Slovenia	ARNES	100	100	10	310	1 000	1 000	1 000	1 000	1 Gbit/s
Spain	RedIRIS	155	155	2 488	2 488	2 488	2 488	10 000	10 000	n x 10 Gbit/s
Sweden	SUNET	622	1 000	10 000	10 000	10 000	10 000	10 000	10 000	Same
Switzerland	SWITCH	310	...	1 000	1 000	10 000	10 000	10 000	10 000	2 x 10 Gbit/s in parallel
United Kingdom	JANET (UK)	2 488	2 488	10 000	10 000	10 000	10 000	10 000	10 000	40 Gbit/s
Other countries										
Algeria	CERIST	...	...	155	155	310	310	34	...	...
Azerbaijan	AzNet	...	...	...	1 000	1 000	1 000	1 000	...	...
Belarus	BASNET	...	...	...	...	...	...	...	100	1 Gbit/s
Croatia	CARNet	155	155	155	155	310	310	1 000	1 000	The bandwidth will be upgraded in the MANs and the number of PoPs will increase
Georgia	GRENA	0.896	2.048	4.1	4	1 000	1 000	1 000	1 000	1 Gbit/s in Tbilisi, 10 Mb/s in regions
Israel	IUCC	...	...	34	45	1 000	1 000	1 000	1 000	1 Gbit/s
Jordan	JuNET	...	...	...	...	...	1 000	2 000	...	...
Macedonia	MARnet	0.5	2	2	...	10	1 000	1 000	1 000	...
Moldova	RENAM	...	...	2	...	...	1 000	1 000	1 000	In 2009, 10% of the fibre backbone connections will be transferred to 10 Gbit/s Ethernet technology; in 2010, 25% of the fibre backbone connections will be transferred to 10 Gbit/s Ethernet technology

Table 3.4: Bandwidth of NRENs, Mbit/s, 2001-2008, and expected change for 2010 (continued)

Country	NREN	2001	2002	2003	2004	2005	2006	2007	2008	2010
Other countries (continued)										
Montenegro	MREN	...	...	...	...	...	...	1 000	1 000	...
Morocco	MARWAN	...	...	2	34	45	155	155	155	...
Palestinian Authority	PADI2	...	...	...	...	...	...	100	...	...
Russia	RBNet/RUN Net	...	...	100	...	2 488	2 488	2 488	10 000	40 000
Serbia	AMRES	...	2	155	500	100	1 000	1 000	1 000	Same bandwidth with more optical PoPs and backbone distance to 2 700 km
Turkey	ULAKBIM	34	34	155	155	45	310	500	500	10 Gbit/s
Ukraine	UARNet	...	...	...	...	...	...	...	10 GE	n x 10 Gbit/s

Note: Highlighted cells refer to speeds equal to or greater than 10 Gbit/s. In a number of cases, the information from earlier years refers to the capacity of external connections, not to the capacity of the backbone. "...": data not available.
Source: TERENA (2008), Table 3A.4.3, p. 38, and Table 3A.5.1, p. 40.

In Europe, *GÉANT* was launched in December 2001 to promote global research connectivity and cooperation between Europe, North America and Japan. The European GÉANT network established connections from the European backbone to North America (NASA and the research networks *Abilene, ESnet* and *CA*net4*, in service since January 2002). It has been succeeded by *GÉANT2* (Box 3.3) and will soon be upgraded to *GÉANT3* offering truly global research networking connectivity.

Other regional networking projects are now being implemented around the world — in Latin America (ALICE), the Mediterranean (EUMEDCONNECT) and the Asia-Pacific region (TEIN2), some with funding assistance from the European Commission. DANTE-Internet2-CANARIE-ESnet (DICE) is an initiative for trans-Atlantic cooperation within the framework of the GÉANT2 technical programme that enables engineers to work on advancing their research.

In the Mediterranean basin, EUMEDCONNECT2 is a high-capacity IP network serving the research and education communities in seven countries (Algeria, Egypt, Jordan, Morocco, the Palestinian Authority, Syria and Tunisia). With direct links to GÉANT2, EUMEDCONNECT2 connects some 2 million users in 700 institutions across North Africa and the Middle East, enabling them to collaborate with their peers at over 300 research and education establishments in Europe.

In Central Asia, the objective of the *CAREN* project is to establish a high-capacity research and education network as a gateway to global research collaboration by the end of 2009. It aims to replace the Silk project's satellite-based connectivity with a broadband Internet network using terrestrial fibre with a direct link to GÉANT, so as to connect researchers, educators and students in Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.

The *Trans-Eurasia Information Network* (TEIN2 network) was established to improve collaborative research networking between Europe and the Asia-Pacific region. TEIN2 currently connects over 30 million users in 4 000 research and education institutes, with direct connectivity to GÉANT2, across ten countries in Asia and the Pacific, including China, Hong Kong (China), Indonesia, Japan, Republic of Korea, Malaysia, the Philippines, Singapore, Thailand and Viet Nam, with the active participation of Australia.[13] *TEIN3* was awarded EUR 18 million of funding in October 2008 (EUR 12 million from the EU and EUR 6 million from Asian partners) and will run until 2011, offering higher-speed connections to more Asian countries, such as Laos PDR. The *ORIENT* project was launched in March 2006 to provide dedicated links to the Chinese research networks CERNET and CSTNET,[14] connect the Shanghai Astronomical Observatory to its European counterparts and promote the EUChinaGrid, a grid computing project uniting computing resources in China and Europe [Ruggieri, 2005]. India's research network ERNET was connected to GÉANT2 in October 2006.

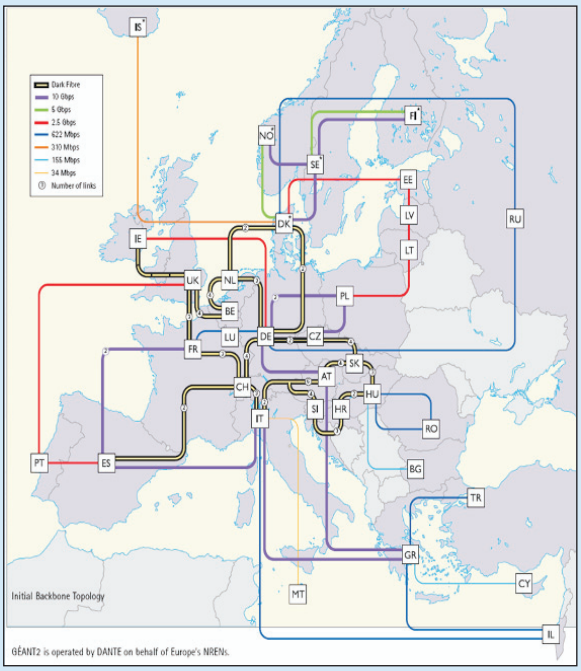
In Latin America, the *ALICE* project was established in 2003 to develop an IP research network infrastructure towards Europe. It sought to address what was then a lack of connectivity in Latin America, as well as the infrastructure ob-

Box 3.3: GÉANT 2

GÉANT 2 was launched in September 2004 as the high-bandwidth academic Internet serving Europe's research and education community (as the successor to GÉANT). It is funded by the European Commission and managed by DANTE (Delivery of Advanced Network Technology to Europe). It connects over 30 million researchers in a multidomain topology spanning 34 European countries through 30 national research and education networks (NRENs), with links to a number of other world regions.

The first links came into service in early December 2005 between Switzerland and Italy and Switzerland and Germany. There are now two interconnection points in the United States — the original GÉANT point of presence (PoP) established in New York in 1998 and a second PoP in Washington. A number of 10 Gbit/s links connect the United States and Europe — two funded by GÉANT2 and a further two funded by the American National Science Foundation and Internet2. The topology of GÉANT2 in 2005 is shown in Figure 1 Box 3.3. A direct Canada-Europe link is under discussion.

Figure 1 Box 3.3: GÉANT 2 research network backbone



Source: www.GEANT2.net and CERN Computer Centre.

Network design for GÉANT 2 has focused on maximizing operational and service flexibility. The network architecture is based on a combination of routed IP and switched components, with multiple 10 Gbit/s wavelengths used in the network's core. All GÉANT2's 25 PoPs are fully equipped and in service. Furthermore, 43 of the network's 44 routes are fully installed and operational, with one dark fibre route still under preparation. For the GÉANT+ service, all NRENs subscribing to GÉANT+ have prepaid quotas of 10 Gbit/s of GÉANT+ capacity. In practice, this means that up to 9 Gbit/s ethernet services can be requested at short notice by any combination of NRENs in GÉANT2's fibre cloud. Alternatively, full-capacity 10 Gbit/s wavelengths can also be ordered between any two fibre-cloud GÉANT2 PoPs.

GÉANT2 participants covered by dark fibre (and thus able to receive point-to-point services) are considered as being "within the GÉANT2 fibre cloud." At present, these include:

ACOnet (Austria); ARNES (Slovenia); BELNET (Belgium); CARNet (Croatia); CESNET (Czech Rep.); DFN (Germany); HEAnet (Ireland); NIIF (Hungary); NORDUnet (Nordic region); PSNC (Poland — currently GÉANT+ service only); RedIRIS (Spain); RENATER (France); SANET (Slovakia); SURFnet (Netherlands); SWITCH (Switzerland); and UKERNA (UK).

jectives of the European Commission's @LIS programme. It has established the RedCLARA network connecting new and existing Latin American NRENs in a ring and spur topology, with an onward connection to GÉANT2 in Europe at 622 Mbit/s. ALICE has had an important catalytic effect in promoting national networks across Latin America. Several countries which had no centralized research connectivity have established NRENs in order to connect with ALICE. Other countries (e.g. Chile and Cuba) have expanded their existing networks. For those countries where research networking was already well-developed (e.g. Brazil and Mexico), researchers are now more involved with their collaborators in Europe.

Today, the world's largest computing grid and one of the largest data-processing networks in the world has been established at CERN (Box 3.4). The computing power needed to deal with the immense amounts of data generated by the Large Hadron Collider (LHC) is far beyond CERN's computing capacity, and a special Worldwide LHC Computing Grid (WLCG) has been established at CERN to store, process and analyse data.

Box 3.4: A look to the future: the Worldwide LHC Computing Grid (WLCG) at CERN

The *Worldwide LHC Computing Grid* (WLCG) is a global collaboration linking grid infrastructures and computer centres worldwide in order to distribute, store and analyse the immense amounts of data generated by the *Large Hadron Collider* (LHC) project at CERN in Geneva. It consists of massive, multipetabyte storage systems and computing clusters with thousands of nodes connected by high-speed networks. It uses specialized tools to manage the vast data storage systems needed for LHC data, and to allow applications to access the data for simulation and analysis.

Today, WLCG combines the computing resources of more than 100 000 processors from over 170 sites in 34 countries, producing a massive distributed computing infrastructure that provides over 8 000 physicists around the world with near real-time access to LHC data and the power to process it. WLCG consists of three layers or "tiers:"

- ***Tier-0*** is the CERN Computing Centre. All data from the LHC pass through this central hub, but it provides less than 20 per cent of the total computing capacity. CERN is connected to the other major tiers and grid services using dedicated 10Gbit/s optical wide-area links.
- ***Tier-1*** comprises eleven sites located in Canada, France, Germany, Italy, the Netherlands, the Nordic countries, Spain, Taiwan (China), the United Kingdom and the United States. These sites provide distribution networks, processing of raw data, data analysis and storage facilities.
- ***Tier-2*** comprises around 160 sites around the world. Altogether, these sites provide approximately half the capacity needed to process LHC data.

Exchanging data between WLCG centres is managed by the Grid File Transfer Service developed by the *Enabling Grids for E-sciencE* (EGEE) project for transferring large volumes of data across distributed computing grids securely and reliably. It has been tailored to support the special needs of grid computing, including authentication and confidentiality features, reliability and fault tolerance, and third party and file transfer.

Source: CERN Computer Centre.

Conclusions and recommendations

Most research centres and universities are connected to the Internet, often with a broadband connection. Many universities and research institutes are also connected to the NREN, where one exists. By early 2010, around 62 per cent of countries had an NREN, ranging from 100 and 88 per cent of countries in CIS and Europe, respectively, to 33 per cent of countries in Africa.

Connecting NRENs to regional and international networks is essential for connecting scientific and research institutions to the high-bandwidth networks needed for scientific research. Such networks promote international collaboration and partnerships for building an advanced information society. In order to promote the expansion of NRENs, governments in both developed and developing countries could consider the following policy recommendations to connect scientific and research centres to advanced ICT networks, thus attaining Target 3:

- **National innovation system**: Governments and policy-makers should work with research and education institutions to ensure that the NREN is fully embedded within their overall national innovation system and serves the needs of the local research community. NRENs and international collaborative research networks are not just about connectivity, but must enable collaborative research for their full benefits to be realized (in developing research skills and advanced human capital). Related issues such as the "brain drain" or loss of expertise abroad should also be addressed as part of policy for strengthening the national innovation system and the NREN.
- **National consultations**: Governments could consider conducting consultations with the NREN and associated institutions in order to review challenges and bottlenecks to boosting network deployment and connectivity. These could include the regulation of international gateways, review of international routing options, the liberalization of cheaper or efficient communication services such as Skype and VoIP and/or schemes and consortia for boosting fibre backbone access. The outcome of these consultations should inform national policies, which

should focus on the roll-out and growth of NRENs in developing countries, and enhance their bandwidth capacities.

- **Plan of priorities for connecting institutions**: Policy-makers should also consider prioritizing the research institutes to be connected to the NREN, based on their size and the types of research performed there. Partnerships and connection to existing regional and global networks should be explored (as along the lines of ALICE's onward connection to GÉANT2 in Europe). Connectivity with at least two other regions is advisable in terms of back-up routes and supporting connectivity. The expansion of collaborative research networks generally progresses fastest where there are strong academic research links between different institutions in similar fields of research.

- **Public-private partnerships (PPPs)**: Establishing PPPs with incumbent telecommunication operators and new ISPs could be another important way of enhancing infrastructure and helping integrate international research network connectivity with existing incumbents' networks.

Developing countries can consider formalizing their international research links and collaborative research initiatives. Historically, research contacts are often personal or institutional, but these collaborations could be extended and placed on an official footing so as to include formal projects extending linkages to NRENs. Developing countries may also need to consider issues of routing and transit connectivity and regional networks, in order to ensure linkages and stable back-up capacity to large-capacity networks in Europe, Asia and North America and to avoid situations such as the Egyptian Internet blackout in January 2008.

While academic and research networks are being rolled out at an accelerating pace, quantifiable statistical measurement of Target 3 in terms of scientific and research institutions may prove difficult for some countries. For each country, it is necessary to determine the national set of scientific and research centres (including some universities, but most likely not all) on the basis of UNESCO definitions. The basic Internet access connectivity of these institutions, in particular universities, is likely to be high (see also the chapter on Target 2), especially since universities have been closely connected with the Internet since its inception.

WSIS Action Line C7 refers to affordable and high-speed Internet access and, in the future information society, connectivity for scientific and research purposes refers to academic NRENs that are increasingly being used for collaborative research. The statistical evaluation of the roll-out of these networks is fraught with difficulty, most notably in assigning sovereignty to an international network and in avoiding double-counting of bandwidth on routes between countries. Furthermore, a network's PoPs in a country and the total bandwidth available to a country are likely to depend on the topology chosen for the network. Virtually all world regions now enjoy the benefits of these advanced research and education networks, but there remains a need to integrate regional networks so as to ensure that developing countries can also benefit by participating in and contributing to the pioneering developments in scientific and academic research that characterize the information society.

Notes

1 This chapter was co-authored by Phillippa Biggs and Desirée van Welsum of ITU, who gratefully acknowledge review and feedback from Susan Teltscher and other colleagues of the ITU Statistics Division.

2 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c7.

3 Scientific and technical research is defined as including "*fundamental research, applied research (in such fields as agriculture, medicine, industrial chemistry etc.) and development work leading to new devices, products or processes*" — UNESCO's "Questionnaire on Statistics of Science and Technology," available at: http://unesdoc.unesco.org/images/0017/001781/178114eb.pdf. It includes research related to economics or sociology, but excludes routine testing, censuses and market studies. For example, this means that national statistics offices are excluded from counts of research institutions for routine assessments, but could be included if the definition of research institutions focuses on research into economic or social problems.

4 The survey "Main Trends of Inquiry in the Field of Natural Sciences" (UN and UNESCO, Paris 1961, UNESCO/NS/ROU/14), available at: http://unesdoc.unesco.org/images/0015/001542/154284eb.pdf.

5 The International Standard Classification of Education ("ISCED 1997") was approved by the 29th UNESCO General Conference in November 1997. ISCED 1997 covers two main cross-classification variables (*levels* and *fields* of education) and provides definitions for primary, secondary and tertiary education institutes.

6 DANTE (Delivery of Advanced Network Technology to Europe) plans, builds and operates networks for research and education. It is owned by European NRENs and works in partnership with them and the European Commission.

7 http://www.dante.net/server/show/nav.00100e.

8 Given recent developments in collaborative research, the current classification of scientific and technical institutions may be increasingly outdated and in need of revision. The classification and number of public scientific and research centres is not straightforward to measure. Indeed, certain types of institutions (for example vocational training institutes, or institutions that have public-private partnerships or other types of collaboration) may need to be included additionally. It is doubtful that all universities should be included.

9 http://www.geant2.net/server/show/conWebDoc.1017.

10 http://www.geant2.net/server/show/conWebDoc.1010.

11 http://www.dante.net/server/show/nav.00100e.

12 TERENA refers to "core usable backbone capacity" as the typical core capacity of the linked nodes in the core. Some networks do not have a core backbone, for example, because they have a star topology. In those cases, TERENA asked for the maximum capacity into the central node of the network. Some NRENs have dark fibre with a very high theoretical capacity — in these cases, TERENA asked for the usable IP capacity.

13 http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/1581&format=HTML&aged=0&language-EN&guiLanguage=en.

14 http://www.dante.net/server/show/nav.1678&?PHPSESSID=de99b27200a4448c6029ada4c6747088.

References

OSILAC (2007), Monitoring eLAC2007: Progress and current state of development of Latin American and Caribbean information societies, ECLAC, Santiago.

TERENA (2008), TERENA Compendium 2008: http:www.terena.org/activities/compendium.

TERENA (2009), TERENA Compendium 2009: http:www.terena.org/activities/compendium.

Ruggieri, F. (2005), "GRID projects for the Mediterranean and China," presentation given at the GARR Conference 2005, Pisa, 11 May 2005: http://www.garr.it/conf_05/slides/f_ruggieri-med_china_grid.pdf.

Annex 3.1: List of national research and education networks (NRENs)

- AFRENA (Afghanistan)
- ANA (Albania)
- CERIST and CNTI (Algeria)
- Australian Academic and Research Network, AARNet (Australia) — connected to TEIN2 and TEIN3 networks.
- Red (Argentina)
- ARENA (Armenia)
- AZNET (Azerbaijan)
- ACOnet (Austria)
- BDREN (Bangladesh)
- Belnet (Belgium)
- BASNET (Belarus)
- RUB (Bhutan)
- BOLNET (Bolivia)
- BIHARNET (Bosnia and Herzegovina)
- RNP (Brazil)
- Brunet (Brunei Darussalam)
- BREN (Bulgaria)
- ITC (Cambodia)
- Cameroonian NRET (Cameroon)
- CANARIE, CA*Net (Canada)
- REUNA (Chile)
- CERNET and CSTNET (China) — connected to TEIN2 network.
- RENATA (Colombia)
- eb@le (Democratic Republic of the Congo)
- CR2Net (Costa Rica)
- CARNet (Croatia)
- RedUNIV (Cuba)
- CYNET (Cyprus)
- CESNET (Czech Republic)
- Forskningsnettet (Denmark)
- CEDIA (Ecuador)
- EUN (Egypt) — connected to EUMEDCONNECT2.
- RAICES (El Salvador)
- EENet (Estonia)
- FUNET (Finland)
- RENATER (France)
- DFN (Germany)
- GRENA (Georgia)
- GARNET (Ghana)
- GRNET (Greece) — Greek Research & Technology Network.
- RAGIE (Guatemala)
- UNITEC (Honduras)
- HARNET (Hong Kong, China) — connected to TEIN2 and TEIN3 networks.
- NIIF and HUNGARNET (Hungary)
- RHnet (Iceland)
- ERNET (India)
- INHERENT — Indonesia Higher Education & Research Network NREN — ITB (Indonesia) connected to TEIN2 and TEIN3 networks.
- Iranet/IPM (Islamic Republic of Iran)
- HEAnet (Ireland)
- IUCC (Israel)
- Consortium GARR (Italy). Also INFN — Instituto Nazionale di Fisica Nucleare (Italy).
- SINET (Japan) — connected to TEIN2 and TEIN3 networks.
- UniCo/JUNet, NITC (Jordan) — connected to EUMEDCONNECT2.

- KazRENA (Kazakhstan) — connected to CAREN.
- KOREN and KREONET (Republic of Korea) — connected to TEIN2 and TEIN3 networks.
- KENET (Kenya)
- KRENA-AKNET (Kyrgyzstan) — connected to CAREN.
- LERNET (Laos PDR) to be connected to TEIN3 in 2011.
- SigmaNet (Latvia)
- CNRS (Lebanon)
- LITNET (Lithuania)
- RESTENA (Luxembourg)
- MALICO/MAREN (Malawi)
- MYREN (Malaysia) — connected to TEIN2 and TEIN3 networks.
- University of Malta CSC (Malta)
- CUDI (Mexico)
- RENAM (Moldova)
- MREN (Montenegro)
- NARWAN (Morocco) — connected to EUMEDCONNECT2.
- MoRENet (Mozambique)
- NAMREN (Namibia)
- Nepal Research and Education Network (Nepal)
- SURFnet (Netherlands)
- KIWI Advanced Research and Education Network (KAREN) and (REANNZ) New Zealand Research and Education Network (New Zealand)
- RENIA (Nicaragua)
- NgNER (Nigeria)
- UNINETT (Norway)
- GCC and PAD12 (Palestinian Authority) — connected to EUMEDCONNECT2.
- PERN (Pakistan)
- RedCyT (Panama)
- PNGARNet (Papua New Guinea)
- Arandu (Paraguay)
- RAAP (Peru)
- PREGINET (Philippines) — connected to TEIN2 and TEIN3 networks.
- PIONIER (PCSS) (Poland — currently GÉANT+ service only).
- FCCN (Portugal)
- Qatar Foundation (Qatar)
- RNC / RoEduNet (Romania)
- RUNNet/RBNet — Russian University Network — and FREEnet (Russian Federation).
- RwEdNet (Rwanda)
- KAUST (Saudi Arabia)
- RENER (Senegal)
- AMRES (Serbia)
- SingAREN (Singapore) — connected to TEIN2 and TEIN3 networks.
- SANET (Slovakia)
- ARNES (Slovenia)
- TENET and SANReN (South Africa)
- RedIRIS or RED.ES (Spain)
- Lanka Education & Research Network LEARN (Sri Lanka)
- SUIN Sudanese Universities Information Network SUIN (Sudan)
- SUNET (Sweden)
- SWITCH (Switzerland)
- SHERN and HIAST (Syria) — connected to EUMEDCONNECT2.
- TWAREN and ASGC (Taiwan, China)
- TERNET (Tanzania)
- TARENA (Tajikistan) — planned to be connected to CAREN.
- MARNET (TFYR Macedonia)
- ThaiREN and Uninet (Thailand) — connected to TEIN2 and TEIN3 networks.
- TURENA (Turkmenistan) — planned to be connected to CAREN.

- RNRST (Tunisia) — connected to EUMEDCONNECT2.
- ULAKBIM (Turkey)
- RENU (Uganda)
- UARNet, URAN and UNREN (Ukraine)
- UKERNA and JANET (JANET(UK)) (United Kingdom) — connected to GÉANT2;
- United States:
    - Internet2 (UCAID) — de facto NREN of the United States
    - National LambdaRail (NLR) — United States NREN
    - CalREN — Californian NREN operated by CENIC
    - vBNS
- RAU (Uruguay)
- UzSciNet (Uzbekistan) — planned to be connected to CAREN.
- REACCIUN (Venezuela)
- VINAREN (Viet Nam) — connected to TEIN2 and TEIN3 networks.
- ZAMREN (Zambia)

Regional or NREN consortia:

- Internet2 US Research and Education Network
- Asia Pacific Advanced Network Consortium — Asia-Pacific Advanced Network
- TERENA — Trans-European Research and Education Networking Association (Association of European NRENs) — see the Terena Compendium
- DANTE — runs GÉANT2 backbone network on behalf of European NRENs
- CLARA — Cooperación Latino Americana de Redes Avanzadas (Association of Latin American NRENs) that runs the RedCLARA backbone network
- NORDUnet — Nordic backbone network

Source: ITU.

Annex 3.2: Extract from the TERENA Compendium 2009 questionnaire

Section B: SERVICES

Network & connectivity services

*In this section, please provide information about the entire network that is **managed** by your organisation, excluding links outside your national territory.*

B.1 What is the number of PoPs on your network? (A PoP is defined here as a point on the NREN backbone which can connect client networks or aggregations of client networks such as MANs, or external networks.)

B.2 What is the number of places where you undertake core networking routing?

B.3 **What is the number of managed sites on your network?** (i.e. the number of sites where youmanage routing or switching equipment)

B.4 At how many places do you offer optical PoPs?

B.5 How many of these optical POPs also provide L3 routing?

B.6 How many circuits (that carry production traffic) **do you manage?**

B.7 What is the total kilometric length of dark fibre installed on your network?

(This question replaces the previous question asking for an estimate of bandwidth*distance which NRENs have found increasingly difficult to answer.)

B.8 What is the current typical core usable backbone capacity on your network?

B.9 Please provide a list of the operational external IP connections you had at the end of January 2009 (usable links excluding backup links):

External Network IP Connections	Usable capacity (Mbit/s)
Direct to GÉANT	
Indirectly to GÉANT via the SEEREN or EUMEDCONNECT project or another NREN *(please specify each connection — adding as many lines as needed)*	
Direct to NORDUnet	
Direct to other research locations (e.g. other NRENs, CERN, Starlight, Abilene) *(please specify each connection — adding as many lines as needed)*	
Direct connections to the Commercial Internet excluding Internet Exchanges *(please specify each connection — adding as many lines as needed)*	
Peerings, connections to Internet Exchanges *(please specify each peering — adding as many lines as needed)*	
Other — Please specify type	
Total:	

Annex 3.3: Status of NRENs in Latin America, 2007

County	Name of network	Year created	Type of coordinating organization	Number of members		Characteristics of members	Whether connected to RedCLARA	
				2004	2007		2004	2007
Argentina	InnovaRed	2006	...	52	55	42 higher education institutions, 8 research organizations, 5 government agencies	Yes	Yes
Bolivia	BOLNET	1990	Public education organization (self-financed)	20	...	In process of reorganization via ADSIB	No	No
Brazil	RNP	1989	Mixed non-profit organization	369	156	100 higher education institutions, 35 research organizations, 8 development organizations, 2 hospitals, 6 governmental agencies, 6 NGOs	Yes	Yes
Colombia	RENATA	2007	Currently being organized as a private nonprofit organization	75	57	54 higher-education and research institutions, and 3 government agencies	No	Yes
Costa Rica	CR2Net	2002	Governmental organization (Ministry of Science and Technology)	...	9	5 higher education institutions, 2 research organizations and 2 government agencies	No	No
Cuba	REDUNIV	2005	Governmental organization (Ministry of Higher Education)	21	22	17 higher education institutions, 5 research organizations	No	No
Chile	REUNA	1986	Self-financing private non-profit organization	19	17	15 higher-education institutions, 1 research centre and CONICYT	Yes	Yes
Ecuador	CEDIA	2002	Governmental organization (Ministry of Education and Culture)	38	24	17 higher-education institutions, 3 research organizations, 3 gov. agencies, 1 private-sector organization	No	Yes
El Salvador	RAICES	2003	Self-financing private non-profit organization	8	9	8 higher education institutions, 1 research organization	No	Yes
Guatemala	RAGIE	...	Non-profit civic organization	...	9	7 higher education institutions, 2 private-sector organizations	No	Yes
Honduras	RHUTA	2005	...	...	...	Public and private universities, 1 private organization, 1 government agency	Not applic.	No
Mexico	CUDI	1999	Non-profit civic organization	...	80	37 higher-education institutions, 37 research organizations, 4 private organizations, 2 international organizations	Yes	Yes
Nicaragua	RENIA	2005	Non-profit civic organization	...	8	7 higher-education institutions, 1 private-sector organization, 1 NGO	Not applic.	No
Panama	REDCYT	2002	Non-profit educational organization	10	10	7 higher-education institutions, 1 research organization, 2 government agencies	Yes	Yes
Paraguay	ARANDU*	Not applicable	Non-profit educational organization	22	...	No physical network. The project is inactive.	No	No
Peru	RAAP	2003	Non-profit civic organization	...	7	5 higher-education institutions, 2 research organizations	...	Yes
Uruguay	RAU	1990	Non-profit higher education institution	16	16	4 higher-education institutions, 6 research organizations, 4 government agencies, 1 international organization, 1 private-sector organization	No	Yes
Venezuela	REACCIUN	1994	Non-profit civic organization (Ministry of Science and Technology)	73	67	34 higher-education institutions, 2 research organizations, 7 academic institutions, 5 foundations, 19 government agencies	Yes	Yes

Note: *Data as of July 2003. "...": data/information not available.
Source: OSILAC (2007).

Target 4: Connect public libraries, cultural centres, museums, post offices and archives with ICTs[1]

Introduction

Target 4 deals with highly knowledge- and information-intensive institutions, such as libraries, museums and archives. Therefore, it fits neatly into the overall WSIS objective, namely: "*to build an inclusive information society; to put the potential of knowledge and ICTs at the service of development; to promote the use of information and knowledge for the achievement of internationally agreed development goals*."[2]

However, the target encompasses several "subtargets," covering aspects related to both access (institutions providing access to the Internet) and content (institutions with websites, providing access to information, and contributing to the preservation of cultural heritage). Because of this dual aspect of providing Internet access and generating content online, it is especially relevant for the following WSIS action lines:

- Action Line C2 (Information and communication infrastructure), specifically:
  c) In the context of national e-strategies, provide and improve ICT connectivity for all schools, universities, health institutions, libraries, post offices, community centres, museums and other institutions accessible to the public, in line with the indicative targets.[3]

- Action Line C3 (Access to information and knowledge), specifically:
  h) Support the creation and development of a digital public library and archive services, adapted to the information society, including reviewing national library strategies and legislation, developing a global understanding of the need for "hybrid libraries," and fostering worldwide cooperation between libraries.
  i) Encourage initiatives to facilitate access, including free and affordable access to open access journals and books, and open archives for scientific information.[4]

- Action Line C8 (Cultural diversity and identity, linguistic diversity and local content), specifically:
  b) Develop national policies and laws to ensure that libraries, archives, museums and other cultural institutions can play their full role of content — including traditional knowledge — providers in the information society, more particularly by providing continued access to recorded information.
  c) Support efforts to develop and use ICTs for the preservation of natural and cultural heritage, keeping it accessible as a living part of today's culture. This includes developing systems for ensuring continued access to archived digital information and multimedia content in digital repositories, and support archives, cultural collections and libraries as the memory of humankind.
  e) Support local content development, translation and adaptation, digital archives, and diverse forms of digital and traditional media by local authorities. These activities can also strengthen local and indigenous communities.[5]

It is also related to Target 1 insofar as some of the institutions concerned, notably libraries, cultural centres and post offices, can also serve to provide public Internet access; and to Target 9, as they contribute to promoting the development of online (local) content in local languages.

Last but not least, Action line C4 (Capacity building) is an important enabler in this context, especially in regard to the need for training programmes for the use of ICTs by information professionals, who will include archivists, librarians, museum professionals and postal workers.[6]

Even though the institutions covered by these subtargets have some points in common in that they all tend to provide highly information- and knowledge-intensive services, they are also quite different in other ways, in terms of the specific purpose they serve and the role they can play in contributing to providing Internet access or online content. Therefore, this chapter will deal with each of the five subtargets separately, proposing indicators and monitoring and evaluating each subtarget individually, before wrapping up with an overall conclusion.

Public libraries

The information society is about "information," so it is logical that traditional repositories of tangible information — libraries — should be a key player. Public libraries provide a venue for the community to read and learn and, like the community access points referred to in Target 1, are ideally positioned to extend their mission by also providing Internet access for people without easy or affordable access. One study found that 78 per cent of public libraries in the United States are the sole location providing free access to computers and the Internet in their communities.[7]

This community connectivity aspect of libraries is emphasized in the WSIS Geneva Plan of Action. Libraries are specifically referenced in Action Line C2 as institutions to be provided with connectivity as part of the national e-strategy. They are also important in several ways in the context of Action Line C3. First, they are repositories of information and knowledge with their collections of books, journals and other items, so connecting libraries is therefore of direct relevance, since it facilitates access to the information and knowledge they contain. Second, they are also cited as candidates for housing community public access points. Finally, the action line specifically encourages the development of a digital public library (and archives, see later in this chapter) and online access to journals and books.[8]

Libraries around the world have rich collections of historical documents that are an important source of cultural and linguistic diversity and identity, which are thus highly relevant to Action Line C8, and strongly related to WSIS Target 9 which includes encouraging the development of local content. Libraries promote cultural diversity, linguistic diversity and local content given that their collections feature national works in the language of the country.

It is imperative for libraries to digitize and document their holdings and create websites to provide online access to this information for the global community. There are various aspects to library digitization, including digital books, the digitization of key national heritage documents and the availability of a digital or electronic card catalogue. Several initiatives to digitize libraries are described in Box 4.1.

Measuring the subtarget — Proposed indicators

According to the UNESCO Institute of Statistics (UIS), a library is an "*Organization, or part of an organization, the main aims of which are to build and maintain a collection and to facilitate the use of such information resources and*

Box 4.1: Digital libraries

There are a number of significant initiatives to improve the digital offerings of libraries and enhance their website presence. The *European Library* groups 48 national libraries across the region through an online portal (www.theeuropeanlibrary.org). Its vision is the "*provision of equal access to promote worldwide understanding of the richness and diversity of European learning and culture.*"[9] Key sections are available in the 35 languages of the participating libraries, with other pages in English, French and German. In addition to coordinating multilingual aspects, participants are also working on standardizing and integrating card catalogues.

The library includes items that have been digitized including books, journals, photographs and paintings; sound and movie files and "born digital" files that were originally created in a digital format like e-books. The quality of the site is ensured through the expertise of the professional national librarian staff.

Among the many features of the European Library is the ability to quickly identify and link to collections and exhibitions across all libraries using various search criteria. For example, one can link to a special digital exhibit at the National Library of Sweden about Dag Hammarskjöld, a Swedish diplomat and second Secretary-General of the United Nations. The multimedia exhibit features photographs, key documents such as newspaper articles and television interviews structured across key periods in his life. The National Library of Sweden is well advanced with digitization in order "*to make its collections available to citizens throughout all of Sweden via the Internet.*"[10] One example is the "Codex Gigas" (Devil's Bible), supposedly the largest (by size) surviving European manuscript. The National Library website features digitized pages of every page of the book as well as documentation about the book's history, comments about the text, a bibliography and a glossary. The Internet is the only way the public at large can see the Codex Gigas since due to its age and condition it is stored in a climate-controlled room and not available for display.

The European Commission, which has provided funding for the European Library, sees it as a flagship project for digital access to Europe's heritage, using ICTs to "*...enable you to tap into Europe's collective memory with a click of your mouse*."[11]

The *World Digital Library* (WDL) provides an example of using information technology to share the world's historical heritage in digitized format over the Internet. The concept was proposed by U.S. Librarian of Congress James H. Billington in 2006. The Library of Congress worked with UNESCO and other libraries (Bibliotheca Alexandrina, the National Library of Brazil, the National Library and Archives of Egypt, the National Library of Russia, and the Russian State Library) in a consultative process along with the International Federation of Library Associations (IFLA) and around 40 countries, in order to develop a prototype.

A WDL Experts Meeting held in 2006[12] noted problems to be overcome: "*... little cultural content was being digitized in many countries and that developing countries in particular lacked the capacity to digitize and display their cultural treasures. Existing websites often had poorly developed search and display functions. Multilingual access was not well developed. Many websites maintained by cultural institutions (including libraries) were difficult to use and, in many cases, failed to appeal to users, particularly young users.*"

Features of WDL include a user interface in seven languages and extensive information about the works. The project also worked with digitization centres in Brazil, Egypt, Iraq and Russia to convert holdings to digital format. WDL was launched in April 2009 and is available at: http://www.wdl.org.

Another initiative to digitize books is Google's "*Google Books*," launched in October 2004, which scans books and makes them available online. If a book exists in Google's database that matches a user's search query, the results are returned. If the book is not subject to copyright or the copyright has expired, the user can view the full text. Otherwise, there are links to where the user can purchase it from. Currently, some seven million[13] titles are available through Google Books.

Google has faced thorny copyright issues with its book service. One problem is knowing when the copyright has expired, since this can vary by country. Google has also been sued by publishers and authors over perceived copyright violations. However, a settlement has been reached that should make millions of additional books available online,[14] helping progress towards the quest to create "*...the digital ... library of the future, making humanity's entire body of knowledge accessible to everyone.*"[15]

facilities as are required to meet the informational, research, educational, cultural or recreational needs of its users; these are the basic requirements for a library and do not exclude any additional resources and services incidental to its main purpose."

The aims include facilitating the use of information resources to meet the needs of users. In that regard, UIS defines electronic services of libraries as: "*Electronic library services, which are either supplied from local servers or accessible via networks, include online catalogues, the library website, electronic collection, electronic document delivery (mediated), electronic reference service, user training on electronic services and Internet access offered via the library.*"

The target states the aim as being to "connect libraries." This could mean equipping libraries themselves with Internet access. However, there are two further aspects to consider. One is providing users with Internet access at libraries, as a public Internet access point (PIAP). The second would be making library content available online. Accomplishing the latter would then permit access to computerized collection catalogues, digital documents and other online library services. Thus, the following indicators are proposed:

1. Percentage of public libraries with access to the Internet, by type of access

2. Percentage of public libraries providing users with Internet access

3. Percentage of public libraries with a website.

These indicators have been used by UIS in a pilot survey on libraries for Latin America and the Caribbean.[16] Out of the 22 indicators in the survey covering various aspects of libraries (i.e. not just ICTs), the percentage of libraries providing Internet access had the highest fulfilment rate and the percentage of libraries with a website had the sixth highest. These indicators are emphasized because of their public-service orientation, but libraries equally need to computerize their own internal workings by providing staff with computers and computer training, and using ICTs to inventory and catalogue their collections. In fact, it is likely that libraries providing Internet access and having a website will have a certain level of ICT use and competencies to apply to their internal operations. It might also be useful to ascertain other details about a library's public ICT services, such as whether computers or wireless Internet access are available for library users.

There is a lack of comprehensive data coverage on the overall number of public libraries in countries, let alone the number with Internet access or websites. The International Federation of Library Associations (IFLA) and the Committee on Free Access to Information and Freedom of Expression (FAIFE) compile a biennial yearbook that contains data on the number of libraries in a country along with what proportion of libraries offer Internet access, in broad ranges.[17] The 2007 edition features data for 115 countries. Apart from the limitation of not covering all United Nations Member States, the statistical data are presented in an aggregated form. Country data can be obtained from the text of the individual country reports, but the data on Internet access availability are presented in quintiles rather than the exact percentage of libraries. There are also no data on the proportion of libraries with a website. Nevertheless, the publication is a valuable starting point for measuring public-library connectivity.

One fundamental problem with monitoring the subtarget is defining the universe of public libraries. In some countries, public libraries are centrally administered while in others the library system is decentralized. It is not clear whether surveys are capturing all of the relevant public-library units and whether branches and mobile units are being included. For example, in the UIS data for Latin America and the Caribbean, there were only 27 public libraries reported for Argentina compared to 167 for Uruguay, a much smaller country.[18]

A related issue to the uncertainty surrounding the number of public libraries is measuring the number of public libraries with a website. In some countries, there is a network of public branches that are administered by a central library. While the central library may have a website, the branches might not. Therefore, the percentage of libraries with a website can be misleading, since it might be sufficient for the main branch to be online. On the other hand,

each individual library having a website would have advantages in terms of the potential ability to offer a full suite of online services about information relevant to that particular library.

A few countries publish statistics on public-library connectivity. For example, Australia measures the number of Internet workstations per public library, the percentage of libraries with a website and the percentage with their catalogues on the web.[19] The U.S. National Centre for Education Statistics publishes a report that includes the percentage of public libraries providing access to the Internet and the number of Internet terminals in public libraries for public use per inhabitant and per library.[20]

The European Union includes the availability of electronic card catalogues in public libraries as one of the 20 policy indicators comprising its e-government indicator. The percentage of public libraries with a website could be a proxy for this indicator, because it would then be possible to access the catalogue online.

In the future it might be useful to obtain more detailed information about library ICT connectivity aspects such as the number of terminals with Internet access available or the number of users of library Internet services.[21]

Status of the subtarget

There is no comprehensive international database on global library connectivity presented in a format that adequately suits monitoring of the target. ITU carried out an ad-hoc survey in 2009 in the context of tracking the WSIS targets. It included questions on access to the Internet for public libraries, by type of access, and whether libraries had a website. The results point to large differences across countries (Table 4.1), reflecting at least in part some of the measurement challenges described above.

The number of libraries varies widely, reflecting country size and population differences, as well as difficulties related to the measurement unit mentioned above (central library, branches, etc.). Thus, the figure ranges from over 7 000 in Mexico and over 5 000 in Czech Republic and Brazil, to just 4, 3 and 2 libraries in Djibouti, Lesotho and Bhutan, respectively. Not all of these have access to the Internet, though. For example, only 32 per cent of the reported 7 283 libraries in Mexico have access to the Internet, 23 per cent with a broadband connection. There is only one library with a website. In Djibouti, three of the four libraries have access to the Internet, although each with a broadband connection, and two have a website. Overall, connectivity is high in developed countries. Furthermore, those libraries with access to the Internet tend to have broadband access. The percentage of libraries with a website can be somewhat misleading since, as mentioned above, there may be a single website covering a network of libraries and/or branches.

The IFLA/FAIFE data, though not complete in terms of coverage and with limitations in terms of data clarity, provide some indication of the recent status of the provision of public Internet access in libraries (Table 4.2). According to the data, only about a third of the respondent countries reported that at least 80 per cent of their public libraries offered Internet access, whereas around 40 per cent of the respondent countries reported that less than 20 per cent of their public libraries offered Internet access. No region reported that at least 80 per cent of all public libraries provided Internet access. The lowest numbers reported were for Africa, where 71 per cent of the respondent countries reported that less than 20 per cent of public libraries offered Internet access.

The UIS survey provides fairly comprehensive coverage for the Latin America and Caribbean region (Table 4.3). The number of public libraries per 1 000 inhabitants ranges from 0.001 to 0.228. There is a wide range of library connectivity achievement in the region. It is easier to provide Internet access to only a few libraries, so most of the small island states in the Caribbean have a relatively high ratio of libraries providing Internet access. Fewer data were available for public libraries with a website. Where data are available for this indicator, the figure tends to be lower than for libraries providing Internet access. This may be due to the structural issue alluded to above, i.e. branches of main libraries where only the main branch has a website. Even though some of the connectivity rates are fairly low, there are a number of initiatives in place in all parts of the world to connect libraries (Box 4.2).

Table 4.1: Public libraries with access to the Internet, by type of access, and with a website, by country, 2009*

Country	Number of public libraries	Number of public libraries with access to the Internet (any type of connection)	% of public libraries with access to the Internet (any type of connection)	Number of public libraries with access to the Internet (broadband only)	% of public libraries with access to the Internet (broadband only)	Number of public libraries with a website	% of public libraries with a website
Albania	50	20	40	20	40	3	6
Andorra	9	8	89	8	89	9	100
Bhutan	2	2	100	...	...	1	50
Bolivia	2134	40	2	4	0	20	1
Bosnia and Herzegovina	790	340	43	201	25	157	20
Botswana	27	4	15	4	15	...	...
Brazil	5232	...	...	...	...	...	...
Brunei	9	...	...	...	...	1	11
Bulgaria	47	47	100	...	...	...	...
Croatia	202	194	96	...	...	197	98
Czech Republic	5438	...	...	...	...	1637	30
Denmark	97	97	100	97	100	97	100
Djibouti	4	3	75	3	75	2	50
Egypt	2256	676	30	...	...	...	...
Finland	1660	1660	100	...	...	...	...
Haiti	195	...	...	...	...	...	...
Hungary	2073	1521	73	1391	67	601	29
Iraq	470	...	...	...	...	...	...
Korea (Rep.)	626	626	100	626	100	...	...
Latvia	874	874	100	874	100	...	...
Lesotho	3	3	100	1	33	0	0
Lithuania	1347	1021	76	598	44	144	11
Malta	56	8	14	2	4	...	...
Mexico	7283	2335	32	1650	23	1	0.01
New Zealand	317	...	...	...	...	...	...
Paraguay	37	5	14	5	14	3	8
Singapore	22	22	100	22	100	22	100
St. Lucia	18	12	67	12	67	0	0
St. Vincent and the Grenadines	23	10	43	10	43	1	4
Sweden	1286	1286	100	...	...	290	23
Thailand	1393	...	...	...	...	...	...
Turkey	1150	673	59	673	59	33	3
United Kingdom	3500	3500	100	3500	100	...	...

Note: *Or latest available year. "...": data not available.
Source: ITU Survey on the WSIS Targets.

Table 4.2: Percentage of public libraries offering Internet access, by region, 2007

	Africa		Asia		Europe		Latin America & Caribbean		North America		Oceania		Total	
	Coun-tries	%	Coun-tries	%	Coun-tries	%	Coun-tries	%	Coun-tries	%	Coun-tries	%	Coun-tries	%
81-100%	2	7.1	4	20	16	47.1	6	27.3	2	66.7	4	50	34	29.6
61-80%	1	3.6	1	5	3	8.8	4	18.2	0	0	0	0	9	7.8
41-60%	2	7.1	4	20	8	23.5	1	4.5	0	0	1	12.5	16	13.9
21-40%	3	10.7	3	15	1	2.9	3	13.6	1	33.3	0	0	11	9.6
≤20%	20	71.4	8	40	6	17.6	8	36.4	0	0	3	37.5	45	39.1
Total	**28**	**100**	**20**	**100**	**34**	**100**	**22**	**100**	**3**	**100**	**8**	**100**	**115**	**100**

Note: % refers to the percentage of countries responding. For example, in two African countries, between 81 and 100 per cent of public libraries offer Internet access. These two countries make up 7.1 per cent of the African countries that replied to the survey.
Source: IFLA/FAIFE.

Table 4.3: Percentage of public libraries with Internet access for users, and websites, 2006 or latest, Latin America and the Caribbean

Country	Number of public libraries	% of public libraries offering Internet access to users	% of public libraries with websites
Antigua and Barbuda	1	100	100
Argentina	27	51.9	51.9
Bahamas	32	81.3	9.4
Brazil	4 801	9.3	...
British Virgin Islands	5	40	20
Chile	428	2.3	1.4
Colombia	1 595	15.2	2
Costa Rica	57	66.7	...
Dominica	4	50	...
Dominican Republic	398	...	...
El Salvador	16	25	...
Guyana	21	28.6	4.8
Honduras	116	6.9	...
Jamaica	615	14.8	14.8
Mexico	7 210	37.1	...
Montserrat	1	100	...
Netherlands Antilles	1	100	100
Peru	826	...	...
St. Kitts and Nevis	3	100	...
St. Lucia	18	...	...
St. Vincent & the Grenadines	20	...	5
Suriname	7	14.3	...
Trinidad and Tobago	23	100	8.7
Uruguay	167	19.2	...
Venezuela	728	100	0.1
Percentage of each indicator availability for all countries	100%	84%	48%

Note: "...": data not available.
Source: UNESCO Institute of Statistics.

Box 4.2: Examples of initiatives to connect libraries

A number of countries have made progress in connecting their public libraries with ICTs. Some examples are discussed below, including the United States, which has used universal service funds to extend connectivity to public libraries; Venezuela, where public libraries are an important element of the country's public Internet access programme; Singapore, which has implemented information technology in libraries through a series of plans; and Trinidad and Tobago, where public libraries are an important location for extending Internet access to the community. Philanthropy organizations may also play a role in providing Internet access for public libraries.

The 2006 Telecommunications Act in the ***United States*** created a provision for schools and libraries to benefit from reduced service charges for Internet access, financed with subsidies from the country's universal service fund (all licensed telecommunication operators contribute a portion of their revenue to the fund). The discount, referred to as the "e-rate," has made Internet access more affordable for public libraries, and the proportion of libraries with Internet access has risen from 28 per cent in 1996 to over 95 per cent today.[22]

Venezuela is the only country in Latin America with all of its public libraries providing Internet access to library users. This was achieved as part of the country's "*Infocentro*" project launched in 2000 for creating public Internet access centres.[23] Libraries are a logical place in which to provide access, since they are already public places and in Venezuela they are spread throughout the country, with at least one in each state. The National Library of Venezuela has a website and a digital collection of Venezuela's historical documents, as well as an online card catalogue.[24] It also participates in regional digital library initiatives.[25]

Information technology has played a key role in transforming ***Singapore***'s public libraries from "*mediocre at best to world class*."[26] The transformation began with the establishment of the National Library Board (NLB) in 1995 to implement the nation's *Library 2000* plan.[27] From 1998, broadband was rolled out to the two dozen public libraries, and all of the libraries have Wi-Fi Internet access for users with their own laptops. In 2007, there were 38 million physical library visits, 7 million logins to the NLB website and 72 million electronic retrievals.[28]

The public-library system in ***Trinidad and Tobago*** is recognized as one of the best in the Caribbean. The libraries are administered by the National Library and Information System Authority (NALIS).[29] As of 2007, all 24 public libraries provided Internet access through 250 computers [Watson and Ramlal, 2007]. Some 17 000 people a month use the Internet facilities, where they can log on for one hour a day free of charge. A number of libraries also have Wi-Fi Internet access. The libraries' websites provide an array of digital content, including exhibitions that have been held at NALIS; card catalogues showing, among other things, how many copies of a book exist, in which branch they are located and whether they are checked out or not; and digital versions of important historical collections and newspaper clippings.

The Bill and Melinda Gates Foundation has been active in supporting Internet access in U.S. public libraries. It has expanded this activity overseas through the *Global Library Initiative*.[30] The Foundation has granted over USD 200 million to libraries in ten countries (Chile, Mexico, Latvia, Lithuania, Romania, Viet Nam, Poland, Botswana, Bulgaria and Ukraine) to provide computers and Internet access.[31] In 2006, the *Public Library Development Project* in Latvia received a grant of USD 16 million from the Foundation, along with USD 21 million from the Latvian government and USD 8 million from Microsoft to equip all 874 Latvian public libraries with broadband Internet connections, provide Wi-Fi access and furnish around three computers per library.[32]

Cultural centres

The concept of a "*cultural centre*" is not well defined, and even the Geneva Plan of Action does not specify what is meant by the term. It is used only in the wording of the target itself.[33] The Plan of Action does refer to "*cultural institutions*," which can be assumed to include cultural centres, under Action Line C8.[34]

Depending on the definition adopted, there could be a public Internet access consideration, as cultural centres are typically places where the public gathers,[35] as well as a cultural heritage and local content aspect. Cultural centres

could include places for arts, educational and recreational activities, exhibitions, shows, social gatherings and so forth (see below for definitions provided by countries). The subtarget would then be in line with Action lines C2, C3 and C8, in particular through promoting the diversity and preservation of cultural heritage. As such, it is also strongly linked to WSIS Targets 1 and 9.

Measuring the subtarget — Proposed indicators

Given the dual aspect of public Internet access and local (cultural heritage) content, indicators that could be relevant in the context of this subtarget include:

1. Percentage of cultural centres with access to the Internet, by type of access

2. Percentage of cultural centres with a website

3. Percentage of cultural centres providing public Internet access.

The first indicator deals with Internet access, and could constitute a first indication of the use of ICTs in cultural centres, in this case as a first step, or basic indicator, towards providing Internet access to users and visitors of the centre. The second indicator focuses on providing online content, looking at whether or not the cultural centre has a website, a prerequisite for providing online information and access to content. The third indicator deals with public Internet access, which could also be monitored under Target 1.

However, there is currently no organization or institution that collects data to construct such indicators, and as cultural centres are not defined, and are extremely diverse (related to culture, arts, sports and other recreational activities, health, religion, etc.), it is extremely difficult to track this target at the international level.

Status of the subtarget

ITU carried out an ad-hoc survey in 2009 in the context of monitoring the WSIS targets. It included questions on Internet access in cultural centres, including by type of access. The results point to large differences in connectivity, and highlight the difficulties in measuring this subtarget. Indeed, the absence of a clear definition of the term "cultural centre" makes it difficult to collect data. Several countries have reported statistics on the number of cultural centres, though this may vary with the size of the country and its population, and the definitions provided highlight not only the problem of circumscribing the concept, but also the diverse interpretations across countries.

The responses to the first question on the number of cultural centres already indicate differences across countries, both in the number and the definition (if provided). Some countries reported very large numbers of cultural centres, such as:

- ***Bulgaria***: 2 895.

- ***Egypt***: 969 — distinguishing between a culture palace, which is a multi-activity complex aiming to upgrade the cultural awareness of the public in different fields and located in the capital and major cities, and a culture house, which is a culture complex that serves villages, hamlets and the smaller districts.

- ***Lithuania***: 856 (in 2008), where a cultural centre is defined as a legal institution whose aim is to foster ethnic culture, promote amateur art, develop educational and recreational activities and meet the cultural needs of the community.

- ***Latvia***: 534 (in 2008), where a cultural centre is defined as a multifunctional institution whose aim it is to maintain and develop Latvian cultural diversity, to promote national and local cultural values and inheritance of traditions and to facilitate intercultural dialogue and cooperation and help establish an environment that encourages creation, social participation and lifelong education.

- ***Korea***: 390, where the term (public) cultural centre may refer to a "cultural and arts centre" or a "local cultural centre." The term "cultural and arts centre" refers to a cultural complex with a main auditorium established by

the central or local government. The term "local cultural centre" refers to a public corporation established to carry out local cultural programmes for local culture promotion.[36]

At the other extreme, Nauru reported zero cultural centres, but did provide a definition (an organization, building or complex that promotes Nauruan culture and arts). A single cultural centre was reported by Botswana, Brunei (an attraction centre for ecotourism showcasing Malay culture and tradition), Lesotho, Mexico (where a cultural centre is defined as a site or group of art spaces developed for entertainment and conducting exhibitions, shows, social gatherings and reading practice, and designed to hold activities to promote culture among its inhabitants that supports education and updating knowledge) and St Lucia (where a cultural centre is defined as an institution for presenting and developing cultural arts and a venue for the stimulation of national pride).

Remaining responses were provided by Djibouti (three — where a cultural centre is defined as a place for shows, conferences, exhibitions and socio-cultural animations), Andorra (eight), Bhutan (21, including Dzongs which are centres where traditional cultures are preserved), Paraguay (60), Bolivia (71) and Singapore (91 — including performing arts centres, i.e. black boxes, prosceniums, theatres, multipurpose halls, auditoriums and concert halls; and visual arts exhibition halls, i.e. exhibition halls, public galleries (excluding commercial galleries), dedicated art museums and mega-trade exposition halls).

Among the countries that responded to the ITU questionnaire, few provided information on access to the Internet for cultural centres (Table 4.4).[37] The available information again points to substantial differences among countries. All of Korea's 390 and Singapore's 91 cultural centres have broadband Internet access. In Egypt, 60 per cent of the 969 cultural centres have broadband Internet access. In Hungary, 70 per cent of the 3 487 cultural centres have Internet access, but only 29 per cent have broadband Internet access.

These data are insufficient for measuring or monitoring the subtarget in a comprehensive manner, and for evaluating progress or the likelihood of achieving the subtarget by 2015. Nonetheless, there are initiatives in countries to promote the connectivity of cultural centres (Box 4.3), suggesting that at least some progress has been made.

Table 4.4: Cultural centres with Internet access, by country, by type of access, 2009*

Country	Number of cultural centres	Number of cultural centres with access to the Internet (any type of connection)	% of cultural centres with access to the Internet (any type of connection)	Number of cultural centres with access to the Internet (broadband only)	% of cultural centres with access to the Internet (broadband only)
Brunei	1	0	0	0	0
Djibouti	3	3	100	3	100
Egypt	969	586	60	586	60
Hungary	3 487	2 451	70	1 023	29
Korea (Rep.)	390	390	100	390	100
Latvia	534	103	19	...	...
Mexico	1	1	100	1	100
Paraguay	60	9	15	...	...
Singapore	91	91	100	91	100
St. Lucia	1	1	100	1	100

Note: * Or most recent available. "...": data not available.
Source: ITU Survey on the WSIS Targets.

Box 4.3: Examples of initiatives to connect cultural centres

In Kharkov, ***Ukraine***, the computer laboratory in the Israeli Cultural Centre (ICC) was opened on 12 January 2001. It offers PCs, server, printers and other office equipment. The main audience of the centre includes the participants in ICC programmes, both adults and children. The centre offers various computer qualification courses, and the computer lab is also home to the ICC's Publishing Group which developed the centre's website and the newspaper "*Our news*" ("*Nashi novosti*").[38]

The *Communication Cultural Centre* in Banda Aceh, the capital of Aceh province (***Indonesia***) focuses on providing ICT training. The centre was established by the UNESCO Jakarta office, under the project funded by United Nations Office of Coordination for Humanitarian Affairs (UN-OCHA). A Jakarta-based NGO, *Nurul Fikri Foundation*, is the implementing partner in the project. The centre became operational late June 2006 and is used by the communities to access and exchange information and to preserve and develop Acehnese culture.

The centre provides an FM radio station (producing and broadcasting a variety of news, current affairs and music programmes, as well as talk shows and other interactive programmes), a place for art and culture activities, and an Internet café equipped with 10 computers, printer and scanner, offering free Internet access and ICT training courses. So far, participants in these training courses have come from diverse backgrounds, including Nasyid's singers (a group of singers who sing religious songs), journalists, writers and Acehnese traditional dancers.[39]

Connecting cultural centres can be useful in preserving cultural heritage. For example, in ***Western Australia*** as part of the "*Saving traditions*" project, between 1980 and 2003 a small group of the indigenous Ngalia people generated a lot of cultural research material, including a full Ngalia language dictionary and thesaurus, digital song archives, complex databases of genealogy records, and maps of culturally significant resources — using GPS receivers to plot locations such as waterholes, rock formations and rivers. In 2006, the Ngalia community expanded their work to a youth participatory video project, in order to build on the interest shown by young people in using ICTs. The video project yielded many positive outcomes, including young people using traditional language, referring to plants of cultural significance and explaining their traditional uses. A second video, filmed and edited entirely by four Ngalia boys, further raised interest in the cultural history and provided a marketable product for the community. The Ngalia have continued to take advantage of new technologies to improve their communication facilities, notably by connecting the community cultural centre to a wireless network in 2007. Furthermore, an advocacy-related group around the Ngalia movement — the "*Indigenous Land Justice: Ngalia Foundation Appeal*" — was created using Facebook.[40]

Connecting cultural centres can also be driven by public-access considerations, as shown in an example from ***Egypt***, where the Ministry of Communication and Information Technology (MCIT) supports the creation of IT clubs in hosting organizations, including community centres. As the early pilot projects (in 1997) had limited reach (mainly children under 15 and local professionals), the ministry subsequently launched the *IT Club* initiative, designed to promote awareness and provide affordable access to ICTs for all Egyptian citizens, including those in underprivileged areas and those with little or no prior experience of ICTs. At least 40 per cent of the IT clubs have been established in youth centres, sports clubs, cultural centres, schools, mosques, churches and NGOs in every governorate. MCIT selects and supports hosting organizations, notably by providing the necessary equipment (computers, printers, LAN, Internet access, server, etc.) on the basis of a three-year lease. If the IT club is successful, it retains ownership of the equipment on lease maturity. Private-sector partners provide space, infrastructure, utilities, furniture and security.[41]

Museums

Providing museums with information and communication technology is essential for digitization and electronic dissemination of the world's cultural heritage. WSIS highlights the importance of connectivity for museums in the Geneva Plan of Action, emphasizing that museums must "... *play their full role of content … providers in the information society*...."[42] Putting museum collections online extends their reach to a much broader audience than those that can physically visit the museum.

Another reason for connecting museums is to improve the linkages between content and context. Many museums and museum pieces are already on the Internet, whether voluntarily or not, through tourist blogs, travel agencies or photos of the collection posted on social networking sites.[43] In most cases there is only a superficial, if any, explanation of the work, and the unofficial depiction of museum pieces is often unprofessional. Only museums posses the curatorial skills required for documenting and providing professional insights into the significance of the pieces in their collection.

Action Line C2 recommends that providing connectivity to museums be included in countries' national e-strategies.[44] Action Line C4, relating to capacity building, is also important in this context, especially the following provision: "*Design specific training programmes in the use of ICTs in order to meet the educational needs of information professionals, such as archivists, librarians, museum professionals, scientists, teachers, journalists, postal workers and other relevant professional groups. Training of information professionals should focus not only on new methods and techniques for the development and provision of information and communication services, but also on relevant management skills to ensure the best use of technologies. Training of teachers should focus on the technical aspects of ICTs, on development of content, and on the potential possibilities and challenges of ICTs.*"[45] Action Line C8 is also again relevant, advocating that countries "*Develop national policies and laws to ensure that libraries, archives, museums and other cultural institutions can play their full role of content — including traditional knowledge — providers in the information society, more particularly by providing continued access to recorded information*,"[46] thus linking this target also to Target 9.

Measuring the subtarget — Proposed indicators

The International Council of Museums (ICOM) defines a museum as: "*… a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment*."[47] The interpretation of including "connect" in the target is that museums should have Internet access. The benefits of online access to a museum's resources are highlighted by statistics from the Smithsonian Museums in the United States, which were visited by some 25.2 million people in 2008, eight times less than the 172.8 million who visited its websites.[48]

In addition to the percentage of museums with access to the Internet, by type of access, the proportion of museums with a website could be a useful indicator towards measuring the online content availability of museums. Having said that, the information featured on museum websites varies greatly, from just the address and opening hours to interactive features showing museum collections.

Thus, the two indicators proposed to measure this subtarget are:

1. Percentage of museums with access to the Internet, by type of access

2. Percentage of museums with a website

It could also be useful to expand on the basic indicator on the percentage of museums with a website to include demand-side indicators that reflect how often and in what way the websites are being used. A number of museums publish statistics on the number of hits their websites receive each year. The Prado in Spain surveys visitors to find out their impressions of the museum's website. Some 18 per cent of visitors consulted the museum's website prior to their visit. The Musée d'Orsay tracks the percentage of website visitors by language. Mexico asks visitors how they found about the museum, with the Internet being one of the choices. Australia publishes data on the percentage of pieces in museum's collections that are accessible online.

Status of the subtarget

A major weakness of museum statistics is that there is no official source for recent data on the number of museums broken down by country.[49] One problem is the lack of a satisfactory framework for cultural data within national statistical systems, as pointed out by the European Commission: "*The field of culture defined in this way does not equate to any particular economic sector and therefore is not covered by sectoral surveys. It includes activities in numerous areas of social and economic life, which are not always identifiable in economic classifications. As a result, statistics are missing for a number of activities which cannot be singled out and examined from national and European surveys or data collections*" [Eurostat, 2007].

Table 4.5: Museums with access to the Internet by type of connection, and with a website, selected countries, 2009*

Country	Number of museums	Number of museums with Internet access (any type of connection)	% of museums with Internet access (any type of connection)	Number of museums with Internet access (broadband only)	% of museums with Internet access (broadband only)	Number of museums with a website	% of museums with a website
Albania	28	27	96	18	64	12	43
Andorra	19	...	...	...	...	4	21
Bhutan	4	4	100	...	...	2	50
Bolivia	68	...	...	...	...	...	...
Bosnia and Herzegovina	26	16	62	12	46	13	50
Botswana	7	1	14	1	14	1	14
Brazil	2618	...	...	...	...	...	...
Brunei	1	...	...	...	...	1	100
Bulgaria	222	154	69	...	...	85	38
Croatia	225	191	85	...	...	140	62
Czech Republic	491	...	...	...	...	351	71
Denmark	124	124	100	124	100	123	99
Egypt	104	20	19	20	19	...	...
Hungary	671	279	42	227	34	230	34
Iraq	16	...	...	...	...	...	...
Korea (Rep.)	310	310	100	310	100	...	...
Latvia	128	115	90	...	...	45	35
Lesotho	1	...	...	...	...	...	0
Lithuania	106	106	100	7	7	67	63
Malta	33	19	58	19	58	23	70
Mexico	135	...	...	...	...	...	...
Singapore	8	8	100	8	100	8	100
St. Vincent and the Grenadines	1	1	100	1	100	0	0
Sweden	205	205	100	...	...	205	100
Thailand	1123	...	...	...	...	...	...
Turkey	188	188	100	188	100	10	5

Note: * Or latest available year. "...": data not available.
Source: ITU Survey on the WSIS Targets.

ITU included questions on the connectivity of museums in its 2009 ad-hoc survey carried out in the context of monitoring the WSIS targets. The results point to substantial differences across countries in the number of museums, their connectivity and the percentage of museums with a website (Table 4.5). The reported number of museums ranges from over 2 000 in Brazil and over 1 000 in Thailand, to a single museum in Brunei, Lesotho and St Vincent and the Grenadines. Connectivity tends to be higher in developed than in developing countries, but the percentage of museums with a website lags almost everywhere.

In spite of the point made by the European Commission above, the only region with comprehensive data for museums is Europe. The European Group on Museum Statistics (EGMUS) provides a number of statistics by country, including on the number of museums with a website (Table 4.6).[50] Data are available for 28 countries, reporting some 18 500 museums.[51] Among the countries reporting website data, 66 per cent of museums had a website.

ICOM supports an online directory of museums (the Virtual Library museums pages — VLmp).[52] Theoretically, the links could be aggregated at country level to determine the number of museums with a website. However, the directory is not

Table 4.6: Museums with a website, European countries, latest year available

Country	Year	Number of museums	Number of visits	Number of museums with a website	
				Total	%
Austria	2006	399	11 579 900	...	...
Belarus	2008	145	3 977 205	68	47
Belgium	2004	162	3 706 139	114	70
Croatia	2007	222	2 563 700	131	59
Czech Republic	2008	455	9 586 707	...	...
Denmark	2004	258	10 077 458	...	...
Estonia	2008	224	2 058 817	174	78
Finland	2006	322	4 527 830	159	49
France	2003	1 173	40 469 600	730	62
Germany	2006	6 175	102 645 078	...	...
Greece	2007	176	4 755 535	176	100
Hungary	2008	671	10 123 438	...	...
Ireland	2005	258		...	...
Italy	2007	430	34 443 085	...	...
Latvia	2007	128	2 402 581	...	...
Luxembourg	2006	39	384	20	51
Netherlands	2005	775	19 648 000	651	84
Norway	2007	173	10 193 903	...	...
Poland	2005	690	18 488 000	...	...
Portugal	2007	557	6 876 218	...	...
Romania	2007	446	3 633 443	236	53
Slovak Republic	2003	85	3 886 928	85	100
Slovenia	2006	177	2 340 558	164	93
Spain	2006	1 343	53 174 971	768	57
Sweden	2007	207	18 903 000	...	...
Switzerland	2005	948	6 696 417	622	66
TFYR Macedonia	2006	22	163	5	23
United Kingdom	1999	1 850	74 600 000	...	...
EGMUS	**...**	**18 510**	**...**	**...**	**66**

Note: See original source for detailed notes. "...": data not available.
Source: European Group on Museum Statistics (EGMUS). "Statistics." http://www.egmus.eu/index.php?id=10&L=0&STIL=0.

comprehensive, as it does not necessarily contain each museum online for every country in the world, some of the links are not functioning and some appear to be informal portals without official sanction.[53] In any case, without knowing how many museums there are in a country, such museum portals are of little use in determining the level of connectivity.

Data for other regions are also fairly limited. Among the around 1 000 museums in Africa, roughly a third are in South Africa.[54] Though connectivity is low, reflecting the overall poor level of Internet access in the region, there are exceptions. UNESCO, the International Centre for the Study of the Preservation and Restoration of Cultural Property

Table 4.7: Selected museums with a website, Africa, 2007

	Number of objects	AR*	MF **	MR ***	Computer-ized	Website
Musée historique d'Abomey, Benin	1 400	Yes	Yes	Yes	0	http://www.epa-prema.net/abomey
Musée national du Burkina Faso	About 6 000	Yes	Yes	Yes	300. Stopped	http://www.culture.gov.bf/textes/etbl_museenational.htm
Libreville, Gabon	2 400	No	No	Yes	419	http://www.numibia.net/gabon/
Robben Isld., South Africa	About 6 000	Yes	No	Yes	Very few. Stopped	http://www.robben-island.org.za/
Kisumu, Kenya	About 2 500	No	No	No		http://www.museums.or.ke/content/blogcategory/14/20/
Huila, Angola	About 3 500	No	Yes	No	No	
Sao Tomé	About 1 400	No	No	No	30	
Madagascar 1	About 1 300	No	No	Yes	Few. Word (destroyed)	
Madagascar 2	7 000	No	Yes	Yes	10%. Excel	
Musée national du Mali	About 10 000	Yes	Yes	Yes	3668	http://www.mnm-mali.org

Note: *AR=Accession Register. ** MF=Master File. *** MR=Movement Register.
Source: Adapted from UNESCO/ICCROM/EPA.

(ICCROM) and the *Ecole du Patrimoine Africain* carried out a study of selected museums in Africa [ICCROM-UNESCO, 2007]. Of the ten museums for which data were collected, six had some type of information available on the web (Table 4.7). One challenge the museums face is proper cataloguing, documentation and computerization of their collections. This is an essential prerequisite in order for the pieces to be digitized and posted on a website.

Some countries in the Americas publish data on the number of museums (Table 4.8). Several have specific sites dedicated to museum administration and information. Argentina and Canada have portals displaying the locations of museums in the country. Few countries list the number of museums with a website, but anecdo-

Table 4.8: Museums in selected countries in the Americas

	Number of museums	Year	Source	Portal
United States	4 763	2005	US Census	
Canada	2 400		Canadian Heritage	http://www.museevirtuel-virtualmuseum.ca/Search.do?mu=on&lang=en
Argentina	863	2007	Dirección Nacional de Patrimonio y Museos (DNPYM)	http://sinca.cultura.gov.ar/sic/mapacultural/mapa_cultural.php
Brazil	2 618		Sistema Brasileiro de Museus — SBM	
Mexico	1 123	2007	Consejo Nacional para la Cultura y las Artes	

Source: ITU.

tal evidence suggests that the ratio is high (e.g. portal listings and dedicated national websites for cultural heritage).

Some countries publish data on the number of museums, generally in statistical yearbooks under a culture section or through publications of cultural ministries or agencies.[55] According to the Russian Federation's official museum list, there are 2 204 museums in the country.[56] All have a description on the portal supported by the Federal Agency on Press and Mass Communications and a number of them have their own website.

Developed economies in the Asia and the Pacific region have information about the number of museums and typically have official museum portals including links to museum websites when available. For example, the Australian Bureau of Statistics publishes statistics on the ICT services of museums; it reported that of the 1 329 museums in the country at June 2004, 73.5 per cent had a website (and 11.8 per cent of the 54.9 million pieces in their collections were available for viewing online).[57] The Republic of Korea has 358 museums;[58] the National Heritage site lists all the museums with a description, and most have websites.[59] In Japan, the Statistics Bureau reports 1 196 museums;[60] the Japan Internet Museum has entries for around 500, including websites when available. All of Singapore's 50 or so museums are online with an entry portal (http://www.museums.com.sg/museums/members/). The main museums in the region's large developing nations are online. China's Statistics Bureau reported 1 722 museums in 2007, of which the biggest is the National Museum of China (http://www.chnmuseum.cn). Six of the seven museums administered by the Ministry of Culture in India have websites, including the oldest in the Asia and the Pacific region (Indian Museum, Kolkata).

There are a variety of museum-related portals for the Arab States, which give an idea of the number of museums and website availability. According to the Jordan Tourism Board, the country currently has 27 museums,[61] of which just over a fifth have websites. The Qatar Tourism Authority website lists five museums;[62] two have their own websites and information about the others can be obtained from the Qatar Museums Authority website.[63] The Association of Egyptian Travel Businesses on the Internet lists 47 museums on their website.[64] Most have a

Table 4.9: Websites of some of the world's major museums

Museum	Annual visitors	Website	Annual web visitors
Musée du Louvre, Paris, France	8 260 000 (2007)[67]	www.louvre.fr	9.86 million (2007)
Vatican Museums, Vatican City, Rome, Italy	...	http://mv.vatican.va	...
Metropolitan Museum of Art, New York	4.7 million (2008/09)	www.metmuseum.org	34.7 million (2008/09)
J Paul Getty Centre, Los Angeles, California	1.6 million (2008)	www.getty.edu/museum/	...
Musée d'Orsay, Paris, France	3 025 164 (2008)[68]	www.musee-orsay.fr	5 091 983 (2008)
Uffizi Gallery, Florence, Italy	...	www.uffizi.firenze.it	...
Art Institute of Chicago, Illinois	1 434 000 (2008)	www.artic.edu/aic/	...
Tate Modern, London, England	4 647 881 (2008/09)	www.tate.org.uk/modern/	18 494 657
Prado Museum, Madrid, Spain	2 759 029 (2008)	www.museodelprado.es	...
National Gallery of Art, Washington, DC	4.8 million (2009)	www.nga.gov	45 800 per day (2009)

Note: "...": data not available.
Source: [Metropolitan Museum of Art, 2009], [J Paul Getty Trust, 2009], [Musée d'Orsay, 2008], [Art Institute of Chicago, 2008], [Tate Modern London, 2009], [Museo del Prado, 2008], [National Gallery of Art, 2009].

Box 4.4: Virtual museum visits

Establishing a website is just the first step on a museum's digital journey. A website can provide practical information such as the history of the museum, what it contains, its location, operating hours and admission fees. The purpose of any museum is to display its collection, and there are numerous ways the Internet can enhance and extend museum holdings. The most obvious is to feature digital versions of the key pieces in the collection. Digital photography has improved in quality and prices have come down, so high-quality digital cameras are becoming increasingly affordable for many museums around the world. Some museums have photographic units that predate the digital age, which were used for documenting collections and providing photos of works for catalogues. They are now moving to the digital age. The photography unit of the Indian Museum in Kolkata digitized 7 149 objects in 2008 [India Ministry of Culture, 2009]. Providing digital versions of key holdings is just a first step, the eventual goal being to provide online access to a museum's whole collection. The Internet digitally extends a museum's exhibition space, since a website can showcase all of a collection, including works that are not normally displayed because of a lack of exhibit area or because they are on loan.

The collection can be further enriched over the Internet through extensive documentation. The Internet allows far more information to be provided in respect of a piece than can be offered on a physical visit, plus the ability to link it to related things. The Smithsonian Institute in the United States, which houses 137 million objects in its collection, envisions not only displaying Isaac Singer's original sewing machine online but also linking it to a video showing how it works.[69]

Some museums offer virtual tours on their website. The Louvre in Paris allows the viewer to pan and scroll Leonardo da Vinci's masterpiece "Mona Lisa," but without the crowds, and to tie in to events such as the film "The Da Vinci Code."[70] In addition to virtual tours, users can download podcasts from some museums to listen to when they visit the museum. The Metropolitan Museum in New York launched podcasts in 2005, and some 330 000 were downloaded in its 2009 fiscal year [Metropolitan Museum of Art, 2009]. Dozens of museums now offer podcasts through the Apple iTunes store.

Other extras that museums are adding to their websites include e-commerce capabilities, so that users can purchase advance tickets online or order guides, catalogues and souvenirs from the museum's shop. Multilingualism of the website is also important. Paris's Musée d'Orsay notes that 60 per cent of its website visitors used the French version in 2008, as against 25 per cent for English and 6 per cent each for Italian and Spanish [Musée d'Orsay, 2008].

The flurry of activity surrounding museum website development is illustrated by growing international exchanges, assistance and conferences. Archives & Museum Informatics has been holding the annual "Museums and the Web" international conference since 1997[71] and also organizes the annual "Best of the Web" awards, which recognize the top museums in a number of website categories.[72]

descriptive page on the association's website. Collections of some of them are included in the Eternal Egypt website,[66] a collaboration of the Supreme Council of Antiquities, the Centre for Documentation of Cultural and Natural Heritage and IBM Corporation.

Though complete statistics on the extent of museum connectivity around the world are not available, a number of countries have made impressive progress. In addition to the availability of online information about museums, some countries have created portals linking and geo-tagging their museums. For example, Greece, which reports that all of its museums are online, adds functionality through a "cultural map" that displays the locations of all museums and allows users to select specific types of museums and see their location on the map.

The world's major museums all have advanced websites, often in different languages, and in addition to reporting the number of physical visitors some also report the number of online visitors they receive (Table 4.9).[66]

While they often lack the sophistication of the world's largest museums, a growing number of museums in developing countries have established a web presence. For example, the National Museums of Kenya portal features descriptions of the 18 museums comprising the system (http://www.museums.or.ke). The Fiji Museum, which dates back to

the early 1900s, has a wealth of information on its website (http://www.fijimuseum.org.fj), including pictures of its collections, links to its gift shop and a publications listing.

There are ongoing initiatives to improve the connectivity of museums and the online accessibility of collections (Box 4.4).

Post offices

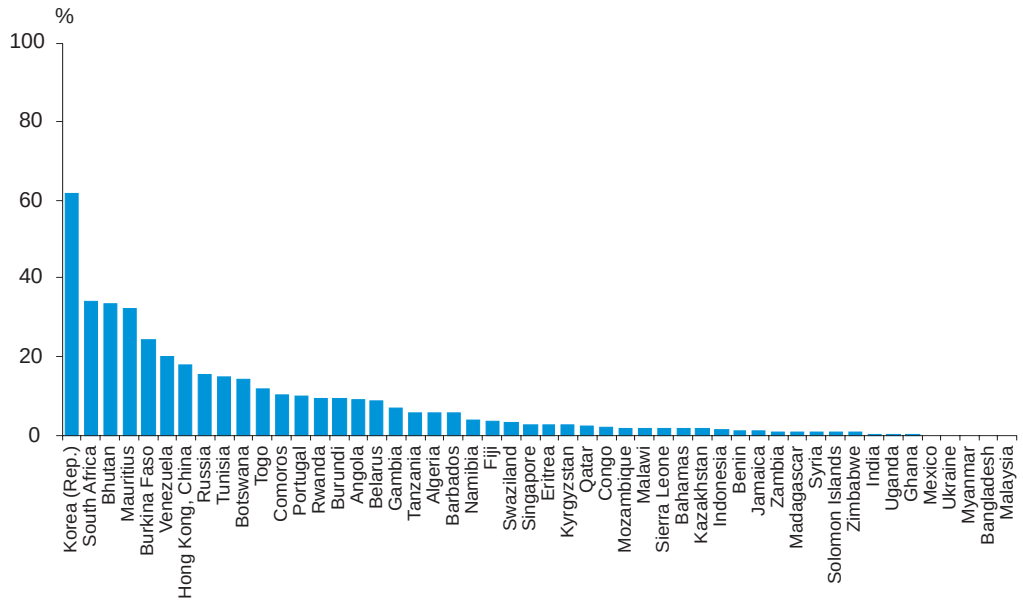
In view of the vast network of post offices worldwide, connecting post offices can have a potentially big impact on making ICTs available to a wider population who may not otherwise be connected, especially in developing countries. Access is of course one of the main considerations of this subtarget, but this could also be tracked under Target 1; indeed, many policies on connecting post offices specifically mention the intent to use them as public Internet access points (Box 4.5). The subtarget fits in with both WSIS Action Lines C2 and C3. There is potentially also some content aspect to this subtarget, when post offices offer online services, which are useful not only for individuals but also for businesses. In some cases, post offices are used to complement other ICT-related initiatives. For example, in Sri Lanka, the "Mobile ATM" programme uses mobile phones to confirm cash requests from users, who subsequently receive their cash from a travelling agent, or though a post office. Verification of credentials can be done by bank officers as well as post-office agents.[73] Overall, connecting post offices could significantly expand access to ICTs in previously unconnected areas which are nonetheless served by a post office.

Measuring the subtarget — Proposed indicators

The two indicators proposed to measure this subtarget are:

1. Percentage of post offices with access to the Internet, by type of access
2. Percentage of post office offering public Internet access (PIA)

Chart 4.1: Proportion of post offices* providing public Internet access, selected countries, 2008



Note: *Data include both permanent and mobile post offices.
Source: ITU based on UPU data.

The Universal Postal Union (UPU) also collects data on whether certain types of online services are offered in a country (for example, Internet postage service, Internet bill payment, e-mail service, Internet goods-ordering service, and so on). Most of the data pertain to developing countries, where providing Internet access through post offices is relatively more important than in developed countries, since in the latter the Internet can be accessed more easily from multiple locations, including at home. A useful complement would be to add an urban-rural dimension to these data and indicators, as well as an indication of the number of people served by post offices offering public Internet access points.

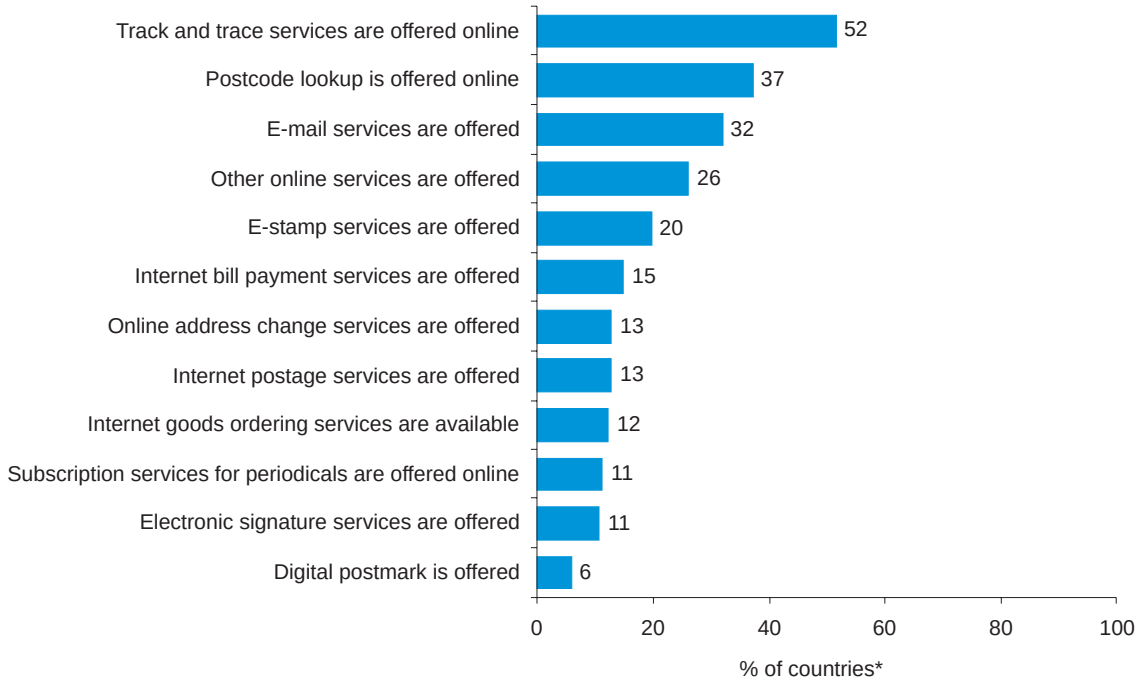
Status of the subtarget

The percentage of post offices offering PIA in 2008 was fairly low in most countries for which data are available, and in particular developing countries, where such access points would, arguably, be the most useful (Chart 4.1). Furthermore, while the number of post offices offering PIA in a country is known for quite a few countries, their location is not. Therefore, it is not possible to know whether these post offices are concentrated in the major cities and urban areas or whether they also cover rural or otherwise unconnected areas. Finally, while it is possible to calculate the average number of people to a post office in a country, it is not possible to do this for the post offices offering PIA in particular.

The percentage of post offices offering PIA exceeds 20 per cent in only five of the countries for which data are available: the Republic of Korea, South Africa, Bhutan, Mauritius and Burkina Faso; it exceeds 10 per cent in only around one-fifth of the countries; and it is less than 5 per cent in three-fifths of the countries.

UPU also collects data on the offering of online postal services. Online postal services are available in 61 per cent of the countries for which data are available, public Internet access points are offered in 37 per cent of the countries. The proportion of countries in which a given service was offered out of the total number of countries for which data

Chart 4.2: Availability of online postal services*, 2008



Note: *Percentages are based on 188 countries.
Source: ITU based on UPU data.

Box 4.5: Examples of initiatives to connect post offices

This box relates some examples of policies or initiatives to connect post offices taken from ICT policy papers. However, as "before and after" data are not available, it is not possible to assess how successful these announcements and initiatives have been.

In ***Lesotho***, establishing public Internet access points in post offices was part of the 2005 ICT Policy Paper, within a broader strategy to use the post offices and the National Library of Lesotho and other public venues to provide public Internet access throughout the country. In particular, the Ministry of Communications, Science and Technology, in conjunction with relevant stakeholders from the ICT sector and the private sector, was to ensure that all post offices include public access points for the Internet and other ICT services by 2010 [Lesotho Ministry of Communications, Science and Technology, 2005].

In ***Kenya***, the 2006 ICT Policy Paper [Communication Commission of Kenya, 2006] stated that the "*The government will also support the development, deployment and maintenance of multipurpose community, public library and post office owned public access centres*." Furthermore, the policy paper recognizes that "*the use of modern communications technology can significantly improve the speed of mail delivery and funds transfer. The government's ultimate aim is to have all post offices connected to the Internet to support electronic mail services.*" According to UPU data, close to 52 per cent of post offices in Kenya offered public Internet access in 2006. While this is already a relatively important percentage of the total number of post offices, more still could be connected. Furthermore, in 2003 the number of post offices in Kenya also fell short of the UPU guidelines, with one post office for 36 000 inhabitants in Kenya, significantly less than the one for 6 000 recommended by UPU.

In ***Mauritius***, one aim under the ICT policy for 2007-2011 [Mauritius Ministry of Information Technology and Telecommunications, 2007] is to use post offices for providing public Internet access points: "*Government will provide access to ICTs through the enhancement of existing public Internet access points (PIAPs) in post offices and the setting up of PIAPs with multipurpose functions at new locations to be accessed by the whole community.*" According to UPU data, some 32 per cent of post offices in Mauritius offered PIA in 2008, leaving plenty of scope for increasing post-office connectivity.

In ***Jamaica***, the September 2009 ICT policy statement on universal service[74] specifies that the government will "*continue to fund connectivity services and supporting infrastructure to educational institutions, libraries, post offices*" using the Universal Service Fund to "*(among other initiatives) support connectivity access, the provision of hardware, software and supporting infrastructure to schools, provision of hardware and software to libraries and post offices; support content, information literacy, educational and technical training in ICTs*." According to UPU data, only 0.9 per cent of post offices in Jamaica provided public Internet access in 2008, indicating that there is still a huge potential for improvement.

In ***Bhutan***, post offices have been revamped into ICT centres. Since 2003, a joint project by ITU, UPU and the governments of India and Bhutan has managed to connect a total of 37 post offices, and to bring the benefits of digital technologies to people in rural and remote areas across Bhutan. The project covers some very remote locations that had no telecommunication infrastructure and now enjoy VSAT-based connectivity, providing their inhabitants with various ICTs, including basic telephone and fax services and Internet access. Access to telecommunication/ICT services has had a major impact on people's lives. While it used to take postal mail five to seven days to reach certain villages, people can now send and receive messages or make phone calls instantaneously. The project also allowed people in newly connected areas to receive up-to-date information on the country's 2008 election results, and helped to modernize Bhutan Post, which was able to improve some of its working methods and encourage innovation among its staff [ITU-UPU, 2009].

were available in 2008 is given in Chart 4.2. Tracking and tracing is the most widely available service (in 52 per cent of the countries), followed by post code look-up (37 per cent), and e-mail services (32 per cent).

Even though the proportion of countries where post offices offer PIA is still fairly low, as is the proportion of countries in which online postal services are available, there are initiatives under way in developing countries to connect post offices (Box 4.5).

Archives

Connecting archives is extremely important from a content point of view, in particular in the context of the Action Lines C3 and C8. This subtarget is also closely related to Target 9 on encouraging the development of local content. As archives constitute the memory of nations and of societies, they contribute to shaping their identity and support the respect, preservation, promotion and enhancement of cultural and linguistic diversity and cultural heritage within the information society. Furthermore, "*by guaranteeing citizens" rights of access to official information and to knowledge of their history, archives are fundamental to democracy, accountability and good governance.*"[75] The objective to connect archives is important from the point of view of granting access to stored information and knowledge, as well as for digitizing content in the form of digital archives. Many countries have national archives to store important records, and some also have regional and local archives.

Measuring the subtarget — Proposed indicators

As content can be considered an important part of Target 4, and archives should guarantee citizens access to official information and knowledge, several indicators can be proposed to measure and monitor this aspect of the subtarget, in addition to the Internet access aspect:

1. Archives with access to the Internet, by type of access

2. Archives with a website

3. Percentage of content in archives that has been digitized

4. Percentage of digitized information in archives that is available online

The first two are indicative of the use of ICTs in archives, and whether or not the archives have a website — a prerequisite for providing online content. The third and fourth indicators deal directly with the information made available online — the third measures the amount of content potentially available online and which can be preserved and shared in digital formats, and the fourth measures the content actually available online.

Status of the subtarget

ITU included questions on the connectivity of archives in its 2009 ad-hoc survey carried out in the context of monitoring the WSIS targets. In collaboration with the International Council on Archives (ICA), it also collected information from ICA members[76] on the following questions:[77]

1. Does the national archive have a website?

2. What percentage of the content has been digitized?

3. What percentage of the (digitized) information is available online?

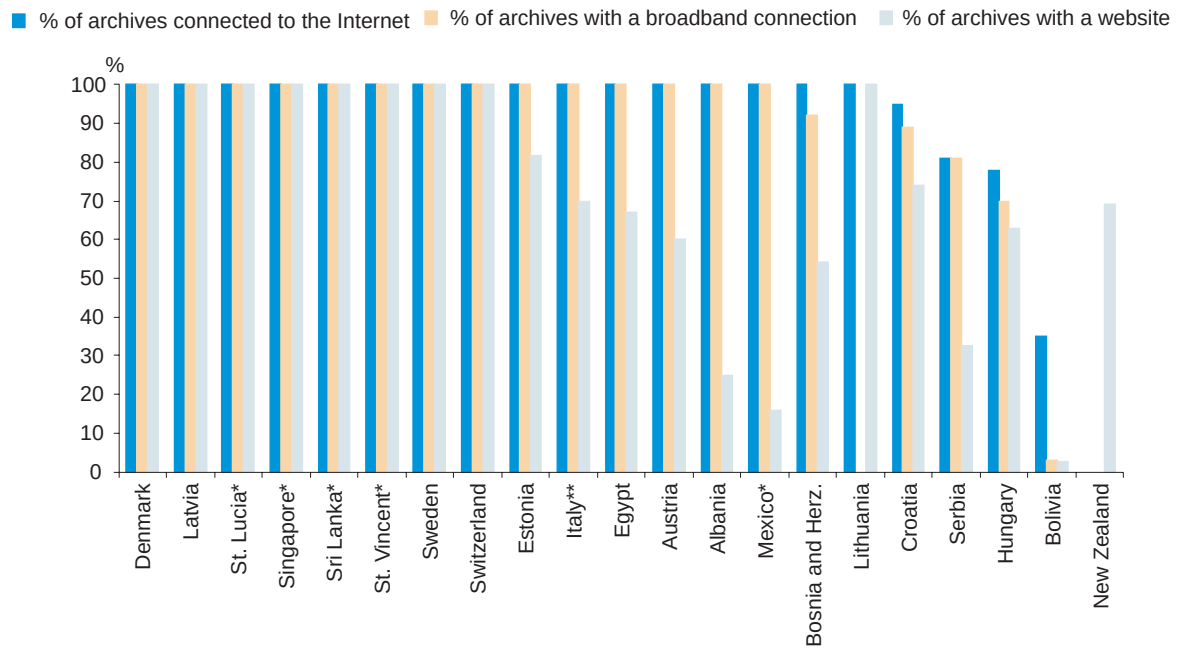
4. What is the total number of archives in the country?

5. What is the number of archives connected to the Internet?

6. What is the number of archives with a broadband Internet connection?

7. What is the number of archives with a website?

Chart 4.3: Percentage of archives with access to the Internet and with a website, by country, 2009



Notes: *Only one national archive. **Italy does not have a national archive. It has a central state archive and a network of 103 state archives.
Source: ITU Survey on the WSIS Targets.

The available information reveals large differences across countries in the numbers of archives, the percentage of archives with access to the Internet and the percentage of archives with a website (Chart 4.3). For example, some countries reported only one national archive, while others reported as many as 250 archives (Austria and Switzerland), 500 archives (Sweden) and even 2 560 archives in Mexico.[78] In most countries, archives that have access to the Internet have a broadband connection. For now, relatively fewer archives have websites, although this could be because the website of the national archive, or a central archive, covers several branches or a network of archives or branches.

Table 4.10: Digitization of archived information, 2009

	Percentage of content that has been digitized	Percentage of (digitized) information available online
Austria	5	100
Bolivia	0.6	0
Burundi	0	0
Estonia	0.8	100
Italy	<1**	50-60**
Mexico	5	24
New Zealand	1	<1*
Sri Lanka	0	0
Sweden	5	40
Switzerland	3	100

Note: * As a percentage of all content. ** In the state archives.
Source: ITU in collaboration with ICA.

Box 4.6: The importance of digital archives

The importance of keeping information has been recognized in international organizations such as the International Council on Archives (ICA), which promotes the preservation and use of archives around the world; UNESCO, which promotes archives as a part of the World Cultural Heritage; and UNHCR, which stresses the importance of archives for dealing with both the past and the present. The digital divide also affects the world of archives, and digital archiving is an important subject in the WSIS follow-up and is, indirectly, part of the WSIS targets.

Dealing with the past covers a number of areas of activity, including fact-finding missions and carrying out justice. Truth commissions and national and international tribunals play a crucial part in this regard, as do projects for the rehabilitation and compensation of victims. Archives, both public and private, are key institutions for identifying, selecting and protecting records that are important for human rights, preserving them and making them available to underpin the principle of non-impunity.

An important project in this regard is the establishment of the Slave Trade Archives, launched by UNESCO 1999 with the aim of improving access to, and safeguarding of, original documents related to the transatlantic slave trade and slavery. As part of the *Memory of the World* programme, and in close cooperation with ICA, a feasibility study was carried out to identify national archives and related institutions in African, Latin American and Caribbean countries, in order to upgrade their facilities and services. The aim is to ensure adequate preservation of original records and to obtain copies and other documents pertaining to slavery.

A famous example of preserving the World Cultural Heritage in Africa is the archive / library of Timbuktu, Mali, which contains hundreds of thousands of ancient manuscripts, mostly written in Arabic; the documents provide a detailed record of daily and intellectual life from the 12th century onward. The fragile manuscripts are digitized, translated, studied, catalogued and communicated digitally to preserve the originals.

Beside the cultural and "dealing with the past" aspects, archiving is a cornerstone of the interdependence of information management and administrative transparency. Here, the monetary advantages of digital records management and archiving are very important. According to estimates by various governments, millions of dollars are being saved annually in public administrations thanks to advice from archives, especially on digital information and records management.

A rapidly increasing number of administrations will be carrying out their business processes electronically by the end of this decade. As a result, documents and data will increasingly be created in digital form only. In addition, a large part of administrative, scientific or economic data will be stored in databases. Archives will have to set up a standardized archiving procedure, ranging from pre-archiving advisory services to document access, taking into account both the organizational and the technical dimensions. Take, for example, the case of Switzerland:

- *Electronic records management*: the Swiss government has passed a range of measures regarding uniform and standardized handling of electronic files, data and documents. The central aim is the comprehensive introduction of electronic records and process management and the ancillary step of making the electronic documents legally binding.

- *Digital archiving at the Swiss Federal Archive* (SFA) aims to reduce the volume of information, and technical complexity. It includes the following steps: selection of information; separation of data from specific IT environments (applications, operating systems, hardware); open, standardized environments that are as generic as possible; homogeneous storage infrastructure; standardization of file formats; and migration procedures.

Technical solutions for digital archiving exist, but further development and testing is necessary. In addition, digital archiving requires archivists to develop new skills. In a period when the methodologies for handling huge quantities of recorded information are gradually emerging, archivists need a solid knowledge of their own professional principles, as well as an understanding of the risks and opportunities of new approaches. All these required investments cannot be made by single institutions. How-

Box 4.6: The importance of digital archives (continued)

ever, (digital) collaboration across industries that produce source and freeware solutions is a promising way forward. Such an approach will not only reduce the digital divide, but will also enable archives to integrate new knowledge by working with ICT professionals. The challenges of the digital age, therefore, provide opportunities as well as risks. However, reliable evidence with contextually embedded information will remain an important and valuable good that guarantees societal auditability, forms an economic asset, and is indispensable for scientific research and as a basis for trust.

The 8th European Conference on Digital Archiving, 28 - 30 April 2010, Geneva

The 8th European Conference on Digital Archiving was held in Geneva from 28 to 30 April 2010. It followed in the footsteps of the European Conferences on Archives of recent decades. However, by emphasizing digital elements and archiving as a function instead of the archive as an institution, it sought to adopt a new approach. The future will be digital, but it is important also to preserve the analogue tradition: it is the responsibility of all archivists that the archive of the future be a safe place for the analogue and digital traces of the past.

See: http://www.eca2010.ch.

Not many countries responded to the digitization questions (2 and 3 above). The available information suggests digitization is still in its infancy (Table 4.10). However, there are attempts to raise awareness of the importance of digital archives (Box 4.6).

Conclusions and recommendations

Target 4 groups together five different types of institutions: libraries, cultural centres, museums, post offices and archives. Even though they are similar to the extent that they each provide highly information — and knowledge-intensive services, they are also quite different, notably in terms of the specific purpose they serve and the role they can play in contributing to providing Internet access or online content. Indeed, the objective of connecting these institutions can be twofold: providing public Internet access (notably in libraries, cultural centres and post offices), and developing local content in local languages (libraries, museums and archives). As such, this target is strongly linked to WSIS Targets 1 and 9, respectively.

Each of the subtargets is characterized by a lack of comprehensive, recent and internationally comparable data, and in most cases the absence of a harmonized definition and measurement scope. The data that are available suggest that, while some level of connectivity has been established in each of the five subtargets, much more needs to be done to ensure that all museums, libraries, archives, cultural centres and post offices are connected to the Internet by 2015. Apart from Internet access, there is also a lot to be done in terms of digitizing information, including archived information and library and museum collections, and making it available online. Even though data are even scarcer on this aspect, what material is available suggests there is still a long way to go before large shares of cultural heritage and content are digitized and available online, let alone achieving complete availability.

Overall, it is in regard to access to the Internet that the target is the most advanced in each of the five subtargets. The provision of Internet access for the public and establishing websites tend to lag behind. Furthermore, connectivity in most of these institutions is much higher in developed countries, and the potential for improvement is greatest in developing countries; yet providing public Internet access is most relevant in the latter, since in the developed world increasing proportions of people have Internet access either at home, at work or at school.

Providing public Internet access

Libraries, post offices and — depending on the definition — cultural centres are ideal locations for providing the community with public Internet access (PIA). They already have an existing infrastructure including a network of branches, and are open to the public, which means they may reach a population that is not otherwise connected and/or does not have access to other PIA locations. In addition, libraries hold a repository of information, and electronic access to information seems a logical extension of their activities.

The available evidence suggests that most public libraries are keen to enter the digital age, but a lack of funding is often the key barrier. While in developed countries most libraries tend to have access to the Internet, this is not yet the case in developing countries. Where data on libraries providing public Internet access are available, such as in Latin America and the Caribbean, they paint a mixed picture. The data for post offices show that offering PIA is not widespread in most of the countries for which data are available, including in developing countries.

Establishing, or continuing to establish, PIA in libraries and post offices, particularly in developing countries, and encouraging the provision of online information and services, is a worthwhile goal to pursue, as it has the potential to reach substantial parts of the population, including those not yet "connected." In some cases, this may require greater private-sector involvement, for example through public-private partnerships.

Providing online content

Libraries, museums and archives each have the provision of online content in common. Many libraries have a treasure of local content — from rare Buddhist texts in the National Library of Bhutan to historical documents dating back to the time of Christopher Columbus in the National Library of Trinidad and Tobago. It is essential these be digitized and made available online in order to promote cultural diversity (cf. Target 9). Similarly, putting the collections of all museums and the information held in archives worldwide on the Internet is vital for providing wider access to the world's cultural heritage. In most developed countries, these institutions are present on the Internet, although the available online information could be expanded; and some of the major institutions in developing countries also have a website, although generally with less information that can be accessed online. Therefore, one of the main challenges is to bring more institutions in developing countries online and to enrich the content of those already having a website.

Providing ICTs for libraries, museums and archives is critical for supporting the digitization of cultural heritage and making it available online to researchers and the public. Unfortunately, many developing countries lack the resources for basic museum upkeep, let alone budgets for information technology. Bandwidth is also often a constraint, in addition to Internet connection charges.

One interim solution would be for national cultural agencies to at least create an online portal listing the cultural institutions in a country, along with a brief description. In the long run, a more progressive solution is required that would allow individual institutions to build up content on their own websites.

Governments should step up efforts to provide appropriate resources to public libraries, museums and archives for them to achieve full connectivity by 2015. Although there is still some way to go, especially in developing countries, the target is attainable by 2015. Indeed, there are many initiatives under way to connect these institutions, and the cost of connecting them is relatively low, especially since there are relatively fewer of them than households or schools, thus increasing the feasibility of reaching the target. Supplementary sources of funding may include the private sector, development agencies and philanthropy organizations, which can be combined with government budgets to create partnerships for connecting these institutions and enabling them to create websites. An example of partnerships might be for libraries, museums and archives in developed countries to "adopt" an institution in a developing country.

There are also examples of private-sector involvement in bringing museum content in developing countries online. One example of a public-private partnership is IBM working with China, Egypt and Russia to develop web presences for their cultural heritage.[79] The Getty Foundation, part of the Getty Institute that also includes the museum of the same name, is working with Jordan's Department of Antiquities to develop an Arabic-English website with a geographical information system featuring the locations of important cultural heritage sites [J Paul Getty Trust, 2008].

There is also a content aspect to connecting post offices, since postal services can be offered online, although they could also be accessed from other locations. The availability of online postal services is still fairly limited, as even the most commonly offered service (online tracking and tracing) is available in only 52 per cent of countries.

It is ironic that despite complaints about lack of local content, few resources tend to be devoted to nurturing it. The Geneva Plan of Action specifically mentions the importance of supporting efforts to develop and use ICTs for the preservation of natural and cultural heritage, keeping it accessible as a living part of today's culture. This includes developing systems for ensuring continued access to archived digital information and multimedia content in digital repositories, and for supporting archives, cultural collections and libraries as the memory of humankind. National policies and laws thus need to be drawn up to ensure that libraries, archives, museums and other cultural institutions can play their full role as purveyors of content, including traditional knowledge, in the information society, more particularly by providing continued access to recorded information.

Monitoring progress towards 2015

Monitoring progress on these subtargets requires the collection of additional data. Going forward, it could be useful to separate out the two different aspects of Target 4: on the one hand, providing PIA (which could also be tracked under Target 1) and, on the other, the provision of (local) content online (which could also be tracked as part of Target 9).

Where data are available, mainly for libraries and museums, definitions should be tightened and internationally harmonized. The scope of the definitions should also be clear. In the case of libraries and archives, for example, there is room for confusion as to whether the definition refers only to the central institution or whether the scope extends to branches and networks. Data should also be collected in a timely manner for as many countries as possible, and additional information and indicators need to be collected to enhance the analytical contribution that can be obtained. In addition to countries, organizations such as IFLA, ICOM and ICA could perhaps also play a role in collecting data. Data are available for post offices through UPU, which is the dedicated organization collecting data, including on the provision of PIA.

Cultural centres are a specific case, in that data required to construct indicators for monitoring progress on this subtarget are not currently collected by any organization or institution. As a result, it is not easy to assess how useful this subtarget is. It would be helpful to have a harmonized definition of a cultural centre, as well as further guidance on whether this subtarget is driven more by public access or by content considerations.

Notes

1 Substantial inputs to the sections on libraries and museums have been provided by Michael Minges. Box 4.6 was provided by Guido Koller and Manuela Höfler of the Schweizerisches Bundesarchiv. Annick Carteret of the International Council on Archives assisted in the collection of information from ICA members.

2 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html, §4

3 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html #c2, §9

4 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c3, §10

5 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c8, §23

6 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c4, §11 k)

7 http://www.ala.org/ala/research/initiatives/plftas/index.cfm.

8 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html #c3, §10 h) and i).

9 http://www.theeuropeanlibrary.org/portal/organisation/about_us/aboutus_en.html.

10 http://www.kb.se/english/about/digitazation/.

11 http://europa.eu/rapid/pressReleasesAction.do?reference=IP/06/253&type=HTML&aged=0&language=EN&guiLanguage=en.

13 http://www.wdl.org/en/about/background.html.

13 http://books.google.com/googlebooks/agreement/.

14 http://www.google.com/intl/en/press/pressrel/20081027_booksearchagreement.html.

15 http://www.spiegel.de/international/business/0,1518,473529-2,00.html.

16 http://www.uis.unesco.org/ev.php?ID=6970_201&ID2=DO_TOPIC.

17 IFLA/FAIFE, 2007, World Report, http://archive.ifla.org/faife/report/world_report_2007.htm.

18 The discrepancy could also be caused by the definition of a public library as being primarily financed by public sources. There are around 2 000 “popular” libraries in Argentina supported by local neighbourhood associations. See: http://www.conabip.gov.ar/contenidos/institucional/que-es-conabip.asp.

19 Australian Bureau of Statistics, Public Libraries, Australia, 2003-04. (2005). http://www.abs.gov.au/AUSSTATS/abs@.nsf/Latestproducts/8561.0Main%20Features12003-04?opendocument&tabname=Summary&prodno=8561.0&issue=2003-04&num=&view=.

20 National Center for Education Statistics (U.S.). March 2005. Public Libraries in the United States: Fiscal Year 2002. http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2008301.

21 The European Union has put emphasis on the availability of electronic card catalogues in public libraries and defined a six-stage process in terms of the online functionality [European Commission, 2007].

22 Anon. E-rate and Universal Service. American Libarary Association. http://www.ala.org/ala/issuesadvocacy/telecom/erate/index.cfm. [Accessed 1 April 2010]

23 http://www.infocentro.gob.ve/.

24 http://www.bnv.gob.ve/.

25 http://www.comunidadandina.org/bda/.

26 http://harvardbusiness.org/product/transforming-singapore-s-public-libraries-abridged/an/805028-PDF-ENG.

27 http://ifla.queenslibrary.org/IV/ifla62/62-sabj.htm.

28 http://www.nlb.gov.sg:80/Corporate.portal?_nfpb=true&_pageLabel=Corporate_portal_page_aboutnlb&node=corporate%2FAbout+NLB%2FFast+Facts&corpCareerNLBParam=Fast+Facts.

29 http://www2.nalis.gov.tt/Home/tabid/37/Default.aspx.

30 http://www.gatesfoundation.org/topics/Pages/libraries.aspx.

31 http://seattletimes.nwsource.com/html/nationworld/2009108724_apusgatesfoundationlibraries.html.

32 http://www.3td.lv/index.php/en/par/apraksts/.

33 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html, § 6d).

34 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html #c8, § 23b)

35 In this case, they should also be considered under Target 1 on community access points.

36 Local Culture Promotion Act, Article 2.

37 Latvia reported that in 2005, 103 cultural centres had access to the Internet, but the total number of cultural centres was not given for that year. However, 534 cultural centres were reported in 2008.

38 See http://ort.ru/en/sng/complete-list-of-ort-schools-and-centres-in-cis/ukraine/city-kharkov/.

39 See http://portal.unesco.org/geography/en/ev.php-URL_ID=8503&URL_DO=DO_TOPIC&URL_SECTION=201.html.

40 See http://www.comminit.com/en/node/269602/307.

41 See http://www.arabdev.org/node/add/book/parent/90.

42 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html #c8, § 23b).

43 For example the Picasso Museum in Barcelona notes that over 500 unauthorized photos of its works are on Flickr, as well as over 100 videos on YouTube. http://www.slideshare.net/museupicassobarcelona/museu-picasso-le-voyage-de-web-10-web-20.

44 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html #c2.

45 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html #c4, § 11k). This action line is also important for the other subtargets insofar as specific skills, including ICT skills, are required for building up online content and digitizing collections.

46 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html #c8, § 23b).

47 http://icom.museum/hist_def_eng.html.

48 http://www.si.edu/about/.

49 While the UNESCO Institute of Statistics lists a 1999 questionnaire for museum statistics, no data on museums are available from their website.

50 http://www.egmus.eu/.

51 http://www.egmus.eu/index.php?id=10&L=0&STIL=0.

52 http://icom.museum/vlmp/.

53 Another website, MuseumLink, claims "*it will eventually contain links to every museum on the planet, from the world's largest to the most obscure (assuming they have a website).*" http://www.museumlink.com/.

54 http://www.dac.gov.za/DACinstitutions.html.

55 For example, Japan has data on the number of museums in the "Education and Culture" chapter of its Statistical Handbook [Statistics Bureau of Japan, 2007]. The Statistical Abstract of the United States has a section on "Arts, Recreation, and Travel" that includes data on the number of museums, number of employees and revenue (e.g. US Census Bureau, 2010). In Mexico, the number of museums and a breakdown by state are included in the publication "*Estadísticas básicas de la cultura en México*" [Consejo Nacional para la Cultura y las Artes, 2008].

56 http://www.russianmuseums.info.

57 http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/D4CDAABA966DC2CACA25700D00762129/$File/85600_2003-04.pdf.

58 http://www.korea.net/detail.do?guid=28252.

59 http://www.heritage.go.kr/eng/mus/nat_lis.jsp.

60 http://www.stat.go.jp/english/data/handbook/c16cont.htm#cha16_3.

61 http://www.visitjordan.com/visitjordan_cms/Museums/tabid/762/Default.aspx.

62 http://www.qatartourism.gov.qa/pillars/index/1/culture/232.

63 http://www.qma.com.qa/eng/index.php/qma/home.

64 http://www.touregypt.net/museums.htm.

65 http://www.eternalegypt.org/EternalEgyptWebsiteWeb/HomeServlet?ee_website_action_key=action.display.sites&language_id=1.

66 The list has been compiled by a travel website based on the amount of traffic it gets to different listings. See: http://www.tripadvisor.com/PressCenter-i173-c1-Press_Releases.html.

67 http://www.louvre.fr/media/repository/ressources/sources/pdf/src_document_54288_v2_m56577569831217194.pdf.

68 http://www.musee-orsay.fr/fr/collections/histoire-du-musee/quelques-chiffres.html.

69 http://www.si.edu/opa/annualrpts/2008report/Smithsonian2008.pdf.

70 http://www.louvre.fr/llv/activite/detail_parcours.jsp?CURRENT_LLV_PARCOURS%3C%3Ecnt_id=10134198673458526&CONTENT%3C%3Ecnt_id=10134198673458720&CURRENT_LLV_CHEMINEMENT%3C%3Ecnt_id=10134198673458720&FOLDER%3C%3Efolder_id=1408474395181115&bmLocale=en.

71 http://www.archimuse.com/conferences/mw.html.

72 http://conference.archimuse.com/forum/mw2009_best_web_sites_selected.

73 See http://publius.cc/dialogue_icts_human_development_growth_and_poverty_reduction/091109 and http://aitec.usp.net/Banking%20&%20Payment%20Technologies%20EA,,17-19Feb2009/MarkHeffernan_SECTECS%20%5BCompatibility%20Mode%5D.pdf.

74 See http://www.opm.gov.jm/node/1078.

75 See the International Council on Archives: http://www.ica.org/en/about.

76 Responses were received from 11 countries.

77 Questions 5, 6 and 7 were also included in the ITU Survey on the WSIS Targets.

78 The numbers for Sweden and Switzerland are estimates.

79 http://www.ibm.com/ibm/ibmgives/grant/arts/index.shtml.

References

Art Institute of Chicago (2008), Report of the Treasurer.

Communications Commission of Kenya (2006), ICT Policy Paper.

Consejo Nacional para la Cultura y las Artes (2008), Estadísticas básicas de la cultura en México.

European Commission (2007), "The User Challenge Benchmarking The Supply Of Online Public Services," report prepared by Gapgemini for European Commission Directorate for Information Society and Media, 7th Measurement, September 2007.

Eurostat (2007), Cultural Statistics, 2007 edition, Eurostat Pocket Books, European Commission, 2007.

India Ministry of Culture (2009), Annual Report 2008-09.

ITU-UPU (2009), Satellite Connectivity to Remote Areas and E-Services for Development: Initiatives through Post Office Telekiosks in Bhutan. A cooperation project between the Royal Government of Bhutan, the Government of India, the International Telecommunication Union and the Universal Postal Union, ITU-UPU 2009.

ICCROM-UNESCO (2007), Partnership for the Preventive Conservation of Endangered Museum Collections in developing countries. Documentation of collections summary of final report, 2007.

Getty Trust, J. P. (2009), 2008 Report.

Lesotho Ministry of Communications, Science and Technology (2005), ICT Policy for Lesotho.

Mauritius Ministry of Information Technology and Telecommunications (2007), National ICT Policy 2007-11.

Metropolitan Museum of Art (2009), Annual Report 2008-2009.

Musée d'Orsay (2008), Rapport d'Activités 2008.

Museo del Prado (2008), Informe Anual 2008.

National Gallery of Art (2009), National Gallery of Art Performance and Accountability Report for the year ended September 30, 2009, Washington DC.

Statistics Bureau of Japan (2007), Statistical Handbook of Japan, Chapter 16: Education and culture, Director-General for Policy Planning (Statistical Standards) and Statistical Research and Training Institute.

Tate Modern London (2009), Tate Report 08-09.

Watson, P. K., and B. Ramlal (2007), The Digital Divide in Trinidad & Tobago 2007, Telecommunication Authority of Trinidad and Tobago, 2007.

Target 5: Connect health centres and hospitals with ICTs[1]

Introduction

As with most of the other WSIS targets, the wording of Target 5 aims to provide high-level guidance to countries, allowing scope for interpretation. The ultimate goal of the targets is to connect the citizens of the world, and the institutions and facilities which serve them, so as to provide the communications infrastructure to deliver online the tools and services of the information age. The WSIS targets are essentially ICT targets, reflecting the composition of the WSIS delegates, who were primarily from the ICT sector.

In the *Geneva Declaration of Principles*, all WSIS stakeholders resolved to work together to "*ensure that everyone can benefit from the opportunities that ICTs have to offer*." The health sector was among those identified as potentially benefiting from ICT applications, for example through the more efficient delivery of healthcare services and the provision of health information to the general public, resulting in Target 5: Connect health centres and hospitals with ICTs.

At the second phase of WSIS, the *Tunis Agenda for the Information Society* stakeholders elaborated on Target 5 by aligning the work more closely with that of the Millennium Development Goals (MDG), stating "*we are committed to improving access to the world's health knowledge and telemedicine services…*."[2] It is proposed that governments strategically align Target 5 with MDG Goal 8F, which promotes the public-private partnership (PPP) approach for development, in order to "*in cooperation with the private sector, make available the benefits of new technologies, especially information and communications*."

Target 5 needs to be considered in the context of WSIS Action Line C6 (Enabling environment), which addresses the creation of an enabling environment,[3] and Action Line C2 (Information and communication infrastructure), which states that, in the context of national e-strategies, countries should provide and improve ICT connectivity, including for health institutions.[4] The health sector is also specifically mentioned in Action Line C7 (ICT applications), which relates to benefits in all aspects of life, notably through e-health applications.[5]

Use of ICT for health as an internationally agreed goal

The World Health Organization (WHO) defines the use of ICT for health as "e-health."[6] Carefully planned introduction of ICT into the health sector should result in improved ways in which data and information are collected, stored, retrieved and shared. ICT has proven to be a powerful tool in supporting more effective delivery of health services and increasing the efficiency of health systems. Trends show that the adoption of e-health enabling policies and actions in the health sector started to gain momentum in high-income and upper-middle income countries in the early 1990s. Uptake by developing countries started more slowly, but has significantly accelerated since 2000 [WHO, 2006].

It should be noted that while Target 5 refers to hospitals and health centres, these are not well defined. Health systems are highly complex structures that vary from country to country and consist of many inter-related components. These components are the facilities and institutions which care directly or indirectly for citizens' health needs, professional and support staff, infrastructure, health commodities such as medication and technical equipment, logistics management and finance. They deliver care in public health and educate and deploy the health workforce. As health systems become increasingly sophisticated and, therefore, a greater challenge to manage, the use of ICTs in processing patient, hospital and health-facility information is becoming an integral part of health-systems management at all levels of care.

Health systems in most countries comprise three levels of service — primary, secondary and tertiary, but not all countries have all of these levels. Primary care is the first level of care that a citizen will encounter. Primary care is non-emergency care, and is usually provided by a medical or nursing practitioner in health centres. Secondary care is more specialized, and is provided in a hospital setting as either inpatient or outpatient services. Tertiary care refers to the provision of complex treatments offered in specialized hospitals and provided by medical specialists.

The health sector is highly information-intensive. Providing effective health services requires the extensive collection of patient data in analogue and digital forms, which are then processed and disseminated within the same institution or sent to other institutions. Increasingly, these data will not only be shared within the same country, but will be sent to other countries, if necessary for the treatment of the patient. E-health also serves to broaden the information and communication horizons of healthcare workers. Knowledge, information and data can now be accessed and exchanged locally, nationally, regionally and globally. These opportunities apply equally to developing countries and to developed countries although, clearly, the challenges are greater in the developing world.

The face of public health services is changing as they adopt ICTs. Examples of applications in the health sector include:

- Electronic health records/electronic medical records EHR/EMR (often used interchangeably): the use of ICTs to generate, store and share longitudinal real-time electronic records of a patient's healthcare information
- Telehealth/telemedicine: the use of ICTs to offer diagnostic and treatment services remotely
- M-health/mobile health: the use of mobile devices such as mobile phones for health purposes (Box 5.1)
- Decision-support systems (DSS): the use of online information resources for clinical decision-making
- E-learning: the use of ICTs for the education and ongoing training of health professionals and students
- E-journals: the use of ICTs to create and publish virtual journals and disseminate them via the Internet or CD/DVD if connectivity is poor.

An example of an initiative that supports the latter two applications is provided in Box 5.2.

Box 5.1: M-health

M-health (also known as mobile health) is a relatively recent term for medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, PDAs and other wireless devices [Germanakos *et al*., 2005]. M-health presents a unique opportunity to improve health services. The massive expansion of mobile technology worldwide coupled with the continued lack of adequate Internet connectivity in many poorer countries provides fertile ground for m-health to grow. By the end of 2009, there were an estimated 4.6 billion mobile cellular subscriptions, 3.2 billion of which in the developing world [ITU, 2010]. Thus, with an estimated mobile cellular penetration rate of 56.8 per 100 inhabitants in the developing world, mobile technologies constitute a powerful tool for health-related purposes on a large scale.

M-health offers a number of areas of application for public health, including:

- Remote diagnosis and support
- Medication adherence and remote monitoring
- Disease outbreak surveillance and associated data collection and reporting
- Mass dissemination of public health information.

The following case study illustrates the use of m-health in the fight against HIV/AIDS in South Africa.

The use of cell phones in combating HIV/AIDS in South Africa

South Africa enjoys a very high mobile cellular penetration rate: 90.6 mobile cellular subscriptions per 100 inhabitants in 2008 [ITU, 2010]. The prevalence rate of HIV and AIDS in adults aged 15 to 49 is 18.1 per cent.[7] *Cell-Life*, a Cape Town-based NGO, is seizing the opportunity to capitalize on the existing highly developed mobile communications infrastructure to combat the AIDS epidemic by using mobile phones as a health communication tool.

A major ongoing programme of Cell-Life is *Aftercare*, where health workers provide home-based care to HIV/AIDS patients receiving antiretroviral treatments (ART). The Aftercare programme uses mobile technology to support treatment. Regimens are discussed and clinical information is captured using mobile devices. The information is then sent as a text message to a central patient database. There, a care manager monitors incoming patient data and can respond to health workers' questions or provide additional information for the patient. Not only is the programme proving to be effective due to its immediacy in providing information, but it is helping to build a database of the severity and prevalence of HIV in the region. The cost of the programme has been kept relatively low through the use of data-collection software which operates even on low-cost mobile phones.

Source: WHO.

Measuring Target 5 — Proposed indicators

As with the other WSIS targets, there is a need for further clarification of what is being measured and how it is to be measured. Each element in the target requires a definition in order to ensure national and global consistency of measurement and reporting and comparable results.

The following definitions are suggested for Target 5:[9]

1. **Hospital** — Residential establishment equipped with inpatient facilities for 24-hour medical and nursing care, diagnosis, treatment and rehabilitation of the sick and injured, usually for both medical and surgical conditions, and staffed with at least one physician. The hospital may also provide outpatient services.

Box 5.2: HINARI *(Health InterNetwork Access to Research Initiative)* — When content drives connectivity

The *HINARI* project is a concrete example of how providing connectivity to teaching hospitals and universities can profoundly improve researchers and health professionals, in training and in practices, through access to the world of scientific literature. The initiative provides access for health professionals and students to thousands of online biomedical journals. It grew out of the *Health Internetwork* (HIN) which originated from the United Nations Millennium Summit in 2000. HIN builds its foundation for the successful introduction of digital initiatives on four pillars: connectivity, content, capacity building and supporting policy. As a programme, HINARI satisfies all of these criteria and has grown to be the largest electronic journals programme of its kind in the world.

HINARI's mission is to provide online access to the leading biomedical journals of the world at no, or very low, cost. The programme targets non-for-profit health-related institutions in developing countries, with the objective of bridging the digital knowledge divide between rich and poor countries. As a public-private partnership, HINARI is a collaborative effort between WHO and the world's major academic publishers. Launched in 2002 with 1 500 online journals from just six publishers, the service has now grown to an offering of 6 200 journals from 150 publishers.[8]

Eligible institutions include universities; schools of medicine, nursing, pharmacy, public health and dentistry; teaching hospitals; research institutes and national medical libraries. Eligibility and the pricing structure are based on World Bank GNI per capita figures. Countries with a GNI per capita of less than USD 1 250 enjoy free access to all journals. Countries with GNI per capita of between USD 1 250 and USD 3 500 pay USD 1 000 per annum per institution for unlimited access to the content.

Most of the journal articles are in PDF format, resulting in large files and the need for adequate connectivity to download them. HINARI recommends a minimum speed of 56 kbit/s. It would be useful to know what the connection speed is for each of the four thousand participating institutions but, unfortunately, subscribing institutions provide only limited details when registering and connectivity data are not known to the service providers at WHO.

At the beginning of 2010, the number of participating institutions had reached 4 221 across 109 countries (Table 1 Box 5.2).

Table 1 Box 5.2: HINARI institutions by WHO region, 2010

WHO Region	Number of institutions	Percentage of total institutions with HINARI
African Region	1 510	35
Americas Region	724	17
Eastern Mediterranean Region	531	13
European Region	578	14
South East Asian Region	459	11
Western Pacific Region	419	10
World total	**4 221**	**100**

Note: These regions reflect WHO conventions.
Source: HINARI programme data.

The rapid distribution of up-to-date international health-science knowledge across so many developing countries would not have been possible without Internet connectivity. Not only would the cost have been prohibitive, so would the complex logistics of delivery and storage in these resource-poor settings. The digitization of the journals, and the selection, packaging and pricing of the content for developing-country environments, now makes it possible for WHO and its publishing partners to offer HINARI as an invaluable virtual library to over 100 developing countries at little or no cost.

In summary, HINARI is an excellent example of how content can drive connectivity. In the early days of the programme many institutions were not well equipped or connected. The motivation to have access to the wealth of digital content on offer prompted institutions to arrange for connectivity and the operating costs were often borne by the institutions themselves.

2. **Health centre** — A facility that provides (ambulatory) medical and sanitary services to a specific group in a population.

3. **Connect** — Reliable and continuous access to the Internet. In a health context, this is for obtaining information, processing and transmitting data, communicating, and providing and receiving e-health services. Broadband connectivity is now considered essential in order to be able to work effectively with e-health tools and services using ICT.

To date, no organization or institution is collecting data on the connectivity of health institutions at the international level. The suggested indicators (Table 5.1) would be needed to track this target, though even these basic indicators are not always straightforward to collect. Nonetheless, the ministries of health in countries should have up-to-date registries of public hospitals, although health centres are far more difficult to track, and particularly in developing countries.

Table 5.1: Proposed indicators for monitoring Target 5

Indicator	Description
Hospital	1. Proportion of public hospitals with Internet access, by type of access (narrowband, broadband)
Health centre	2. Proportion of health centres with Internet access, by type of access (narrowband, broadband)
Electronic health records — hospital	3. Proportion of public hospitals using computers/the Internet to collect/process/transmit individual patient information
Electronic health records — health centre	4. Proportion of health centres using computers/the Internet to collect/process/transmit individual patient information

There are several measurement challenges. Many developing countries do not know how many health centres there are in the country. Furthermore, these centres may only be staffed by one person on a rotating basis and open infrequently. Depending on the centre, the availability of staff, supplies and the size of the community it serves, it may be the case that records are not kept. Hospitals pose a different measurement challenge. The WSIS target does not differentiate between secondary or tertiary services. The situation is further complicated by the fact that most countries have public, private and charity-based hospitals, as well as public and private health centres. Many countries have a private healthcare system with private hospitals and clinics. The relative proportions of each vary across countries, and the exact number of non-public facilities may not be known by the ministries of health. Thus, measurement of healthcare entities is complicated by definitional problems, as well as, in many cases, incomplete records on the number of facilities.

It should also be noted that there is no agreed international norm for measuring health facilities. The closest established and measured indicator available is that of the number of hospital beds per 10 000 population published annually by WHO in the *World Health Statistics Database.*[10] This is not the same as measuring the number of hospitals, and does not provide a breakdown by type of hospital. Health centres are not measured by WHO.

A few organizations collect data on health and ICT-related indicators (Table 5.2). WHO, through its *Global Observatory for eHealth* (GOe), is currently the only international organization which focuses on trends and developments in e-health worldwide (Box 5.3). The *Healthcare Information and Management Systems Society* (HIMSS) is well established and offers detailed information at health-facility level, but only collects data in North America, although there are plans to extend it to Europe and the Middle East. OECD data focus on OECD member countries. Thus, the GOe is the only programme which collects data globally and with a dedicated focus on e-health in developed and developing countries. However, its level of granularity does not extend to measurement at the individual hospital or health-centre level. In summary, none of the existing data sources provide comprehensive, global coverage of the indicators relevant for measuring Target 5.

Table 5.2: Prime sources of health and ICT-related data

Main areas reported and key indicators	Strengths	Weaknesses
Global Observatory for eHealth (GOe)[11]		
• Global survey data on e-health from over 110 countries • Data on the uptake of e-health technologies and policies	• Data focusing on the adoption of e-health policies and other supporting actions to provide an enabling environment for growth of e-health in countries • E-health country profiles for all participating WHO Member States. • Data collected by survey every two years	• Granularity of the data is at the country level; no lower-level data (by region or by health facility) • Survey results based on self-reporting • Expert informants can change from survey to survey
Organisation for Economic Co-operation and Development (OECD)[12]		
• Data on ICT and health at the country level • Literature review and case studies of ICTs for health in four OECD countries	• A range of ICT indicators as well as health-system indicators for OECD countries. Case studies on e-health in OECD countries	• Data available only for the 30 OECD Member Sates • No comprehensive collection of data on the use of ICTs in the health sector
Healthcare Information and Management Systems Society (HIMSS)[13]		
• Detailed information on ICT usage at the health-facility level, including the type of network connection and service provider, for over 5 100 hospitals and 32 000 medical facilities in the US and Canada • EMR adoption model — scores hospitals based on their level of EMR adoption • Hospital benchmark reports	• Continuously updated data based on annual survey of health facilities • Established data quality assurance procedures, HIMSS peer-reviewed research analysis	• Data available only for health facilities in the US and Canada.

Status of Target 5

Internet access

Currently, data on ICT access in health institutions are not collected internationally in a comprehensive or regular manner. ITU carried out an ad-hoc survey in 2009 in the context of monitoring the WSIS targets. The questionnaire included questions on ICT access in health institutions, including by type of access. The results point to large differences in connectivity, especially for broadband connections (Table 5.3). It is not surprising to find that connectivity tends to be higher in developed than developing countries, and usually with broadband access. There are countries, including developed countries like the Czech Republic, Latvia, Lithuania and New Zealand, where health institutions with access to the Internet do not have a broadband connection. Internet access may also vary considerably within a country. In Thailand, for example, 90 per cent of subdistrict health centres have access to the Internet, but only 60 per cent of them have broadband access.

Some countries also provided information on the number of health institutions with websites. For example, Croatia reported that 64 per cent of health institutions had a website in 2009, while 18 per cent were connected to the *Na-*

Box 5.3: The Global Observatory for eHealth

In recognition of the rapidly growing importance of the use of ICT for health services and systems, the fifty-eighth World Health Assembly in May 2005 adopted Resolution WHA58.28[14] establishing an e-health strategy for WHO. The resolution urged Member States to plan for appropriate e-health services in countries according to their needs. In the same year, WHO launched the *Global Observatory for eHealth* (GOe). The observatory is dedicated to the improvement of health systems and services by providing Member States with strategic information and guidance on effective practices, policies and standards in e-health. It is the only observatory to monitor e-health developments in countries through surveys conducted every two years.

GOe publications include: [15]

- *eHealth Tools and Services: Needs of Member States* (2006)
- *Building Foundations for eHealth: Progress of Member States* (2007)
- *Building Foundations for eHealth in Europe* (2008)

Work is in progress on an eight-volume series based on the 2009 global survey on e-health. The first survey on m-health will be released in summer 2010.

The 2009 survey focused on new areas such as:

- establishing enabling actions for e-health
- trends in the uptake and application of mobile health (m-health)
- the use of telehealth services and barriers to their introduction
- the adoption of e-learning for health professionals and students
- the transition from paper-based patient records to electronic health records
- legal and ethical issues in the e-health domain.

To date, GOe surveys have been conducted at the national level and the data and information sources are provided through a group of nationally recognized experts in e-health. They are usually nominated by the ministry of health and draw on the expertise of other related sectors such as ICT, telecommunications, education, academia and research. Questions address national issues, as current financial resources are inadequate for carrying out the survey work at district or local level. It is anticipated that GOe, with suitable partners, will perform more detailed surveys at district level as funds become available.

tional Research and Educational Network (NREN). In the Czech Republic, over 16 per cent of health institutions had a website (2008), as against five per cent in Lesotho (2007). In Hungary, half of all health institutions maintained a portal (2009), while in Paraguay a unified site operates for 88 health institutions together (representing close to eight per cent of total health institutions in 2009). In Singapore, each of the 24 hospitals reportedly had a website in 2009, but no data were available for other types of health institutions.

Management of patient information

The collection, storage and transmission of patient information can be considered as another measure of the uptake of ICT by health facilities. Results from the WHO GOe survey 2009 demonstrate that, today, patient records are still primarily kept in paper format (Chart 5.1), with exactly half of the responding countries reporting that this method was used in more than 75 per cent of their health facilities. While 90 per cent of countries report at least some use of electronic patient records, they appear to be used intensively in only a small proportion of responding countries. Indeed, only six per cent report that over 75 per cent of health facilities are using such records (“very high” in Chart 5.1). Similarly, close to 80 per cent of countries report at least some use of electronic data transmission, but only as little as three per cent of responding countries report that over 75 per cent of health facilities are transmitting data to other health facilities (“very high” in Chart 5.1). It is these facilities that need ICT connectivity in order to communicate data, so this gives an indication, but certainly not a reliable measurement, of the availability of Internet access in healthcare facilities.

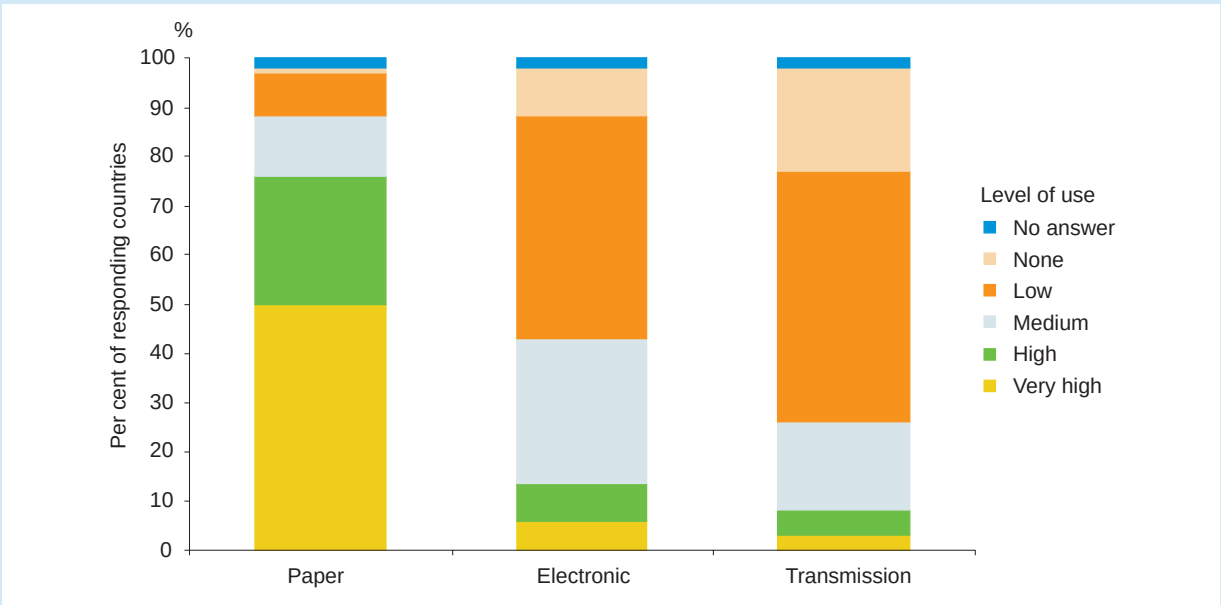
Looking at the results by World Bank income group (Chart 5.2), as may be expected, it is the high-income countries which display the highest incidence of electronic patient data usage. Only countries in the high-income group reported very high use of electronic data formats with the ability to transmit the data electronically (i.e. indicating the use of Internet), with 22 per cent reporting high or very high use. Close to 90 per cent of upper-middle income

Table 5.3: Percentage of health institutions with access to the Internet, 2009**

	Any type of connection	Broadband only
Andorra	100	100
Bhutan	100	...
Bolivia	2	1
Botswana	97	27
Croatia	100	100
Czech Republic	70	48
Djibouti	14	14
Egypt	6	1
Finland	100	...
Hungary	100	100
Korea (Rep.)	100	100
Latvia	99	39
Lesotho	6	...
Lithuania	100	65
Mexico	5	...
Nauru	100	100
New Zealand	100	47
Paraguay	17	4
Singapore*	100	...
Slovak Republic	77	77
St. Vincent and the Grenadines	3	3
Sweden	100	...
Thailand	91	...

Note: * Hospitals only. ** Or latest available year. The country names in this table reflect ITU conventions. "...": data not available.
Source: ITU Survey on the WSIS Targets.

Chart 5.1: Proportion of local healthcare facilities using paper, electronic and electronic plus transmissible patient information, by level of use, 2009



Source: WHO GOe survey 2009.

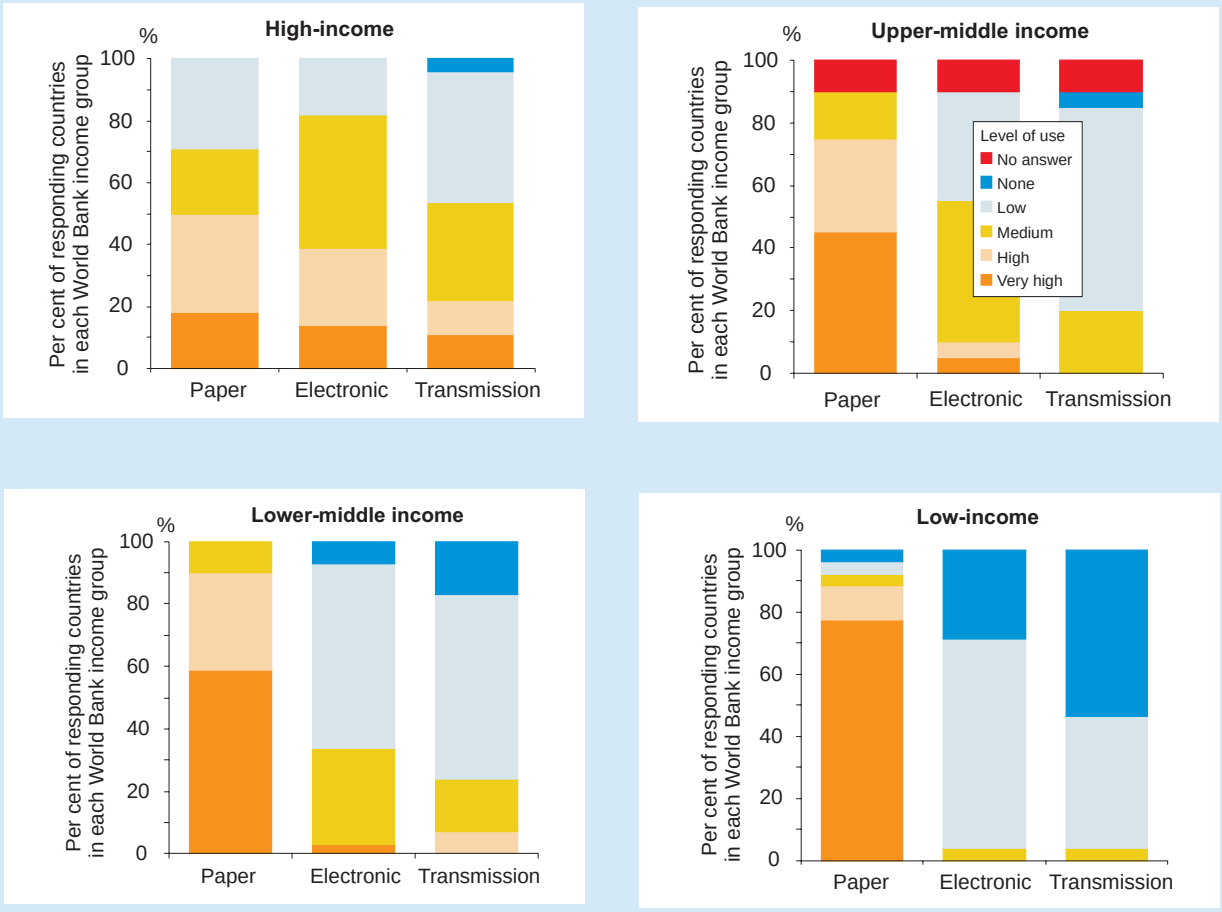
countries report at least some electronic data transmission, compared with over 80 per cent of lower-middle income countries, and around 40 per cent of low-income countries. However, even in the high-income category, high and very high use of electronic records is only just under 40 per cent, reflecting the difficulties of making the transition from a paper-based to an electronic health-record system. Countries in lower-income categories show greater use of paper records and less use of electronic data and data with electronic transmission. In the low-income category, no countries reported high or very high use of electronic data; 50 per cent reported that their health institutions do not use electronic data transmission; and over 40 per cent reported that less than 25 per cent of health institutions transmit data electronically ("low" in Chart 5.2).

Policy framework indicators

In order to complement the limited data on ICT access and use in health institutions, this section reviews data on government efforts in the adoption of foundation actions for building health-sector connectivity. Measuring whether foundation actions (Table 5.4) have been introduced in countries recognizes the importance of policy in developing an enabling environment for e-health.

This method does not provide numerical data on, for example, the percentage of hospitals and health centres with Internet access, but gives a broader overview of the state of progress in countries, at least with respect to the efforts made to put the framework conditions for e-health into place.

Chart 5.2: Proportion of local healthcare facilities using paper, electronic and electronic plus transmissible patient information, by level of use, by World Bank income group*, 2009



Note: * See Annex 5.1.
Source: WHO GOe survey 2009.

Table 5.4: Foundation actions

Indicator	Description
Policy framework	E-health, ICT and other supporting policies such as e-government which provide the blueprint for development of e-health and the necessary connectivity in a country
Funding framework	Financial resources, including any combination of government, private, public-private partnership or donor funding, which support building connectivity for public institutions including the health sector
Infrastructure planning	National e-strategies, or "roadmaps," which plan for the building of country infrastructure, including the health sector

Source: WHO.

Measurement of growth in the adoption of key policies, including infrastructure policies, and of the allocation of funding resources, should provide a high-level overview of ICT development for health by country, region and globally. It is important to note, however, that while the adoption of these actions by countries is a clear signal of their intent to connect the health sector, it does not necessarily mean that this connectivity has already been achieved.

At this time, the only body collecting these data systematically and internationally, although the data are not entirely complete, is WHO's GOe (Box 5.3). Although the data will provide a reliable picture of the environment and policy support for action, it must be recognized that the final step in making progress on health-sector connectivity in a country can only be through the joint action of the three key stakeholders, namely the ICT, finance and health sectors. An example of health-sector reforms, including initiatives to put in place an electronic health-records system, is given in Box 5.4.

GOe measures a series of indicators which are considered as enablers for the introduction of ICT for health. These are listed in Table 5.5, and preliminary results are provided in Table 5.6.

National e-government policies will promote ICT access and use across the entire public sector, while national e-health policies will drive ICT uptake specifically in the health sector. Preliminary results show that a very high proportion of all responding countries (84 out of 101) have national e-government policies — 96 per cent of responding high-income and upper-middle income countries, and 72 per cent of responding lower-middle and low-income countries (Table 5.6).

The figures for national e-health policies do not look quite as positive. Of 101 responding countries, 55 report having an e-health policy — 79 per cent of responding lower-middle and low-income countries and 32 per cent of responding upper-middle and high-income countries. These data indicate that e-health enjoys less of a focus than other ICT policies and that many countries start by adopting e-government policies first.

Looking at the funding support available, 63 out of 101 responding countries report donor support for e-health development — 85 per cent of responding lower-middle and low-income countries, and 38 per cent of responding high-income and upper-middle income countries. Public funding for e-health is available in 81 countries — 74 per cent of responding lower-middle and low-income countries, and 96 per cent of responding high-income and upper-middle income countries.

The aim of Target 5 is for countries to employ a strategic and sustainable approach to the introduction of connectivity for the health sector. This is only likely to happen if countries adopt a systematic approach to deployment of ICT across the whole public sector, and if special rates for connectivity for public-sector services are negotiated with providers. These elements should generally be addressed nationally through e-government or e-health policies.

Box 5.4: Belize — an example of a model national e-health programme in a developing country setting

Background
The beginnings of health-sector reform in Belize date back to 1999 when, working with a management consultancy, the newly appointed regional health management teams identified that health-sector reform could only occur through the introduction of a national health-information system. The Ministry of Health recognized the opportunity and made a significant investment in the development of the *Belize Health Information System* (BHIS), an electronic health-records system developed by the country itself and launched in 2004.

The Belize National Health Information System
BHIS works to improve the health of its population by providing comprehensive health information about patients which can be accessed anywhere in the country by registered users as soon as the patient data have been entered into the system. System architecture features include high levels of functionality, security and full interoperability. The mission is to ensure that all Belizeans have their own individual health record. This appears to be realistic and achievable due to the relatively small population and the rapid diffusion of technology in the country, and most importantly thanks to the commitment of government to the success of the programme.

The system consists of a series of interconnected modules which form the core of a sophisticated electronic health-records system and include:
- Hospital admissions, transfer and discharge
- Clinical order entry
- Laboratory testing
- Billing
- Supply chain management
- HIV/AIDS patient management.

In its next strategic move, the Belize government will extend the impact of BHIS by linking all other government sources of health information including Vital Statistics, Social Security and the National Health Insurance Scheme. The government's motivation is to maximize the sharing and use of patient data, and to improve efficiency in the deployment of human resources for health services.

In 2009, it was estimated that approximately 80 per cent of encounters in the public health system were recorded and stored by BHIS. The private-sector health services displayed a slightly lower percentage, but it was still significantly high.

Policy and funding environment
To gain a better picture as to why Belize has been so successful in its mission to build a successful electronic health-records system, it is important to look at what enabling actions may have been put in place by the government. According to Belize's response to the 2005 global survey on e-health, a number of key actions were taken which helped to build the system. In 2004, Belize introduced both a national e-policy as well as a national e-health policy. These are fundamental elements to assist in the building of e-health initiatives in the health sector. In addition, since 1998, e-health activities have been supported through both public and private funding, increasing the likelihood of sustainability. Citizen protection actions were introduced in 2004 in order to safeguard the privacy of patient information, in particular in the context of electronic patient records. The adoption of e-health standards to promote interoperability occurred in around 2005. ICT infrastructure development in the health sector is fundamental to ensuring access to ICTs for health professionals in hospitals and health centres. This is supported by a *National Plan for ICT Development in Health*. The plan, which sets targets for health-sector connectivity, was deployed from 2004, early on in the project.

Measuring system successes
Significant successes reported by BHIS include:
- Highly improved management of mother-to-child HIV transmission, lowered from 20 per cent to one per cent per annum
- 90 per cent decrease in hospital cases of adverse drug reactions
- Estimated decrease of over eight per cent in medical expenses thanks to increased efficiencies
- H1N1 case information available in real time across the country due to efficiency in monitoring and reporting

These achievements are largely attributable to the effectiveness of the information system deployed and the staff who use it. It could almost be taken for granted that the connectivity which is required to run such an operation was already there. For this system to work, the Belize government has had to connect all elements of the health system, hospitals (public and private) as well as health centres, so that they can all communicate with each other as one integrated system. Without this ICT connectivity a complex and sophisticated national health information system could not exist.

Support for achievements
The national government has been a strong supporter of BHIS. Furthermore, Belize has received financial and technical support from the Health Metrics Network, as well as technical support from Pan-American Health Organization (PAHO/WHO) and financial support from the inter-Caribbean country meeting to share its lessons learned with Eastern Caribbean countries.

Table 5.5: Enabling actions for ICT for health

Indicator	Description (GOe definitions)[16]
National e-government policy	Lays out the vision and objectives for the use of ICT to exchange information, provide services and communicate with citizens, businesses and other sectors.
National e-health policy	Lays out the vision and objectives to promote ICT specifically for the health sector
National ICT in health development plan*	Also sometimes referred to as a "technology roadmap." A plan for the national development and deployment of ICT infrastructure, services and systems in the health sector
*Funding sources for e-health***	*Can be any combination of the following:*
Public funding	Support through financial resources provided by government — may come from national, regional or district level government
Private funding	Support through financial or in-kind services provided by the private or commercial sector
Donor/non-public funding	Support through financial or in-kind resources provided by development agencies, banks, foundations or other non-public funding bodies. These can be international, regional or national bodies
Public-private partnerships	Joint ventures between public organizations and private-sector companies to work together to achieve a common goal

Note: *This indicator was measured in the 2005-06 but not in 2009. **This does not cover all of the possible funding and investment sources.
Source: WHO.

Table 5.6: Preliminary WHO GOe survey results 2009

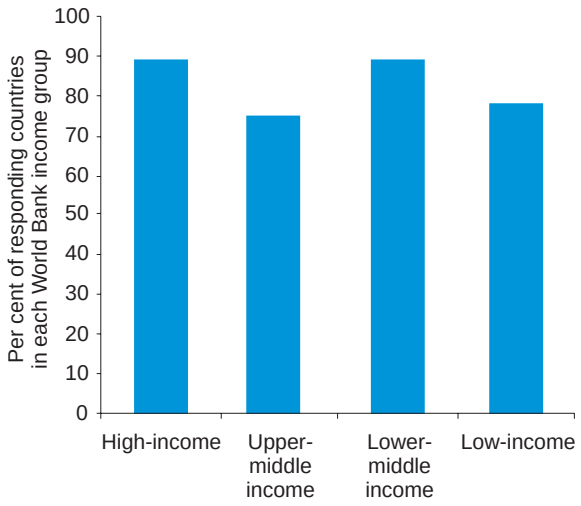
Indicator	Total number of countries reporting action (n= 101)	% World Bank upper and upper-middle income countries (n=48)	% World Bank lower-middle and low-income countries (n=53)
National e-government policy	84	96% (46)	72% (38)
National e-health policy	55	79% (38)	32% (17)
Public funding	85	96% (46)	74% (39)
Private funding	38	42% (20)	34% (18)
Donor / non-public funding	63	38% (18)	85% (45)
Public-private partnerships	40	44% (21)	36% (19)

Source: WHO GOe survey 2009.

M-health and telemedicine

Two other areas that are important for the uptake of e-health in countries relate to activities in m-health and telemedicine services.[17] It has already been noted in this chapter that m-health has huge potential as a public health and medical practice supported by mobile devices.

Chart 5.3: Countries reporting at least one m-health initiative, by World Bank income group*, 2009

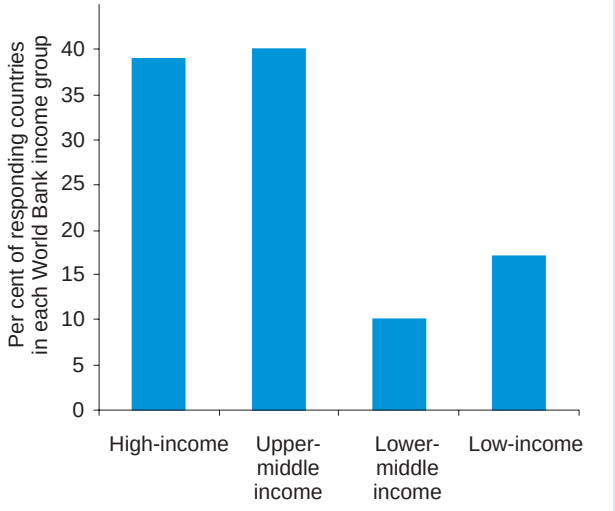


Note: * See Annex 5.1.
Source: WHO GOe survey 2009.

The extent to which m-health has already been adopted by country health systems is illustrated in Chart 5.3. It shows that at least one m-health initiative has been implemented across the vast majority of countries, and in most cases there are many more. The figures range from around 90 per cent of responding countries in the upper and lower-middle income groups, to about 75 per cent for the upper-middle and lower-income groups. It is encouraging to note the absence of a dramatic difference in reported activity between the richer and poorer countries.

The existence of a national telemedicine policy is an indicator of the likelihood of a country offering telemedicine services to its citizens. The proportion of countries in each income group reporting the existence of a national telemedicine policy is relatively low: around 40 per cent of responding high-income and upper-middle income countries, around ten per cent of lower-middle income countries, and around 20 per cent of low-income countries (Chart 5.4). Although telemedicine is not a new e-health service, the data indicate that much work will need to be done before it is integrated into health services worldwide.

Chart 5.4: Percentage of countries with a national telemedicine policy, by World Bank income group*, 2009

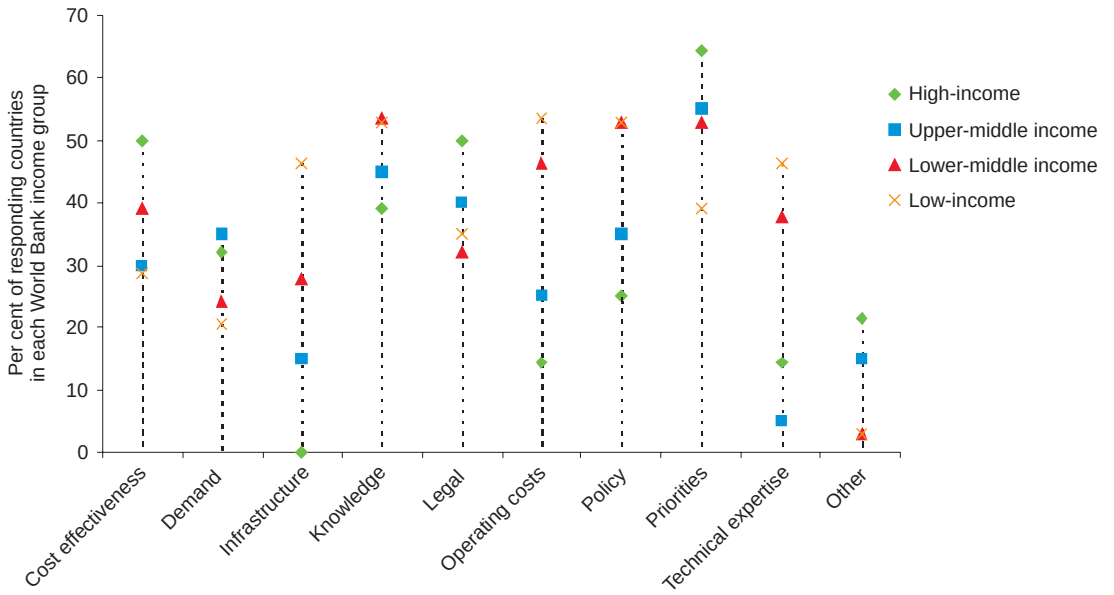


Note: * See Annex 5.1.
Source: WHO GOe survey 2009.

Another approach to assess ICT uptake in the health sector would be to look at the reasons cited for not using m-health and telemedicine, which include infrastructure barriers. While this does not give an indication on what proportion of health centres have access to the Internet, it does give an indication whether infrastructure, or other barriers, matter for taking up this application. Infrastructure is mentioned as a barrier to implementing m-health solutions (except in the highest income group), and the importance of this barrier is inversely related to income: the lower the income level, the greater the percentage of countries citing infrastructure as a barrier (Chart 5.5).

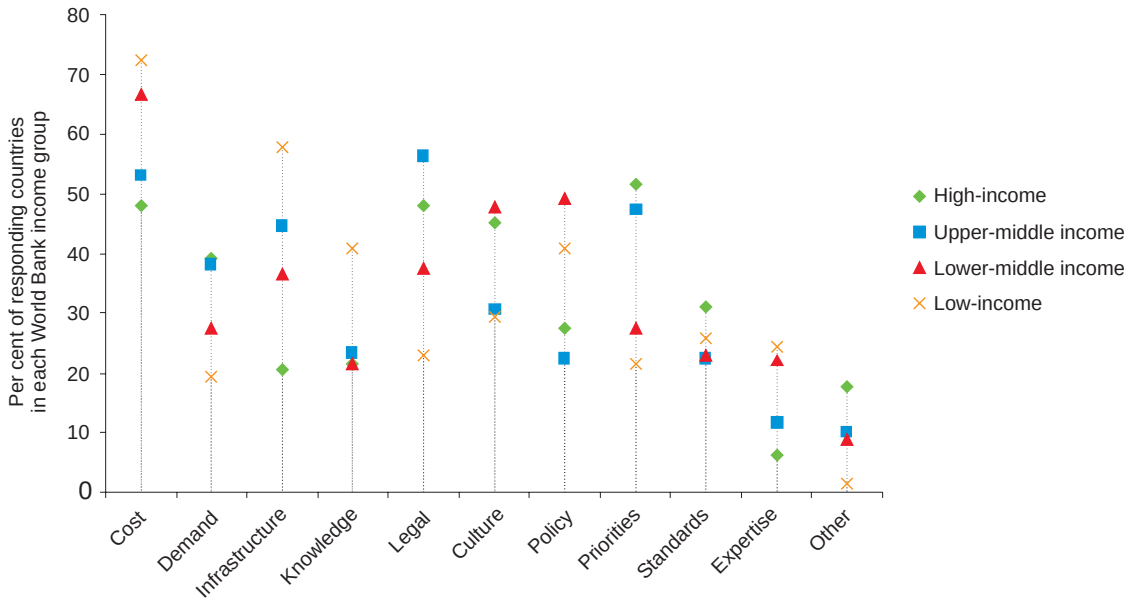
Similarly, infrastructure is also cited as an important barrier to implementing telemedicine solutions, including in the highest income group (Chart 5.6). Countries in the lower-middle income group cite this barrier relatively less often than those in the upper-middle and low-income groups. Indeed, infrastructure is more likely to be an issue for telehealth than for m-health services, as the

Chart 5.5: Most important barriers to implementing m-health solutions, by World Bank income group*



Note: * See Annex 5.1.
Source: WHO GOe survey 2009.

Figure 5.6: Barriers to implementing telemedicine solutions, by World Bank income group*



Note: * See Annex 5.1.
Source: WHO GOe survey 2009.

former require adequate Internet access, as well as the additional hardware and software needed for the telehealth service both at the service-provider and the patient location. The m-health infrastructure is being built by telecommunication service providers and only requires a mobile cellular telephone.

Conclusions and recommendations

The available data point to some progress in connecting health institutions, including in developing countries. Many countries have also introduced the use of ICTs, for example through the connection of health institutions to HINARI or the introduction of electronic patient records, though these facilities are not yet intensively used. Over 75 per cent of countries also report at least one m-health initiative, and mobile health is an area which holds great potential for further growth given the soaring use of mobile technologies, including in the developing world.

Although incomplete, the available figures suggest there is some way to go before reaching full connectivity in health centres and hospitals. However, with five years left until the deadline for the target it is still possible, and likely, that much can be achieved, especially since this represents a fairly distant horizon in terms of ICT advancement. If countries find it possible to measure connectivity in hospitals and health centres, it is most likely that significant improvements in the proportion of these health facilities having access to the Internet will be observed over the next five years. However, it is also likely these trends will tend to occur first in the major cities of developing countries, and less so in remote and isolated regions, even though ICTs can potentially bring even greater benefits in these latter geographical areas.

Substantial efforts are required if the target is to be achieved by 2015. Attention needs to be paid to ensuring that governments are putting in place and implementing foundation actions such as e-government and e-health policies, which will be critical for the successful and sustainable growth of connectivity in the health sector. WHO's GOe proposes to include a series of questions specific to this issue in the 2011 global e-health survey, while ensuring that definitions and feasibility of accurate measurement are tested and piloted well in advance. WHO is also planning to create guidelines for the development and evaluation of e-health strategies that will provide a valuable framework for the many developing countries which still may be operating in an e-health policy vacuum.

Many of the indicators that could be used to measure Target 5 are broad and indirect measures. Most are such that the measurement would generally be made in the public health sector only. An alternative approach would be to invite individual countries to submit data by means of a special brief WSIS topic-specific survey conducted by WHO GOe or any other appropriate institution. This could include questions on the above indicators, as well as questions addressing numbers of hospitals and health centres (if known) and the connectivity situation, both current and planned by 2015. Should funding be available, the data could be collected, processed and analysed during a nine-month period. Otherwise, more current data will be available after the 2011 GOe global survey on e-health.

Finally, a mix of policy recommendations is required to achieve Target 5, including:

- *Government support and recognition*
  Large-scale national connectivity projects require the full support and commitment of governments in order to succeed. The government needs to recognize the importance of connectivity for the health sector, and the benefits it will bring for the health of citizens, not to mention the potential for cost savings through increased efficiencies. This support will need to be reflected in the policy environment as well as the funding environment.

- *Creating an enabling environment*
  The importance of an enabling environment to build connectivity and e-health has been emphasized throughout this chapter. E-government, e-health, e-strategies and funding approaches need to be in place to create an environment for growth in ICT connectivity.

- *Agreement by parties*
  Any significant connectivity initiatives in the e-health domain will need to be agreed on and governed by three ministries: health, ICT/communications, and finance. An understanding and agreement on the mission, strategic approaches, costs and implementation time-line must be shared by all parties if the project is to succeed.

- *Funding*
  One of the biggest impediments to the spread of e-health is insufficient funding allocation to achieve the objectives. Governments must be confident that e-health projects will be adequately funded. Not all sources will necessarily come from public funds. Donor or private funds may be available, as well as public-private partnerships, which are central to the mission of connecting health facilities with ICT.

Notes

1 This chapter was prepared by Misha Kay with Najeeb Al-Shorbaji, Joan Dzenowagis, Marina Takane, Jonathan Santos and Diana Zandi from the World Health Organization, Geneva, in collaboration with ITU. The authors are staff members of the World Health Organization. The authors alone are responsible for the views expressed in this publication and they do not necessarily represent the decisions or policies of the World Health Organization.

2 See WSIS Tunis Agenda for the Information Society, 2005, at: http://www.itu.int/wsis/outcome/booklet/tunis-agenda_D.html , § 90g).

3 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c6.

4 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c2, § 9c).

5 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c7.

6 WHO Global Observatory for eHealth 2009 survey http://www.who.int/goe/data/global_e-health_survey_2009_en.pdf.

7 UNAIDS South Africa Country Response http://www.unaids.org/en/CountryResponses/Countries/south_africa.asp.

8 HINARI: http://www.who.int/hinari/en/.

9 European Observatory on Health Systems and Policies: http://www.euro.who.int/observatory.

10 World Health Statistics, Health workforce infrastructure, essential medicines, WHO 2009 http://apps.who.int/whosis/data/Search.jsp?indicators=%5bIndicator%5d.%5bHSR%5d.Members.

11 http://www.who.int/goe/en/.

12 http://www.oecd.org.

13 http://www.himss.org.

14 http://apps.who.int/gb/ebwha/pdf_files/WHA58/WHA58_28-en.pdf.

15 http://www.who.int/goe/publications.

16 GOe glossary of survey terms: http://www.who.int/goe/data/Global_eHealth_Survey-Glossary-ENGLISH.pdf.

17 Telemedicine (also known as telehealth) involves the delivery of healthcare services where distance is a critical factor. The telemedicine approach uses ICTs for the exchange of information for diagnosis, treatment and prevention of diseases and injuries, for research and evaluation, and for the continuing education of healthcare providers (WHO Global Observatory for eHealth 2009).

References

Germanakos, P., C. Mourlas and G. Samaras (2005), "A Mobile Agent Approach for Ubiquitous and Personalized eHealth Information Systems," Proceedings of the Workshop on "Personalization for e-Health" of the 10th International Conference on User Modeling (UM'05). Edinburgh, July 29, 2005, pp. 67-70.

ITU (2010), *Measuring the Information Society 2010*, ITU, Geneva.

WHO (2006), *Building Foundations for e-health — Progress of Member States*, WHO Global Observatory for eHealth, WHO, Geneva.

Annex 5.1: Breakdown of responding countries in the 2009 GOe global survey on e-health, by World Bank income group 1-4

WB1 — High income	WB2 — Upper-middle income
Austria	Argentina
Belgium	Belarus
Brunei Darussalam	Botswana
Canada	Brazil
Croatia	Bulgaria
Cyprus	Colombia
Czech Republic	Dominican Republic
Denmark	Fiji
Estonia	Latvia
Finland	Lebanon
France	Libya
Germany	Lithuania
Greece	Mauritius
Hungary	Mexico
Iceland	Montenegro
Israel	Panama
Korea (Rep.)	Peru
Kuwait	Poland
Malta	Seychelles
New Zealand	Turkey
Norway	
Oman	
Portugal	
Slovak Republic	
Slovenia	
Spain	
Switzerland	
United Kingdom	

WB3 — Lower-middle income	WB4 — Low income
Albania	Bangladesh
Armenia	Benin
Azerbaijan	Burkina Faso
Belize	Burundi
Bhutan	Cambodia
Cameroon	Chad
Cape Verde	Comoros
Congo	Eritrea
Egypt	Ethiopia
Indonesia	Gambia
Iran (I.R.)	Ghana
Jordan	Guinea-Bissau
Lesotho	Kyrgyzstan
Maldives	Lao P.D.R.
Moldova	Madagascar
Mongolia	Mali
Morocco	Mauritania
Pakistan	Nepal
Paraguay	Niger
Philippines	Senegal
S. Tomé & Principe	Sierra Leone
Sri Lanka	Togo
Sudan	Uzbekistan
Syria	Yemen
Thailand	Zambia
Tonga	Zimbabwe
Turkmenistan	

Note: The country names in this table reflect ITU conventions.

Target 6: Connect all local and central government departments and establish websites and e-mail addresses[1]

Introduction

The use of information and communication technology (ICT) in government — e-government — can be key to achieving specific social and economic development goals. In recent years, governments have increasingly begun to recognize the role ICTs can play in promoting effective and speedy solutions for development through the delivery of public services. There is no doubt that e-government can contribute effectively to creating an enabling environment for development, by enhancing transparency and accountability and promoting good governance in the public sector. As such, e-government is a key tool for public-sector reform towards better governance (see Box 6.1), which is one of the objectives of the United Nations Millennium Declaration. Accordingly, many countries are reforming and modernizing their public-sector systems. This involves putting in place ICT infrastructure (e-government readiness) and promoting the use of ICTs (e-governance) in order to maximize impact and increase public-sector efficiency. Indeed, while investment in infrastructure is necessary for the diffusion of ICTs, the impact will ultimately depend on the use that is being made of them.

The need to employ ICTs for development, including in the public sector, has also been emphasized in international forums. The United Nations has been an integral part of multistakeholder efforts to advance international cooperation and development for the promotion of e-government, including through innovative ICT-enabled e-government solutions and the development of global information repositories and databases. These endeavours have served to create and exploit synergies among different stakeholders, and to identify good practices that will advance the vision and concrete agenda set by WSIS.

The United Nations Department of Economic and Social Affairs (UNDESA) has taken the lead in promoting e-government development in the context of WSIS Action Lines C1 (The role of public governance authorities and all stakeholders in the promotion of ICTs for development), C7 (ICT applications, including e-government) and C11 (International and regional cooperation). In following the progress of Member States towards the WSIS objectives, UNDESA

focuses on how governments use electronic or mobile tools and applications to improve the provision of information and services to their citizens and enhance the functioning of the public sector.

The WSIS vision of e-government urges Member States to implement e-government solutions aimed at using ICTs in government and in public-service delivery. More specifically, the WSIS e-government objectives call on governments to:

- implement e-government strategies focusing on applications aimed at innovating and promoting transparency in public administrations and democratic processes, improving efficiency and strengthening relations with citizens;
- develop national e-government initiatives and services, at all levels, adapted to the needs of citizens and business, to achieve a more efficient allocation of resources and public goods;
- support international cooperation initiatives in the field of e-government, in order to enhance transparency, accountability and efficiency at all levels of government.[2]

The WSIS e-government objectives reflect a growing recognition on the part of policy-makers that the judicious use of ICTs can play a crucial role in pursuing the aims of the public sector and contribute towards achieving social and economic development goals. The underlying principle of e-government has served to improve the internal workings of the public sector by reducing financial costs and transaction times and strengthening linkages between different government agencies, the private sector and civil society for the effective delivery of public services.

Box 6.1: The benefits of e-government

The multistakeholder effort at WSIS recognized that access to information and knowledge is critical for development. ICTs cut across sectors and provide support to key governance processes that are critical for improved functioning of the public sector and for good governance. The 24/7 availability of ICT tools enables faster and more efficient communication not only between the public sector and citizens, but also between government agencies, processes and systems. Thus, ICTs help governments operate more efficiently, improve the delivery of public services and enable more widespread information dissemination to citizens.

E-government can facilitate communication and improve coordination between authorities at different levels of government, including within organizations. This is critical for improved policy coordination and better communication of the resulting decisions, which, in turn, is very important for policy coherence and achieving policy objectives. Increased transparency should also strengthen trust.

E-government can enhance the speed and efficiency of operations, by streamlining processes, lowering costs, improving research capabilities and improving documentation and record-keeping. By making more information publicly available, e-government solutions reduce uncertainty for other socio-economic actors, thus enhancing their resource-allocation decisions.

E-government enables greater inclusion and participation of citizens in policy processes. By enhancing the government's ability to request, receive and take on board feedback from constituents, policy measures can be better tailored to meet the needs and priorities of citizens. Thus, e-government enables more participatory and potentially more democratic governance.

Best practices indicate that the focus on service delivery is becoming intertwined with an emphasis on achieving cost savings and enhancing efficiency in the public sector. By lowering application processing and waiting times, innovative e-government-for-business solutions can reduce the cost of complying with government regulations, lighten the administrative burden for businesses and cut through red tape.

Thus, innovation in e-government solutions at all levels of government enhances the speed and efficiency of public-sector operations, streamlines processes, lowers costs, improves service-delivery capabilities and improves documentation and record-keeping. At the same time, the underlying principle of e-government also serves to strengthen linkages between different government agencies, the private sector and civil society.

Source: UNDESA.

Measuring Target 6 — Proposed indicators

Target 6, namely "**Connect all local and central government departments and establish websites and e-mail addresses**," can be interpreted as comprising three distinct goals:

i) Connect central and local government departments
ii) Establish websites for central and local government departments
iii) Establish e-mail addresses for central and local government departments.

The conceptual framework of the target stemmed from an increasing recognition of the value of integrating technology into government so as to find more effective and speedy solutions for more efficient functioning of governments, improved delivery of basic services and wider dissemination of information to the citizen.

In establishing the WSIS target for e-government, it was deemed important that national and local/municipal governments and departments should implement the use of ICTs, be connected online and make the relevant public officials' e-mail information available to the citizen as a first step towards providing online information.

However, as is the case for the other WSIS targets, it was not clear exactly how the terms "connecting" central and local governments or "establishing a website" were to be interpreted. For example, government offices could have Internet access and/or an established website at varying levels of use. A registered entry point for a ministry or government department does not mean that all its offices and staff are fully equipped with ICTs, or that links have been established between different government entities. Similarly, simply having e-mail contact information posted on a government website is not sufficient to allow a thorough assessment of the website in question in terms of effective service delivery. Experience shows that countries utilize ICTs differently. Assessments based on ICT use show that the establishment of a website without appropriate and useful navigation, interaction or transaction capability may not have any impact in terms of developing effective e-government solutions.

The *Partnership on Measuring ICT for Development* (see Box 2 in the introductory chapter of this report), which was set up in the wake of WSIS, through its Task Group on E-government Indicators (TGEG), is working on the development of a global framework for measuring e-government, including recommendations on a proposed set of indicators which can form a core group to be collected by Member States. Such an approach is important in order to root out inconsistencies in definitions, methodology, reporting and monitoring of e-government indicators across — and between — national and local governments, and will lend consistency to international and national benchmarking efforts. A consistent global approach will also support the application of lessons learnt and best practices in e-government development around the world.

Based on the *Partnership*'s ongoing work, the following key indicators are proposed for measuring progress towards Target 6. The proposed indicators consider basic access to and use of ICTs in government, as well as the role of the government as a provider of public information and services. The suggestions also take into consideration the work accomplished at the regional level by the Working Group on ICT Measurement of the ECLAC Statistical Conference of the Americas (SCA-ECLAC), which has been discussing a core list of e-government indicators [OSILAC, 2009] [OSILAC, 2010]. The proposed indicators are based on a straightforward interpretation of the current wording of Target 6, and the review of the target in the following section follows this interpretation. The indicators will be further refined in due course, as part of the ongoing work of the *Partnership*.

Proposed indicators:

Connect central and local government departments
1. Percentage of government employees using the Internet
2. Percentage of government employees using computers
3. Percentage of government institutions with Internet access, by type of access (narrowband, broadband)
4. Percentage of government institutions using corporate networks (LAN, WAN, intranet, extranet)

Establish central and local government websites
5. Percentage of central government institutions with established websites[3]
6. Percentage of local government institutions with established websites[3]

Establish e-mail contact information

7. Percentage of government institutions with online e-mail contact information[3]
8. Percentage of government institutions offering online services, by type of service (interactive, transactional, connected)

Whereas proposed indicators 1-7 are self-evident, an explanatory note is required for indicator 8. Improving public-service delivery is a key objective of most e-government development programmes. The initial focus of e-government has given way to the notion of *development of coordinated services* such as one-stop shop services to citizens and businesses. In this context, it is important to assess the extent of online public services offered by countries around the world.

For the purposes of assessing the WSIS target, indicator 8 shall also be broken down by level of complexity of service and by type of service:

- Level of complexity of service:

  - *Basic level*: Accessing general information about the institutions, services offered, requirements and/or documentation; requesting information by e-mail
  - *Intermediate level*: Receiving answers to e-mail/phone inquiries; downloading forms (only); downloading and sending forms (document attachments)
  - *Advanced level*: Completing/lodging online forms; making online payments (bills, taxes, health, licences, certificates); obtaining official certificates (through certification or electronic signature).

- Type of service, for citizens and companies:

  - Paying taxes
  - Submitting requests / bids for service
  - Citizen participation (vote system, public queries)
  - Filing reports, complaints and claims
  - Health services
  - Education services
  - Social security services
  - Justice services
  - Labour mediation
  - Online training
  - Companies register
  - Other.

Status of Target 6

i) Connect central and local government departments

This component of the target is assessed by looking at the *percentage of government employees using the Internet,* the *percentage of government employees using computers*, the *percentage of government institutions with Internet access, by type of access (narrowband, broadband)* and the *percentage of government institutions using corporate networks (LAN,WAN, intranet, extranet).*

Table 6.1 presents the percentage of government entities with Internet access in 2009 for a few selected countries. As can be seen, most of them reported 100 per cent of government entities with Internet access. With regard to the adoption of newer technologies, whereas developed economies with high rates of access to ICTs such as Denmark, Republic of Korea, Singapore and the United Kingdom indicate 100 per cent access to broadband connectivity, in some countries such as Albania and Lithuania, the rate is much lower.

Internationally comparable data on the type of government connection (broadband or other), the use of networks such as LAN or WAN, and the extent to which government employees are actually using ICTs such as computers

Table 6.1: Percentage of government entities with Internet access, 2009*

Country	Any type of connection	Broadband only
Albania	93	58
Andorra	100	100
Australia	100	...
Bhutan	100	...
Bolivia	100	...
Brunei	100	100
Bulgaria	100	40
Canada	100	...
Colombia	100	...
Croatia	100	100
Czech Republic	99	94
Denmark	100	100
Djibouti	100	100
Egypt	67	49
Finland	100	...
Hungary	97	87
Korea (Rep.)	100	100
Latvia	100	...
Lithuania	100	66
Mexico	87	...
Myanmar	100	...
Nauru	100	100
Paraguay	100	60
Singapore	100	100
Thailand	100	100
Turkey	75	...
United Kingdom	100	100
United States	100	...

Note: * Or latest available year. Includes estimates. "...": data not available.
Source: ITU and national sources.

and the Internet, are scarce. While the data presented in Table 6.1 are indicative of government entities' access to Internet, it is not known how the Internet is being utilized. Available figures on Internet and broadband penetration (see the Chapter on Target 10) suggest that overall government access and use of ICTs is still rather limited in many developing countries.

The effectiveness of ICT for development is a function of the appropriate patterns of ICT use. Not surprisingly, e-government development in a government entity with only one computer connected has been found to be far less advanced than in government entities where all staff have access to computers. Similarly, how the different government entities are connected to each other is often the determinant of effective solutions in e-government.

Table 6.2: The use of ICT in government, New Zealand, 2008

Organization size (No. of employees)	No. of responding organizations	Servers	Desktops/laptops
< 50	10	41	294
50-99	6	79	479
100-499	36	1 503	10 079
500-999	14	1 570	8 730
1000-4999	29	6 243	53 616
5000 or more	10	4 878	68 516
Organization type			
Central government	93	11 726	124 723
State-owned enterprise	12	2 588	16 991
Overall	105	14 314	141 714

Source: New Zealand State Services Commission report. Government Use of ICT 2008. http://www.e.govt.nz/resources/research/ict-survey-2008/govt-ict-survey-2008.pdf. p 16. Accessed 22 November 2009.

Comparable data on the use of ICTs in government are rare. A few surveys, mostly in developed countries, offer pointers to the use of ICTs in national governments. For example, the New Zealand Government Use of ICT Survey 2008 provides information about the state of ICT use in order to inform government decisions and monitor progress in how ICTs are supporting the goals of efficiency in government (Table 6.2). The survey was administered by the State Services Commission and covered 163 state-sector organizations. Of these, 144 were central government organizations and 19 state-owned enterprises. The overall response rate was 64 per cent, but was somewhat higher for larger organizations (95 per cent for organizations with more than 1 000 employees and 22 per cent for organizations with less than 50 employees). The results illustrate that, after the initial rush by countries to adopt ICTs in government, a more systematic effort is being made at this second stage to ascertain how ICTs are being used by government departments and ministries. Though sporadic, these surveys suggest that, thus far, the potential synergies created by use of ICTs in governments have been exploited only to a limited extent.

ii) Establish central and local government websites

Setting up a website is the entry point for governments to move online, and a basis for developing more sophisticated online services. The indicator comprises *the percentage of central government departments with established websites* and the *percentage of local government departments with established websites.*

Central government departments

A review of progress on the establishment of central government websites shows that the pattern of e-government development in the last few years has been one of expansion and consolidation. Considerable progress has been made by governments worldwide since the second phase of WSIS in Tunis towards providing information and services through the use of ICTs. As e-government services have continued to expand around the world, website assessment indicates that the majority of the UN Member States have vigorously embraced electronic service delivery. Progress on achievement of the WSIS goal of establishing national websites has been rapid. Based on the UNDESA survey findings, at the level of central governments, no fewer than 189 of the 192 UN Member States had set up government websites by 2009 (Table 6.3).

In most developed countries, online presence was initially characterized by the development of a national homepage as the point of entry. As e-government endeavours advanced, this gave way to integrated portals, in some cases with enormous amounts of information and services. Often entitled the *Official Government site, Gateway to Government*, or *Government Electronic Portal*, the evolution of these integrated portals in the

Table 6.3: Countries with government websites, 2003 and 2009

	2003	2009
Countries with central government websites	173	189
Countries without central government websites	18	3
Total UN Member States	191	192*

Note: *On 28 June 2006, Montenegro was accepted as a United Nations Member State, bringing the total UN Member States to 192.
Source: [UNDESA, 2003] and [UNDESA, 2010].

past few years reflects increasing attention to user-friendliness for the convenient delivery of information and services.

In some cases, national portals were consolidated in conjunction with standalone websites as an increasing number of countries opted to establish separate, but connected, e-government portals, providing a one-stop-shop window for easy access to all public services. For example, in 2005, the Government of Malta had two separate websites aimed at different sets of users: one providing information, and one offering online services. Since then, the country has moved forward in consolidating its online services into an integrated portal bringing together all e-government services and offering quick, convenient and personalized access to public electronic services.

Some countries have opted for one national site as the main gateway, with links to other service delivery portals aimed at different users (for example the U.S. FirstGov portal, http://www.firstgov.gov, and in Singapore, http://www.gov.sg).

In another model of e-government, some countries have implemented national online presence with separate portals designed to offer different access points for different audiences. For example, Norway has the official government site, described as *your gateway to the public sector in Norway* (http://norge.no), and another government website for *information from the government and the ministries,* (http://www.regjeringen.no) which provides public information and services on a wide range of issues such as agriculture, asylum and refugee policy, taxes, the economy, etc.

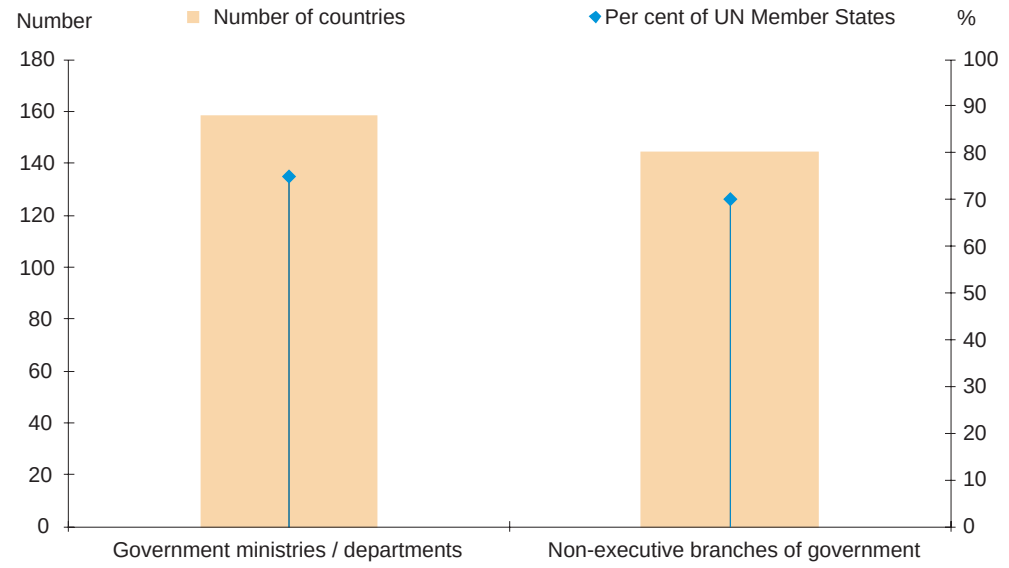
Many developing countries have also chosen this audience-targeted portal approach. For example, Mauritius (http://www.gov.mu) has set up dedicated subportals for citizens and the business sectors.

In some countries, instead of the national government website or portal serving as a single point of entry, the Head of State website serves this purpose, with links to other departments. For example, Algeria has the President's webpage (http://www.el-mouradia.dz/francais/Sommaire.html) with links to national institutions such as the Presidency of the Republic, the National People's Assembly, the National Council and the various ministries. In other instances, Head of State websites are provided in addition to a national homepage or a national portal. By 2008, 124 countries out of the 192 UN Member States had a Head of State website, though in many cases in addition to the national government website.

In most countries, many government ministries/departments are online, too. By 2008, some 82 per cent of all countries had established one or more sectoral websites for the ministries of finance, education, health, social welfare and labour. In around three quarters of the 192 UN Member States, non-executive branches of governments were also online (Chart 6.1).

As with national homepages/central portals, there is no discernible pattern to the establishment of departmental services online. Models vary according to each country's vision, strategy and needs. Some countries have set up links to the national portal; others have done so to the Head of State website, where no national portal exists. A few have independent standalone ministry/department websites which may also serve as the country's entry point. In Angola, for example, there is no single national website; instead, there are standalone websites for the National Assembly, the Constitutional Commission, the National Police, the National Bank of Angola, the Radio and the TV, and several ministries.

Chart 6.1: Government ministries and departments with a website, 2008



Source: [UNDESA, 2008].

Table 6.4: Government ministries connected to the national homepage, 2009

	Number of ministries linked to the national homepage			
	0	1-5	6-10	More than 10
Number of countries	52	13	9	118
Percentage of total	27%	7%	5%	61%

Source: [UNDESA, 2010].

The number of online departments varies across countries as well. In larger and more advanced countries, all departments are online. In developing countries where e-government has not yet fully taken root, only a few individual departments may be online, indicating little synergy. In such cases, the lack of a national website prevents countries from enjoying the benefits of e-government that would stem from effective integration of back-end ministries and departments.

In this context, a review carried out by UNDESA of Member States' progress in interlinking ministries and other government departments shows a mixed picture (Table 6.4). While there has been much progress in establishing websites, less appears to have been done in linking together government departments to improve their combined efficiency and enhance synergies. For example, whereas the majority (61 per cent) of countries had more than 10 ministries/departments connected to the country's homepage or main portal, in almost one-third of the countries none were connected, and another seven per cent had only one to five ministries connected. This suggests that efforts to link up various government departments are still at an early stage worldwide.

Local government departments

Whereas rapid progress has been made in establishing national government websites, the same does not hold true at the local level. At the same time, it should be noted that data on local government online are less readily available than for the national government. Local governments are simply not online, due to a lack of resources, slow implementation of the overall e-government programme or lack of an integrated e-government development. Where local governments have come online, the strategy has followed two distinct paths. Local government websites are either linked from the national webpage, or they exist as standalone sites, delivering services at the local level according to the country's constitutional and political governance.

By 2008, more than half of all countries had one or more local government sites connected via the national website (111 countries, or 58 per cent of the 192 UN Member States [UNDESA, 2008]). In many of these, especially developed countries, local-level information and services were also available via the integrated services portals, as indicated above.

Looking at the level of municipalities, [Holzer and Kim, 2007] examined digital governance in a selected number of large cities in the 100 "most wired" economies. The study evaluated the official websites of each of these cities in their native languages. In 2007, 86 of the 100 cities selected were found to have official municipal websites, and Seoul, Hong Kong, Helsinki, Singapore and Madrid achieved the highest evaluation score. The study found substantial regional disparities, even though these appear to ease somewhat over time. In 2007, 50 per cent of the cities selected in Africa had established official city websites (compared to only 29 per cent in 2005). In Asia, the figure increased from 78 per cent in 2005 to 89 per cent in 2007. By 2007, 70 per cent of the cities selected in North America had established official city websites. In Europe, South America, and Oceania, 100 per cent of the selected cities had their own official website.

iii) Establish email contact and provide online government services

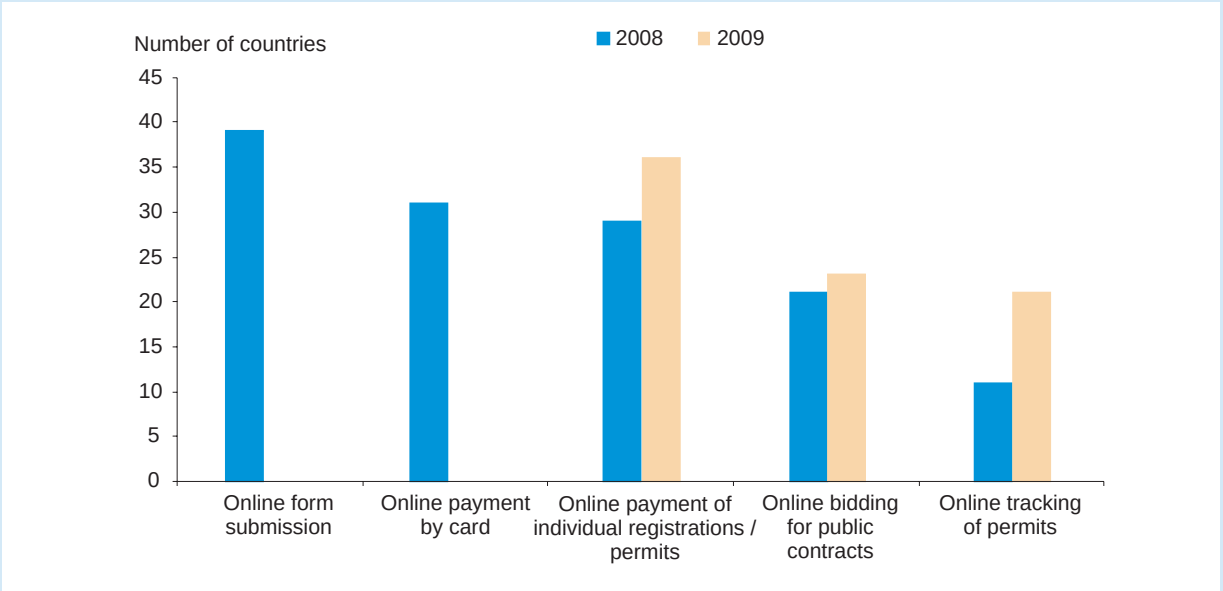
The fact that a government department has set up a website is a necessary but not a sufficient condition for effective e-government. Effective e-government is not achieved if the site does not include any information and features to promote online public services. Collecting information about the types of services offered through the websites is, therefore, crucial for assessing and identifying the potential impact of e-government. Indeed, the usefulness of a public website depends primarily on the services offered (Box 6.2).

The UNDESA Global E-Government Readiness Survey monitors the 192 UN Member States in terms of their state of e-government readiness. The survey is a comparative assessment of the willingness and ability of governments to provide information and services as they progress towards higher levels of digitized public-service delivery, and an appraisal of the use of e-government for the delivery of social services to the citizen.

The assessment of government websites is based upon a four-stage model of e-government development, which is ascending in nature, each stage building upon the previous level of a state's online services. The model defines stages of e-readiness according to the degree of sophistication of the services offered. The websites are assessed on the basis of criteria such as the range of features available on the national portal or an official homepage; links to ministries/departments; current and archived information, such as policies, laws and regulation, newsletters and downloadable databases; and more sophisticated interactive and transactional services. The stages are: *Stage I*: Emerging (where website information is mostly static and/or unidirectional, with information flowing essentially from government to the citizen); *Stage II*: Enhanced (online services of the government enter the interactive mode, with services to enhance convenience for the citizen); *Stage III*: Transactional (two-way interaction and transactional services online); and *Stage IV*: Connected (including features that allow citizens to communicate their views and opinions on public policy issues).

A review of the type of services reveals that not only have countries come online during the past few years, but they have expanded and consolidated their e-services. First-level participatory features such as contact information or e-mail are increasingly the norm, as more and more countries around the world take the first online step towards promoting transparency and accountability in the public sector and allowdirect online citizen contact with the relevant public official. By 2008, 136 countries (out of the 192 UN Member States) had e-mail information available on their national website, while additional contact information, such as telephone number/fax number, was available in 110 countries in 2008 and in 159 countries by 2009.

Chart 6.2: Selected e-government transactional services, 2008 and 2009



Source: [UNDESA, 2008,) and [UNDESA, 2010].

In regard to the more sophisticated services in *Stage III*, the availability of selected online transactional services offered by countries on their websites is presented in Chart 6.2. In 2008, online form submission was the most widely available service, being reported in 39 countries (one-fifth of all 192 UN Member States), and 31 countries offered users the possibility to make online payments with credit or debit cards. For each of the services for which two years of data are available, there is an increase in the number of countries offering them. Online tracking of permits remained the least common service, being offered in 11 countries in 2008, and 21 countries in 2009.

An important aspect of *Stage IV* (Connected) is the assessment of the government's capability and capacity to provide website features for citizen participation in public policy-making. By enhancing government's ability to request, receive and take on board feedback from constituents, policy measures can be better tailored to meet the needs and priorities of citizens. Online provision can be a catalyst for e-inclusion by offering new and better services. In other words, e-government can contribute to more participatory and potentially more democratic governance. In this context, it is important to assess how many countries are actively using ICTs for inclusive e-government. Some progress has been made in the provision of more mature e-government services (Table 6.5). However, much of this is confined to the more developed economies. Whereas a quarter of the countries have some kind of a statement of policy encouraging citizen participation, less than half of these countries actually provide mechanisms for formal consultation and only nine per cent of them provide any feedback to the citizen.

Table 6.5: Online services related to citizen participation, 2009

	Statement or policy encouraging citizen participation	Formal online consultation	Feedback on policies through the online consultation
Number of countries	53	21	18
Percentage of total	28%	11%	9%

Source: UNDESA E-Government Survey 2010.

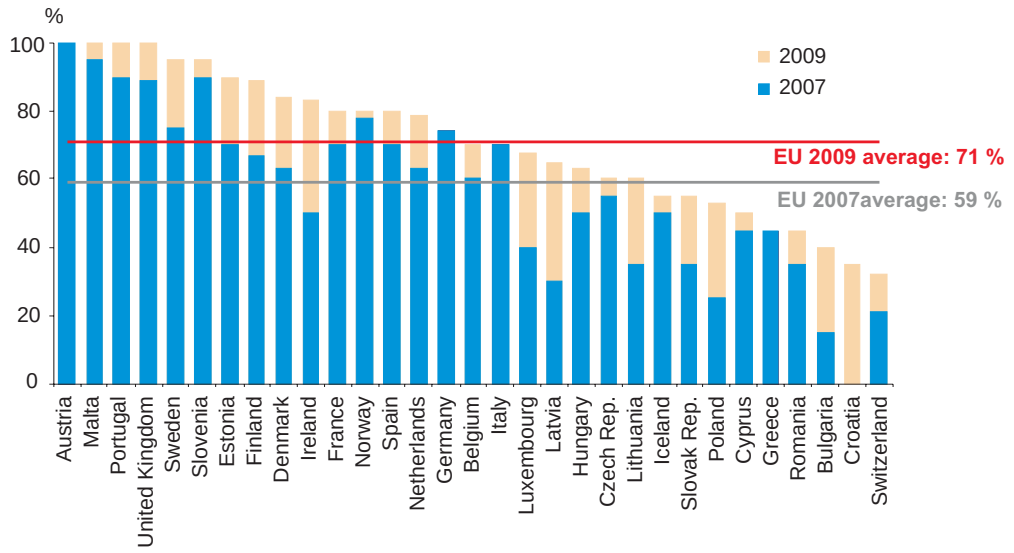
Box 6.2: The level of e-government services in the EU

The EU assesses e-government according to a five-stage maturity model reflecting the ways in which businesses and citizens can interact with public authorities. It distinguishes the following stages: (i) Information, (ii) One-way interaction, (iii) Two-way interaction, (iv) Transaction, and (v) Targetization. [European Commission, 2009]

Many European countries have already reached the third and the fourth levels, offering the possibility of two-way interactions and transactions. Examples of services on offer in these levels include the availability of electronic forms for most services, and full electronic case handling, where the user applies for and receives the service online without any additional paperwork. In the EU model, the fifth level, targetization, provides an indication of the extent to which front and back offices are integrated, data are re-used and services are delivered proactively. The fourth and fifth levels are jointly referred to as "full online availability".

A key indicator used to assess the fourth and fifth stages of the e-government maturity model is the percentage of full online availability based on 20 basic public services for citizens and enterprises, including income taxes, corporate taxes, job search services, car registration, enrolment in higher education, health-related services and social contributions for employees. The four leading European Union nations are Austria, Malta, Portugal and the United Kingdom, each having achieved 100 per cent online availability in 2009 (Chart 1 Box 6.2).

Chart 1 Box 6.2: Percentage of full online availability of 20 basic public services, Europe



Source: Eurostat, e-Government Statistics Database

Whereas most governments have developed websites and are increasingly providing public services online, less is known about how these services are being used. Information on the uptake of e-government services remains scant, but some insights can be gained from regional or country-level surveys which assess how online services are being used.

Use of government online services

How citizens and businesses have made use of online government services is illustrated in Box 6.3. The information is based on the core ICT household and business indicators developed by the *Partnership on Measuring ICT for Development* and collected at the international level by ITU, UNCTAD and Eurostat.

Box 6.3: Use of e-government services by citizens and businesses

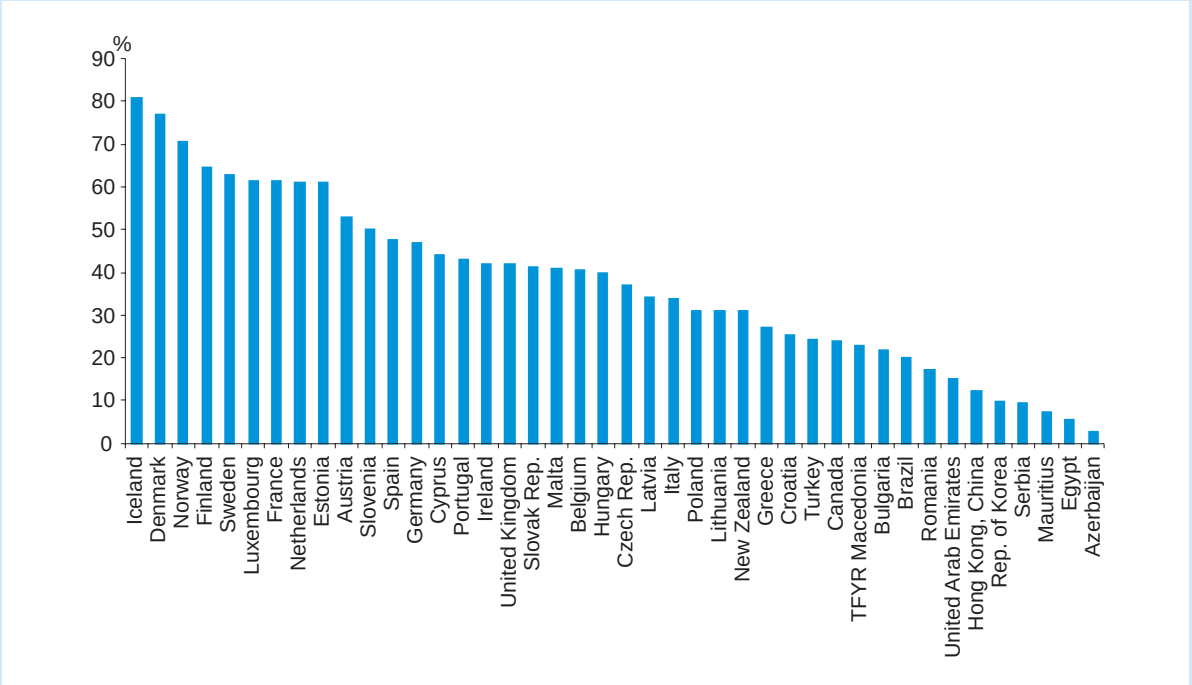
As most governments have developed websites and are increasingly providing public services online, it is important to know how these services are being used by individuals and businesses. As can be seen from Chart 1 Box 6.3, in Europe the proportion of Internet users interacting with government institutions ranges from over 80 per cent in Iceland to over nine per cent in Serbia. For non-European economies, the numbers tend to be lower, ranging from 31 per cent in New Zealand (in 2006) to close to three per cent in Azerbaijan.

In countries which are in the vanguard of e-government, the uptake of e-government by businesses is much higher than by the citizen. For businesses using government online services, a higher percentage of such enterprises interact with public administrations than do individuals, partly because businesses, in general, have greater Internet access and tend to be more connected than individuals. Since the use of ICTs for business offers the opportunity to increase efficiency, including through automation, it is to be expected that businesses use e-government services more than the citizen. In the European Union in 2008, 93 per cent of businesses (with 10 or more employees) had Internet connections, compared to 60 per cent of households.[4]

Between 2004 and 2009, the proportion of businesses in EU countries interacting with government organizations over the Internet was higher, and growing at a faster rate, than the proportion of individuals. Overall, 70 per cent of EU businesses either obtained information or downloaded official forms from government websites in 2009 (Table 1 Box 6.3). The numbers remain relatively lower for e-procurement, with less than 15 per cent of enterprises submitting a proposal using an electronic tendering system.

The use of online government services by business increases with the number of employees (Chart 2 Box 6.3), except in Iceland where enterprises with 50-249 employees made greater use of online government services than enterprises with less than 250 employees. The numbers tend to be higher in European than non-European economies for which data are available. The United Arab Emirates, New Zealand, Singapore and Brazil are among the highest ranked non-European economies.

Chart 1 Box 6.3: Percentage of Internet users interacting with general government organizations online, 2009*



Note: * Or most recent year available.
Source: ITU based on [Eurostat, 2009] and national sources.

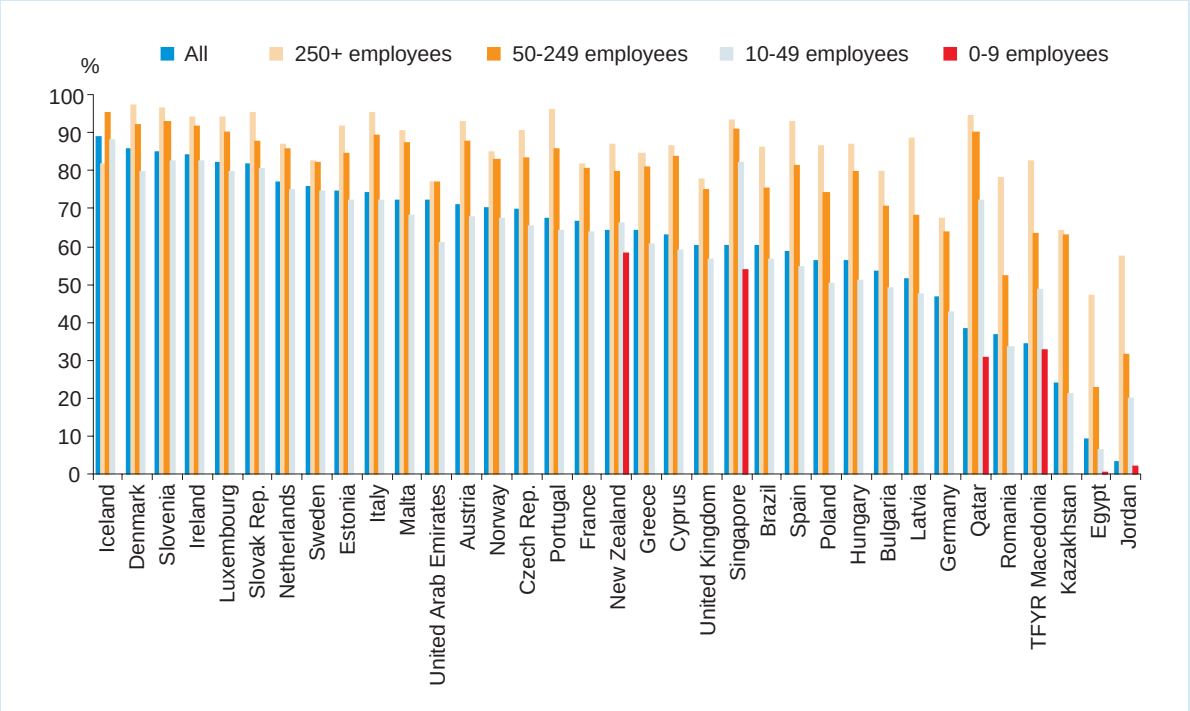
Box 6.3: Use of e-government services by citizens and businesses (continued)

Table 1 Box 6.3: Enterprises using the Internet for interaction with public authorities, EU countries, 2009

	Percentage of enterprises using the Internet				
	For obtaining information	For obtaining forms	For returning filled in forms	For full electronic case handling	For e-procurement
All enterprises	70	70	60	48	12
Large enterprises	85	84	79	63	21
Medium-sized enterprises	78	79	72	57	16
Small enterprises	62	61	51	40	10

Source: Eurostat, e-Government Statistics Database.

Chart 2 Box 6.3: Percentage of enterprises using the Internet for obtaining information from general government organizations, 2008 or 2007*



Note: * Includes estimates.
Source: UNCTAD, Information Economy Database.

Conclusions and recommendations

Recent trends in ICT use by governments point to mixed progress in e-government development worldwide. However, in terms of the use of ICTs in government institutions, for countries where data are available (mainly developed countries), most government departments have access to the Internet. Less is known about the level of Internet access in governments in the rest of the world. Among developing countries, given the relatively low Internet user/subscriber penetration it can be assumed that many government offices are not yet fully connected, in particular to broadband Internet.

Comparable data on ICT use within government departments are scarce, especially on the type and quality of the connectivity, the extent of its diffusion (for example, the proportion of staff in government departments who have been connected) and the actual use that is made of the connectivity by governments. Relatively little information exists on how ICTs are used, for example, for reforming and restructuring the interdepartmental organization of different levels of government. The lack of data on the use of ICTs by the government sector, and its impact, remains a major barrier to an effective review and analysis of e-government efforts, which would be necessary to inform policy decisions. It also limits the scope of learning from, and employing, best practices, underscoring the need to undertake representative surveys.

Considerable progress has nevertheless been made on establishing public websites, one of the main components of Target 6. Today, almost all countries have a central government website providing basic information online; most of them also have contact details; and a large number of countries are on their way to provide more sophisticated interactive and transactional services online.

While substantial progress has been made in recent years in establishing government websites, no single definitive pattern of e-government development has emerged. Assessment of countries' websites reveals a wide range of e-government strategies as evidenced by varying conceptual frameworks, online entry points, levels of features and services offered and visual representations. Even countries at a similar level of income or development appear to conduct e-government programmes differently. The common thread between the various approaches is that the wide variation among — and between — the national and departmental website offerings appears to be a function of the level of economic, technological and human resource development in a country.

Further, wide disparity remains within and between countries. A major global challenge in the utilization of e-government for economic and social development is inequitable access to and use of ICTs. Advanced countries which are in the vanguard, with successful programmes, have developed these on the solid foundations of infrastructure and human resource development. Though most developing countries have followed suit in the adoption of ICTs for public-service delivery, challenges remain in the form of weak capacity, ad hoc online presence and lack of full use of ICTs.

There is little systematic collection of local government website data. Part of the problem lies in the fact that relatively few local governments are as yet fully online. This is especially true in the developing countries, where lack of resources — financial, human and material — is a constraint. Where data exist at the local level, it is not strictly comparable across countries due to differences in the political and economic regimes of national governments which determine what service is local.

One of the challenges for monitoring the efficacy of e-government development is that most of the statistics are derived from supply-side indicators and often from website assessments alone. Little information is available yet regarding the demand side of e-government. Few surveys exist which would indicate "how" citizens use these services and "what" they see as maximizing public value. Only a few studies have been carried out, mostly in advanced economies. There is even less available in terms of impact assessment of national e-government programmes.

In order to achieve Target 6 on e-government by 2015, action needs to be taken at both the national and international levels. Specific recommendations include:

- development of a strategic framework for integrated e-government development aimed at harnessing the synergies of new technologies in government departments and entities;

- greater focus by Member States on the development and implementation of policies to increase the diffusion of ICT infrastructure, in particular broadband connectivity;

- dissemination of best practices and lessons learnt from experiences in effective e-government and e-governance worldwide;

- development and formal adoption by Member States of ICT-for-development and e-government plans that include access targets, within a holistic framework of the Millennium Development Goals;

- continued follow-up on e-government development at the local level, where data are weak and compliance is sporadic. In this context, efforts are needed at the policy and programme level by the whole range of stakeholders to support Member States in highlighting the central role played by ICTs and e-government for development, in disseminating information through various international forums on local e-government development, and in supporting capacity-building efforts for both the development of local e-government programmes and the monitoring of progress through established indicators;

- support through e-government capacity building at the national and local level for the development of a clear strategic e-government development and management framework which informs national goals and targets;

- continued monitoring and assessment of national government websites to follow up on e-government development between now and 2015.

Finally, a global agreement on a consistent framework for measuring e-government development is called for in order to avoid different meanings and interpretations by national and local governments, pave the way for the more effective adoption of best-practice solutions from around the world, and make progress in the international comparison of e-government use and development. The indicators currently developed by the *Partnership on Measuring ICT for Development* will contribute to collecting internationally comparable data that will serve to monitor e-government development and analyse its impacts.

Notes

[1] This chapter has been provided by Seema Hafeez from the United Nations Department of Economic and Social Affairs (UNDESA), in collaboration with ITU.

[2] See: WSIS Geneva Plan of Action, 2003, § 15.

[3] Indicators 5 and 7 are included here as they are considered important for a review of the target to date. However, for future monitoring of e-government, these indicators may no longer be necessary in view of the high achievement rate.

[4] Eurostat e-Government Statistics: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/E-government_statistics#Development_of_e-government_services_usage, accessed 24 November 2009.

References

European Commission (2009), *Smarter, Faster, Better eGovernment,* 8th Benchmark Measurement, report prepared by CAPGEMINI, RAND EUROPE, IDC, SOGETI and DTI for Directorate General for Information Society and Media, Brussels, November 2009.

Eurostat (2009), *Online interactions of European businesses and citizens with public administrations*, Eurostat, Luxembourg.

Holzer, M. and S.-T. Kim (2007), *Digital Governance in Municipalities Worldwide (2007): A Longitudinal Assessment of Municipal Websites Throughout the World*, The E-Governance Institute, Rutgers, the State University of New Jersey, Campus at Newark.

Observatory for the Information Society in Latin America and the Caribbean (OSILAC) (2009), "Developing e-Government indicators: Proposal for a regional list of ICT e-government core indicators," Document prepared by OSILAC, in cooperation with the Working Group on Information and Communications Technologies (ICT) of the Statistical Conference of the Americas of the Economic Commission for Latin America and the Caribbean (ECLAC), November 2009.

Observatory for the Information Society in Latin America and the Caribbean (OSILAC) (2010), "Methodological Guidelines for Core e-government indicators: ECLAC regional proposal," Document prepared by OSILAC, in cooperation with the Working Group on Information and Communications Technologies (ICT) of the Statistical Conference of the Americas of the Economic Commission for Latin America and the Caribbean (ECLAC), February 2010.

UNDESA (2003), *2003 Global E-Government Survey*, United Nations, New York.

UNDESA (2008), *2008 Global E-government Survey*, United Nations, New York.

UNDESA (2010), *2010 Global E-government Survey*, United Nations, New York.

Target 7: Adapt all primary and secondary school curricula to meet the challenges of the information society, taking into account national circumstances[1]

Introduction

The challenges faced by traditional education systems are amplified by the rapidly changing skills demanded in an increasingly globalized labour market. Insights into the direction in which information societies and technological advances are moving reveal a changing vision and a shift away from traditional practices. The impact of technological change on education calls for a critical examination of national policies, past and present. ICTs can play an important role in redefining education to respond to contemporary information society needs. Thus, there is a need to review education, from the earliest levels of schooling to the tertiary level, and to reorient and improve existing curricula so as to capitalize on technological change. This policy response will help prepare a pool of competent and globally competitive workers.

The action lines in the WSIS Geneva Plan of Action express a clear need for capacity building and skills development in order to reap the full benefits of the information society. Teachers who are methodically trained in the fields of ICT literacy and computing are best positioned to deliver curricula that build on the development of basic computer skills in preparation for advanced studies and the labour market. As stated in WSIS Action Line C4, capacity building through e-learning initiatives will be an important precondition for the development of skills in the information society:

> "*Everyone should have the necessary skills to benefit fully from the information society. Therefore capacity building and ICT literacy are essential. ICTs can contribute to achieving universal education worldwide, through delivery of education and training of teachers, and offering improved conditions for lifelong learning, encompassing people that are outside the formal education process, and improving professional skills.*"[2]

The key points within Action Line C4 pertaining to teacher training and ICT-adapted curricula are as follows:

- *Develop domestic policies to ensure that ICTs are fully integrated in education and training at all levels, including in curriculum development, teacher training, institutional administration and management, and in support of the concept of lifelong learning (§ 11a)*

- *Develop pilot projects to demonstrate the impact of ICT-based alternative educational delivery systems, notably for achieving Education for All goals, including basic literacy targets (§ 11f)*

- *Work on removing the gender barriers to ICT education and training and promoting equal training opportunities in ICT-related fields for women and girls. Early intervention programmes in science and technology should target young girls with the aim of increasing the number of women in ICT careers. Promote the exchange of best practices on the integration of gender perspectives in ICT education (§ 11g)*

- *Design specific training programmes in the use of ICT in order to meet the educational needs of information professionals, such as archivists, librarians, museum professionals, scientists, teachers, journalists, postal workers and other relevant professional groups. Training of information professionals should focus not only on new methods and techniques for the development and provision of information and communication services, but also on relevant management skills to ensure the best use of technologies. Training of teachers should focus on the technical aspects of ICTs, on development of content, and on the potential possibilities and challenges of ICTs (§ 11k).*

In addition to the WSIS Geneva Plan of Action, two other international movements calling for equal education opportunities are the *Millennium Development Goals* (MDG)[3] and the *Education for All* (EFA) goals. The EFA movement was officially launched by the international community, including representatives from 155 countries, in 1990 in Jomtien, Thailand.[4] Ten years later, in Dakar, Senegal in 2000, with many countries still far from achieving their commitments, the international community reaffirmed its support to providing Education for All, identifying six goals to be achieved by 2015. The EFA goals[5] aim to increase participation, equity and quality in schooling and lifelong learning for all, in addition to diversifying the skills supply to match the demands of the information society. While it is highly important that all of the goals be achieved, there are two EFA goals that are closely linked to the WSIS action lines, namely Goal 3 and Goal 6, which aim to enhance the quality of education and the development of essential life skills. The idea that ICT-assisted instruction can help enhance the quality of education and expand learning opportunities is one of the

Box 7.1: The six Education for All (EFA) goals

Goal 1: Expanding and improving comprehensive early childhood care and education, especially for the most vulnerable and disadvantaged children

Goal 2: Ensuring that by 2015 all children, particularly girls, children in difficult circumstances and those belonging to ethnic minorities, have access to, and complete, free and compulsory primary education of good quality

Goal 3: Ensuring that the learning needs of all young people and adults are met through equitable access to appropriate learning and life-skills programmes

Goal 4: Achieving a 50 per cent improvement in levels of adult literacy by 2015, especially for women, and equitable access to basic and continuing education for all adults

Goal 5: Eliminating gender disparities in primary and secondary education by 2005, and achieving gender equality in education by 2015, with a focus on ensuring girls' full and equal access to and achievement in basic education of good quality

Goal 6: Improving all aspects of the quality of education and ensuring excellence of all so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills

Source: UNESCO.

Box 7.2: Estonia's tiger leap from prerequisites to action[7]

In 1993, the Estonian Information Network of Education and Science (EENet)[8] was established by the Ministry of Education and Culture to improve Internet connectivity and computer training for teachers. Inspired by the early success of EENet's initiative during the early nineties, the idea of distributing Internet-connected computers throughout Estonian high schools was first envisioned and articulated by a journalist in an 1995 newspaper article. Considering Estonia's size and development trends at the time, the country was quick to embrace the idea of introducing this new paradigm and enhancing the quality of education, to join the "developed world" in a single "tiger leap." The metaphor of a tiger leap became popular and was supported by all interest groups within society, including the President of the Republic, who announced the launch of the venture in a television speech in early 1996.[9] The *Tiger Leap Foundation* was established at the end of 1996.

The main focus of the project was on the acquisition of ICT hardware, the development of data communication networks and the creation of educational software. Another important policy element was teacher education, as well as fostering a virtual environment devoted to the Estonian language, culture and heritage.[10, 11] Actual work in connecting schools to data communication networks started after the project evaluation, at the end of 1997.

By 2006, the Tiger Leap programme had succeeded in ensuring that Estonia's schools were equipped with modern ICTs (including broadband access in the vast majority of schools) and had all integrated the use of ICTs in the curriculum. The focus of the 2006-2009 plan was on the creation of e-learning content and continued improvement of curriculum quality through the use of ICTs.

stepping stones towards achieving the education-related targets in the WSIS Plan of Action and the EFA goals (for a complete list of the EFA goals, see Box 7.1).

In view of the challenges faced in meeting the WSIS, MDG[6] and EFA targets, it seems unrealistic to assume that conventional delivery mechanisms will be capable of ensuring the affordable and sustainable provision of quality and equal education opportunities for all by 2015. Indeed, the biggest challenge for many education systems is to be able to offer training or learning opportunities to traditionally underserved or marginalized groups. This includes girls and women who face barriers to schooling; rural populations that are too dispersed to populate regular schools cost-effectively with reasonable class sizes; children from families in extreme poverty; and special needs groups or persons with disabilities who have no access to learning centres.

While the lack of ICT infrastructure remains a major constraint for many developing countries, some have gone beyond connecting schools. Exemplary actions are being taken by governments in terms of policy initiatives that address the multi-faceted challenges of adapting curricula in primary and secondary schools to meet the demands of an ever-changing society (see, for example Estonia, Box 7.2)

Measuring Target 7 — Proposed indicators

Monitoring curricula at the international level in relation to Target 7 can be understood in two ways. On the one hand, monitoring will track the *outputs* of ICT-adapted curricula. Almost all existing data on outputs in education are derived from sample-based international comparative assessments which rely on direct measurement of ICT use in schools and curricula by students and teachers (see Box 7.3). On the other hand, and of prime importance for Target 7, monitoring must also focus on measuring the *inputs* required in order to gear curricula to the needs of the information society. An evaluation over time of the requisite human and physical capital resources is essential, as these constitute the foundation for curricula that meet the changing needs of society.

A set of core ICT in education indicators that measure aspects of e-readiness and access to ICT in education systems was submitted by the *Partnership on Measuring ICT for Development* to the United Nations Statistical Commission (UNSC) at its 40th session in February 2009 [Partnership, 2010]. As a response to the need to expand the initial core list, UIS has established the international Working Group for ICT Statistics in Education (WISE). The purpose of the working group is to bring together statisticians (national focal points) from ministries of education (or national statistical offices) from 25 countries around the world to pilot the international *Questionnaire on Statistics of ICT in*

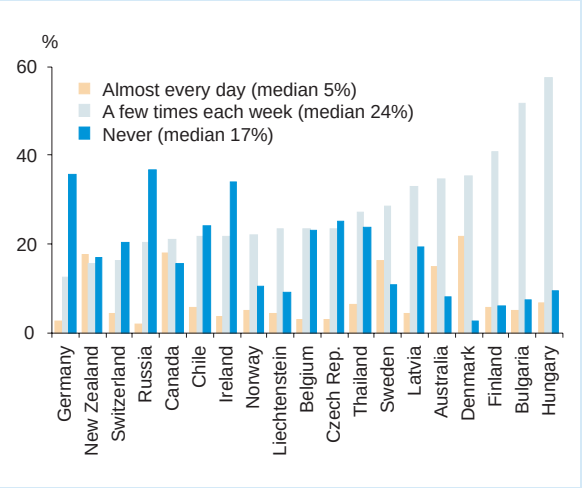
Box 7.3: The use of ICT in curricula — A review of selected comparative assessments

The International Association for the Evaluation of Educational Achievement (IEA) has performed international comparative assessments which focus on measuring student achievement in mathematics, science and reading, and include modules on ICT use by students and teachers as part of the curriculum. Examples of these studies include the Progress in International Reading Literacy (PIRLS)[12] and the Trends in International Mathematics and Science Study (TIMSS).[13] One of the first sample-based assessments aiming exclusively at measuring the use of ICT in education was the Second Information Technology in Education Studies (SITES). Initiated in 1997, SITES is a research programme focused on comparative assessment of ICT use in education across many countries.[14] In addition to cross-national data collection, qualitative case studies of innovative pedagogical practices were also undertaken.[15] SITES 2006 is the third project in the series.[16] Another important study is the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment (PISA). The programme, which is a standardized international assessment targeting the performance of 15-year old students, includes a specific module that examines ICT use by students [OECD, 2006].

The growing prevalence and integration of technology for education over time shows that steps have been taken to bridge the digital divide in education. In Charts 1 and 2 of Box 7.3, a comparison between the years 2000 and 2006 reveals an overall increase in the frequency of use of computers at school for 15 year-old students. The median proportion of students that use computers every day for the same countries has risen modestly from five per cent to nine per cent, while the median value for the proportion of students that use computers once or twice a week[17] reached a relatively high level in 2006 (46 per cent). Comparison of the figures for students who have never used a computer at school in 2000 (17 per cent) and 2006 (5 per cent) points to the growing proliferation and use of computers at schools in many countries.

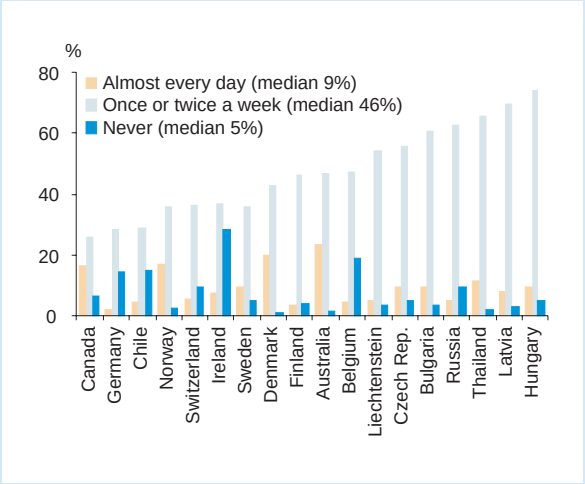
To date, international comparative student assessments remain the predominant source of information for policy questions regarding ICT use in education. These assessments are essential for identifying variables for the purposes of monitoring trends in the integration of ICTs in education.

Chart 1 Box 7.3: Frequency of computer use at school, 2000



Source: OECD PISA database

Chart 2 Box 7.3: Frequency of computer use at school, 2006



Source: OECD PISA database

Education. The following four indicators[18] suggested to monitor Target 7 in the following sections (Box 7.4) are the result of this initiative [UNESCO-UIS, 2009a]:

1. Proportion of ICT-qualified teachers in primary and secondary schools (for ISCED levels 1-3)

2. Proportion of teachers trained to teach subjects using ICT (for ISCED levels 1-3)

3. Proportion of schools with computer-assisted instruction (for ISCED levels 1-3)

4. Proportion of schools with Internet-assisted instruction (for ISCED levels 1-3)

Box 7.4: How is ICT-assisted instruction defined?

ICT-assisted instruction refers to teaching methods or models of instruction delivery that employ ICT in supporting, enhancing and enabling course-content delivery. It includes any, all or combinations of the following: radio-, television-, computer- and Internet-assisted instruction

What are ICT-related fields?

ICT-related fields include all programmes that comprise any of the following four fields of education and training [UNESCO-UIS, 2009a] [Eurostat, 1999]:

Audiovisual techniques and media production is the study of techniques and the acquisition of skills to produce books, newspapers, radio/television programmes, films/videos, recorded music and graphic reproduction with ICT. It includes programmes in methods of colour reproduction, photography and computer graphics, as well as the layout for pictures, words and decorations in the production of books, magazines, posters, advertisements, etc.

Computer science is the study of the design and development of computer systems and computing environments. It includes the study of the design, maintenance and integration of software applications.

Computer use is the study of using computers and computer software and applications for different purposes. These programmes are generally of short duration.

Electronics and automation (engineering and engineering trades) is the study of planning, designing, developing, maintaining and monitoring electronic equipment, machinery and systems. It includes designing computers and equipment for communication.

Source: [UNESCO-UIS, 2009a].

These indicators will measure the inputs or determinants required for the effective delivery of ICT-adapted curricula. Inputs in this instance refer specifically to trained teachers as well as the required conditions for the delivery of ICT-assisted instruction. They serve as the foundation for the integration of ICTs in education systems. The indicators that monitor these inputs are statistically comparable at a cross-national level, and aim to track progress towards Target 7 and the corresponding action lines identified above. At the international level, the collection and dissemination of these indicators are under the responsibility of UIS.

The stock of available human capital for teaching is seen as the hallmark for the effective delivery of any curriculum, in particular one that involves ICT-assisted instruction (for a definition of this indicator, see Box 7.4). One useful measure in monitoring the stock of human capital is thus the *proportion of ICT-qualified teachers* (or teachers trained to teach basic computer skills) in primary and secondary schools. Such a measure sheds light on the extent to which primary and secondary school teachers have the required ICT training to teach basic computer skills (or computing) classes. This indicator is part of the core list of ICT indicators identified by the *Partnership on Measuring ICT for Development* (*Partnership* indicator ED8).

A high percentage of ICT-qualified teachers among the overall teaching staff in primary and secondary schools suggests that a country aims to provide learners with basic ICT skills and to meet emerging and evolving skills requirements in the information society. This does not automatically mean, however, that basic computer skills (or computing) classes are actually offered to learners by all teaching staff who have received formal training to teach basic computer skills (e.g. in cases where certain other prerequisites — such as computer labs, basic computer skills course syllabus, etc. — are not available in schools). Besides its use for international comparison, this indicator can also be calculated and analysed at national and subnational levels (by ISCED level and grade, geographical region, urban/rural area, and public/private school) in order to design tailored policies and help implement training actions and deploy adequate numbers of ICT-trained teachers in schools.

The proportion of ICT-qualified teachers is a measure of human capital stock based on a nationally defined qualification in the core disciplines of ICT or a qualification to teach basic computer skills. The *proportion of primary and secondary school teachers trained to teach subject(s) using ICT* refers to those teachers who have received a nationally defined minimum of formal training to teach one or more subjects at the relevant level(s) using ICT to support their teaching.

A high percentage for the latter indicator can be interpreted as an appropriate measure of e-readiness. It means that teachers have been sufficiently trained to use ICTs to teach subject(s) in primary and secondary schools. When calculated by ISCED level, geographical region, urban/rural area and individual educational institution, and analysed in conjunction with other indicators, this indicator can highlight discrepancies, so that appropriate policy steps can be taken to assign trained teachers more effectively and to provide training to teachers.

Developing an informed assessment of curricula to meet the changing needs of the information society entails multiple dimensions. While targeted policies for the recommended use of ICTs in curricula and for human capital formation of teachers are vital to this assessment, other dimensions are required in order to monitor progress towards achieving the WSIS targets. In tandem with these aspects, therefore, indicators that measure the actual number or *proportion of primary and secondary schools that offer computer-assisted instruction and/or Internet-assisted instruction* provides policy-makers with a sense of the intensity or magnitude of ICT use at the school level. Internet-assisted instruction refers to an interactive learning method using the Internet to deliver instructional materials on a computer or through other devices, in accordance with learners' pedagogical needs. This mode of instruction helps to develop autonomy in research activities as well as information literacy skills. Computer-assisted instruction, which does not necessitate a cable or telephone line and is therefore more accessible, focuses more on the use of educational software and related tools in curricula, which can also increase information literacy skills.

Status of Target 7

While the results of existing surveys provide important insights into the status of school curricula, it is important to note that data for each of the four indicators proposed for measuring Target 7 are limited to about 20-25 economies.[19] Annex 7.1 provides an overview of all available data to track Target 7.

Existing figures for the *proportion of ICT-qualified teachers*[20] range from zero (in Bolivia and Nauru) to six per cent of the entire teaching force for a (limited and rather heterogeneous) selection of countries representing different regions and income levels. Data are available for two developed countries from Europe (Estonia and Lithuania). While Estonia has one per cent of ICT-qualified teachers, four per cent of teachers in Lithuania have ICT qualifications (Chart 7.1). The economies with the largest proportion of ICT-qualified teachers in all schools are Bahrain, Jordan and the Palestinian Authority. In Jordan, a country that has made ICTs a priority (see Box 7.5) the necessary qualification to teach basic computer skills in the public education system has been formalized (and is held by six per cent of teachers in public schools). All teachers that teach the subject have a formal qualification in computer science.

Nevertheless, this indicator only depicts the skilled teaching force available to deliver basic ICT skills (or computing) classes based on nationally defined standards. This does not necessarily mean that each of the teachers recorded as qualified actually teaches a basic ICT skills (or computing) course. Furthermore, in schools where there is no ICT equipment or inadequate ICT equipment, course delivery may not be effective even though the schools have teachers qualified to teach ICT. Given these limitations and the limited number of countries where data are available, it is difficult to identify an ideal percentage of ICT-qualified teachers. Much will depend, therefore, on how a country's ICT-qualified teachers are employed; but the input indicators provide a good insight into teachers' qualifications, training and potential, allow policy-makers to set targets, measure progress and make international comparisons.

Having ascertained the stock of ICT-qualified teachers that have the nationally defined qualification to teach basic computer skills, it is interesting to investigate the proportion of teachers who actually teach basic computer skills. An obvious hypothesis is that there would be a one-to-one relationship between the two groups. Indeed, Chart 7.2 shows that there is evidence in many countries of a more or less linear relationship, indicating a perfect match. Economies such as Jordan, the Palestinian Authority and Tunisia display perfect proportionality (i.e. a one-to-one ratio) between the two groups of teachers. Egypt shows a very high proportion of ICT-qualified teachers (24.5 per cent) as against only a small proportion of teachers actually teaching basic computer skills (1.9 per cent). This extremely high

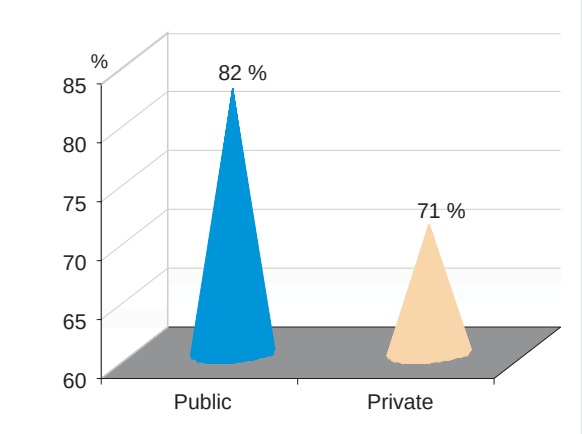
Box 7.5: Integrating ICTs in the curricula — A priority in Jordan[21]

Recognizing the importance and potential impact of the ICT sector for economic development, Jordan has made extensive efforts to achieve a high level of ICT readiness. The country has committed significant investments to reform the current education system in order to allow individuals to participate in the knowledge-based economy. Initiatives have focused on establishing and modernizing the infrastructure required to support ICT-assisted instruction. This includes the provision of Internet connectivity and computer labs that are equipped with relevant hardware and software. By 2009, 72 per cent of learners were entitled to use Internet laboratories at school as a pedagogical aid. Along with the development of electronic content, teacher-training initiatives were also deployed to complement teaching and learning processes with the use of ICTs.

By 2009, 80 per cent of schools in Jordan had Internet-assisted instruction (IAI) — 71 per cent of private schools and 82 per cent of public schools. Computer-assisted instruction (CAI) is practiced in 86 per cent of schools — 95 per cent of private schools and 83 per cent of public schools (see Charts 1 and 2 of Box 7.5).

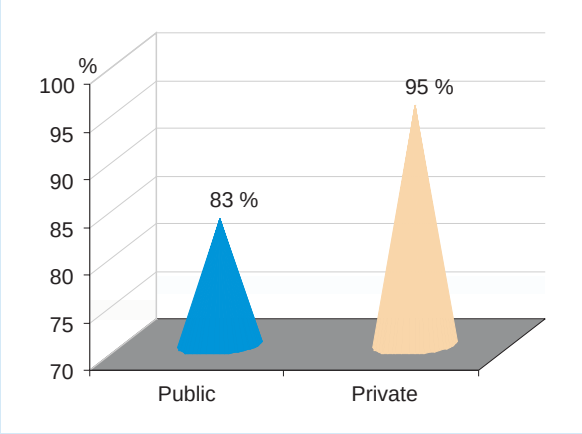
Substantial advances have also been made in terms of teacher training. By 2009, all teachers who teach subjects involving computer literacy have a bachelor's degree in computer science. Overall, ICT-qualified teachers make up six per cent of the teaching force, and the proportion of teachers trained to teach subject(s) using ICT facilities is 62 per cent. The proportion of female teachers trained is 37 per cent, compared to 26 per cent for men (Chart 3 Box 7.5). The ratio of learners-to-"teachers using ICT to teach" is 26:1 (31:1 in public schools and 16:1 in private schools).

Chart 1 Box 7.5: Proportion of schools with Internet-assisted instruction, Jordan, 2009



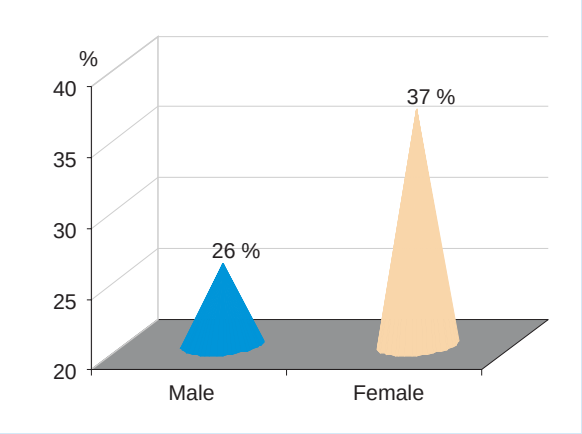
Source: Jordan Ministry of Education.

Chart 2 Box 7.5: Proportion of schools with computer-assisted instruction, Jordan, 2009



Source: Jordan Ministry of Education.

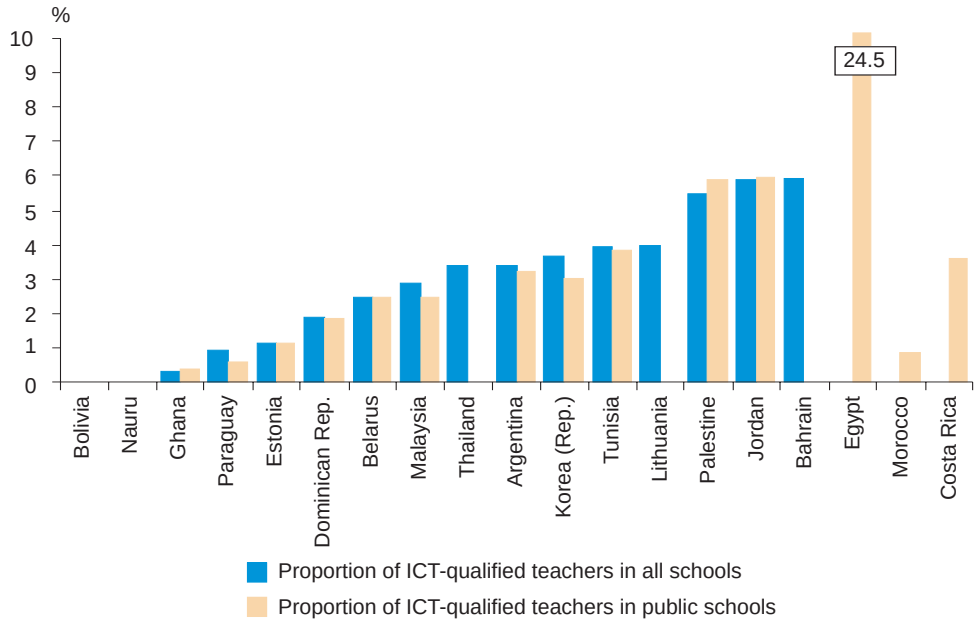
Chart 3 Box 7.5: Proportion of teachers trained to teach subjects using ICTs, Jordan, 2009



Source: Jordan Ministry of Education.

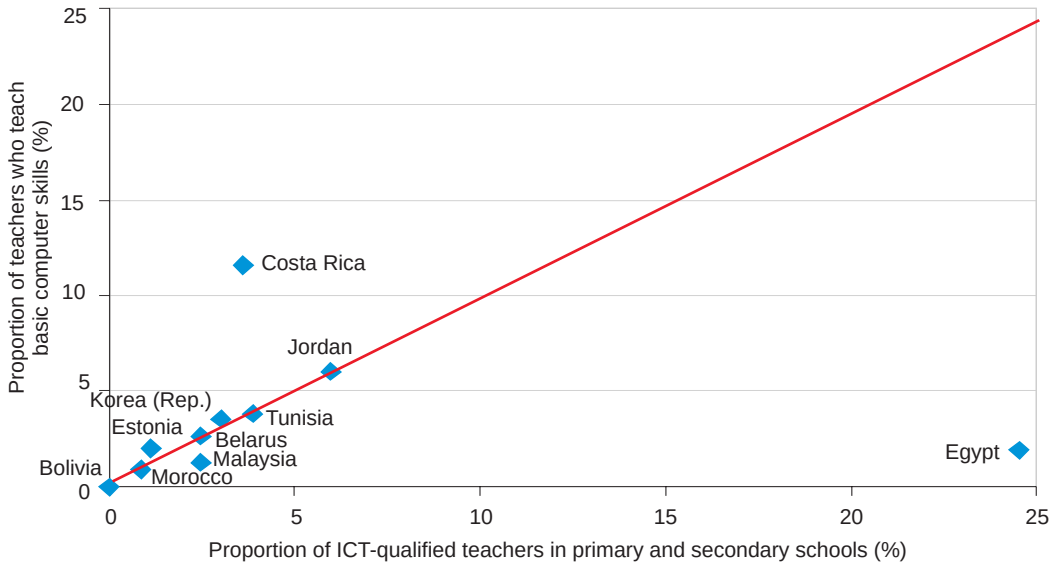
proportion of trained teachers in Egypt is attributed to a government policy by the Ministry of Education that sponsors teachers to take the International Computer Driving Licence.[22] This internationally recognized certification helps develop candidates' computer skills and increases their overall level of competency in using personal computers and common computer applications.[23] Costa Rica, on the other hand, displays a different type of gap between theory

Chart 7.1: Proportion of ICT-qualified teachers in primary and secondary schools, 2008-09*



Note: *Or latest year available.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education and ITU Survey on the WSIS Targets.

Chart 7.2: Proportion of teachers who teach basic computer skills compared to the proportion of ICT-qualified teachers (in public primary and secondary schools), 2008*



Note: *Or latest year available.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education (2009).

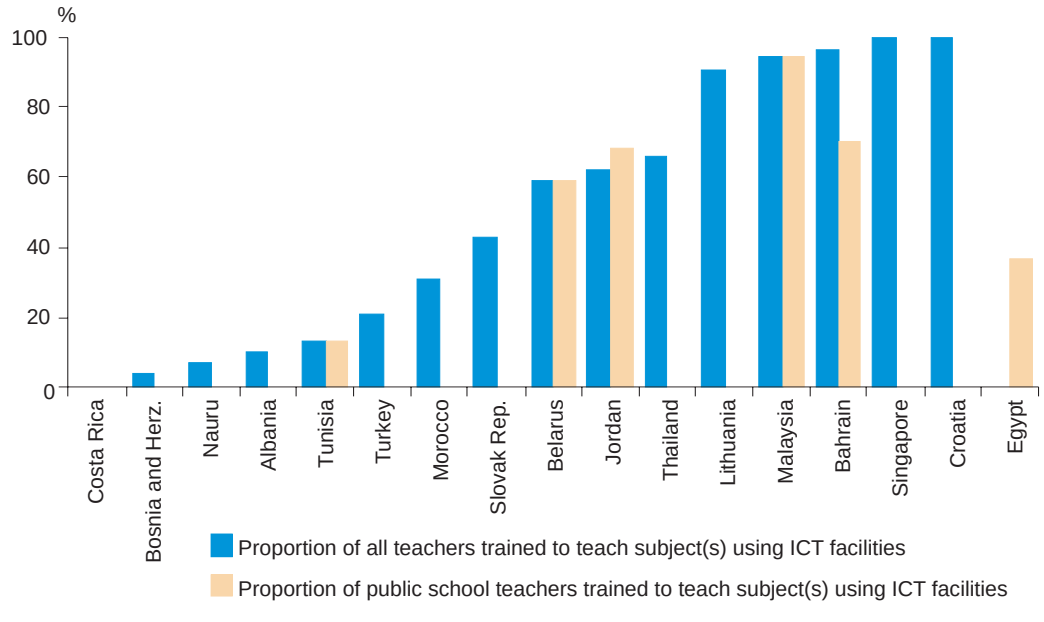
and practice: as many as 12 per cent of teachers teach basic computer skills, yet only four per cent are ICT-qualified. Conversely, figures suggest that Malaysia is not fully utilizing its pool of ICT-qualified teachers (2.5 per cent) to teach basic computer skills, since only 1.3 per cent are teaching ICT courses.

Nationally defined ICT qualifications to teach basic computer skills may differ from one country to another. While some countries may require a formal degree in an ICT-related field, others may have other forms of nationally defined certification to deliver courses in basic computer skills in their curricula.

There is significant variation in terms of the availability of teachers with formalized training in ICT-assisted instruction across the group of countries with available data. This is apparent in Chart 7.3, as the *proportion of teachers trained to teach subjects using ICT* in schools (i.e. ICT-assisted instruction) ranges from zero (in Costa Rica) to 100 per cent (in Singapore and Croatia). A high proportion of teachers are trained in the use of ICTs in both public and private schools in countries such as Jordan (62 per cent, 68 per cent), Bahrain (70 per cent, 97 per cent) Malaysia (94 per cent, 95 per cent) and Belarus (59 per cent for both). This usually reflects ongoing policies to fully integrate ICT into curricula and training programmes in these countries. For instance, under the Malaysian plan to fulfil "Vision 2020," a policy aimed at developing a critically thinking and technologically literate workforce, the Ministry of Education has successfully converted its schools into ICT-enabled "Smart Schools" through various phases beginning in 1999. The objective of the Smart Schools is to enhance the quality of education through the introduction of technology. Different multimedia technologies create the enabling infrastructure for new teaching and learning processes within the education network to link all Smart Schools.[24]

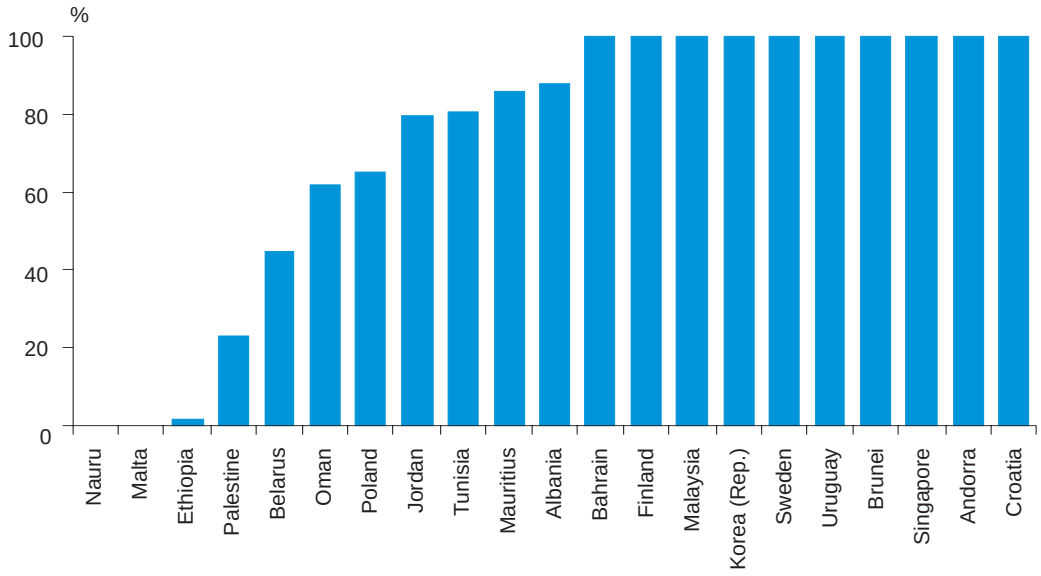
Many countries have moved beyond the initial e-readiness stage, to full penetration of Internet connectivity (see Chart 7.4), with all primary and secondary schools making use of the world wide web in their curricula (Bahrain, Finland, Malaysia, Republic of Korea, Sweden, Uruguay and the United States). In a number of developing countries, including Oman, Jordan, Tunisia and Mauritius, a relatively large proportion of schools (between 60 and 90 per cent) practise *Internet-assisted instruction*. Other countries such as Nauru, Malta, Guatemala and Ethiopia show either low or no presence of Internet-assisted instruction. Having said that, these countries may use alternative technolo-

Chart 7.3: Proportion of primary and secondary school teachers trained to teach subject(s) using ICTs, (for ISCED levels 1-3), 2008-09*



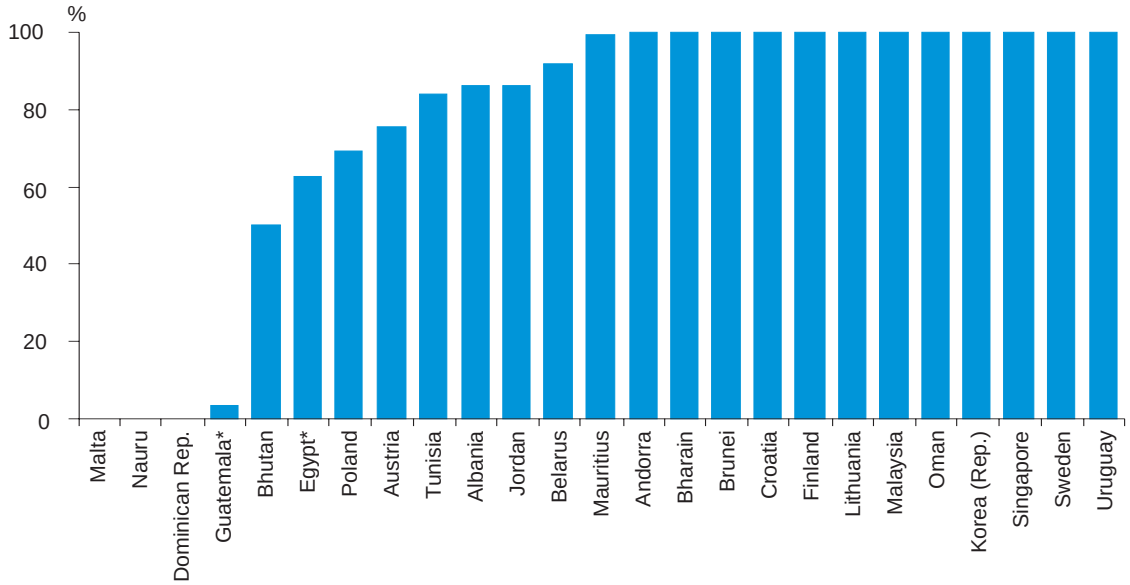
Note: *Or latest year available. Includes national estimates.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education and ITU Survey on the WSIS Targets.

Chart 7.4: Proportion of (public and private) schools with Internet-assisted instruction (for ISCED levels 1-3), 2008-09*



Note: *Or latest year available. Existing data are presented for total schools (public and private)
Source: UIS Pilot Questionnaire on Statistics of ICT in Education and ITU Survey on the WSIS Targets.

Chart 7.5: Proportion of schools with computer-assisted instruction (for ISCED levels 1-3), 2008-09**



Note: **Or latest year available. Existing data is presented for total schools (public and private), unless marked by an * which indicates only public schools.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education and ITU Survey on the WSIS Targets.

gies such as radio-, and television-assisted instruction to complement course delivery, according to national circumstances.

Chart 7.5 shows that *computer-assisted instruction* is very prevalent in a number of countries. This type of instruction is more accessible, because it does not require a cable or telephone connection. It is founded on the use of educational software and related tools in the curricula. As many as eight countries from different regions and at different levels of development indicate that they have fully adopted this mode of instruction in their schools. A country's development status does not necessarily seem to determine the level of computer-assisted instruction, since both Austria and Poland — two developed, European countries — have lower levels (76 and 69 per cent) than a number of developing countries, including Tunisia, Jordan and Mauritius. A number of countries, including Malta, Nauru, the Dominican Republic and Guatemala, report no or little computer-assisted instruction in their schools. On the other hand, these countries may have a greater prevalence of other forms of ICT-assisted instruction such as television- and radio-assisted instruction.

Conclusions and recommendations

Under the right conditions, it is believed that ICTs can have a massive impact on the expansion of learning opportunities to greater and more diverse populations, beyond cultural barriers, and outside the confines of teaching institutions or geographical boundaries [Haddad and Draxler, 2002]. Indeed, technology can improve the teaching and learning process by reforming conventional delivery systems. As a tool, ICTs enhance the quality of learning and facilitate state-of-the-art skills formation.

Guaranteeing an adequate supply of trained teachers is of critical importance and remains a major challenge confronting many countries throughout both the developing and developed world. While only a limited number of countries collect data on the *proportion of ICT-qualified teachers*, there are large variations among countries. Some entirely lack trained staff and therefore remain unprepared to adapt their curricula to the information society. Similar discrepancies exist in terms of the *proportion of primary and secondary teachers trained to teach subjects using ICT* facilities, with the proportion ranging from zero in some countries to 100 per cent in others.

Without an adequate pool of skilled teachers, adapting curricula to meet the needs of the information society is arguably unattainable. It is widely understood that ICTs by themselves cannot provide the education that learners need in order to be productive citizens in society and to contribute to the economic, social and political life of their countries. Success in implementing and leveraging ICTs in education in the conventional classroom setting is heavily dependent on teachers. Moreover, without the necessary investments in infrastructure to support a curriculum that intends to encapsulate ICT in the learning process, the formation of practical ICT skills of both learners as well as teachers is hampered. By definition, schools that do not have the supporting ICT infrastructure and ICT-trained teachers are not in a position to deliver pedagogical initiatives such as computer- and Internet-assisted instruction.

In a general sense, adapting curricula means modifying the way content is presented and delivered. It means adjusting the curriculum to ensure that all ICT-mediated content is accessible to all students. Adapting the curriculum to integrate ICTs requires emphasis on design, development and implementation of instructional approaches that provide multiple means of representation and multiple means of student engagement. The inclusion of ICTs in curriculum design means that more flexibility is required in order to be able to adjust to learners.

For the limited sample of countries for which data are available on the different forms of *ICT-assisted instruction*, the variation across countries is striking. While a number countries show evidence of an ICT-adapted curriculum in all or a majority of their primary and secondary schools, only a small proportion of schools in many developing countries have the requisite inputs to effectively integrate ICT as part of the curriculum. Countries which have adopted full-scale implementation of computer- and Internet-assisted instruction in their schools also have a relatively higher proportion of trained teachers, whereas other countries show signs that they are still in the early stages of implementation. Looking at the gap observed, albeit across the limited number of countries with available data, countries which are in the earlier stages of e-readiness can propel their progress by seizing opportunities to determine what activities or conditions are necessary, learning from more advanced countries which have employed effective models and policies for integrating ICTs in their curricula.

Indeed, to adapt school curricula to meet the challenges of the information society, and hence meet WSIS Target 7, policies must go beyond mere capital investments in ICT-related infrastructure. It is imperative that initiatives also develop ICT-skills building among the teaching force, so that the knowledge can be passed down to students. Policies for developing ICT skills among teachers act as a catalyst for adapting new curricula that prepare student populations for knowledge-based economies. While many developing countries, in partnership with the international community, must continue to commit resources with a view to achieving Target 2 (Connect educational institutions to ICTs), policy-makers must at the same time address the multi-faceted challenges of adapting curricula in primary and secondary schools to meet the demands of an ever-changing society.

Notes

1 Substantial inputs to this chapter have been provided by Mr Claude Akpabie from the UNESCO Institute for Statistics (UIS), Ms Beatriz Valdez-Melgar (UIS), Dr Khalida Shatat from the Jordan Ministry of Education and Mr Joel Peetersoo from the Estonian Ministry of Education and Research. These inputs are greatly acknowledged.

2 See WSIS Geneva Plan of Action, § 11 at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c4.

3 MDG Target 2 is to "achieve universal primary education." For more information on the target and its indicators, see: http://mdgs.un.org/unsd/mdg/Host.aspx?Content=Indicators/OfficialList.htm.

4 The movement was launched at the World Conference on Education for All in 1990 by UNESCO, UNDP, UNFPA, UNICEF and the World Bank and signed by delegates from 155 countries, as well as representatives from some 150 governmental and non-governmental organizations. For more information, see: http://www.unesco.org/en/efa/the-efa-movement/efa-goals/.

5 For an overview of the UNESCO Education for All Goals, see: http://portal.unesco.org/education/en/ev.php-URL_ID=50558&URL_DO=DO_TOPIC&URL_SECTION=201.html.

6 The latest MDG regional assessment (progress chart) highlights that a number of regions are not on track for achieving target 2 of the MDGs, see: http://mdgs.un.org/unsd/mdg/Resources/Static/Products/Progress2009/MDG_Report_2009_Progress_Chart_En.pdf.

7 The content of this box was contributed by Mr Joel Peetersoo, Analyst for Research and Development, Estonian Ministry of Education and Research. For more information on the "Tiger Leap," see: http://www.tiigrihype.ee/.

8 EENet. Akadeemilise andmeside areng Eestis, at: http://www.eenet.ee/EENet/40.html.

9 Jõesaar, A. & Muuli, K. (2005). Ilves kavandab Eestile tiigrihüpet uude sajandisse, at: http://www.eenet.ee/EENet/18.html.

10 Mattson, T. (1997). Tiiger ampsab tuleval aastal vaid 35,5 miljonit, at: http://www.postimees.ee/leht/96/09/24/kuum.htm and RISO (Estonia State Information System).

11 Aastaraamat (1996). Infotehnoloogia rakendamisest ja infosüsteemide arengust valitsusasutustes, at: http://www.riso.ee/et/pub/1996it/p3.html.

12 International Association for the Evaluation of Educational Achievements (IEA), PIRLS 2006, at: http://www.iea.nl/pirls20060.html.

13 International Association for the Evaluation of Educational Achievements (IEA), TIMSS 2007, at: http://www.iea.nl/timss2007.html.

14 International Association for the Evaluation of Educational Achievements (IEA) (1999). SITES M1, at: http://www.iea.nl/sites-m1.html?&no_cache=1&sword_list[]=m1.

15 International Association for the Evaluation of Educational Achievements (IEA), 2002, SITES M2, at: http://www.iea.nl/sites-m2.html?&no_cache=1&sword_list[]=m2.

16 International Association for the Evaluation of Educational Achievements (IEA), 2006,.SITES M3, at: http://www.iea.nl/sites20060.html?&no_cache=1&sword_list[]=m1.

17 The wording for category items in the 2000 and 2006 questionnaire modules differs. The item for weekly frequency in the 2000 questionnaire reads: "A few times each week" whereas the 2006 questionnaire item reads: "Once or twice a week."

18 ISCED refers to the *International Standard Classification of Education* and is used to define the levels and fields of education. ISCED levels 1, 2, and 3 refer to primary, lower secondary and (upper) secondary education. For more information, see [UNESCO 1997].

19 Data are based on the UIS Pilot Questionnaire on Statistics of ICT in Education (which is limited to a group of 25 economies, including the Palestinian Autonomous Territories (Palestinian Authority)), as well as on the ITU Survey on the WSIS Targets.

20 Teachers trained to teach basic computer skills (or computing) refer to teachers considered qualified according to national standards or norms to teach basic computer skills (or computing) courses. All teachers trained specifically in ICTs under pre-service or in-service schemes according to nationally defined qualification standards are counted as qualified. At higher ISCED levels, in particular, teachers trained to teach computing should have a nationally required academic credential in an ICT-related field of study, such as computer science.

21 The content of this box was contributed by Dr Khalida Shatat, Director of Studies and Technology Projects, Jordan Ministry of Education.

22 http://www.icdlegypt.gov.eg/FactsAndFigures.aspx.

23 http://www.icdlegypt.gov.eg/Inside.aspx.

24 UNESCO Bangkok (2006). Malaysia — ICT in Education: Regional and Country Overviews. UNESCO, at: http://www.unescobkk.org/education/ict/themes/policy/regional-country-overviews/malaysia/.

References

Eurostat (1999), Fields of Education and Training — Manual, Luxembourg: Eurostat.

Haddad, W.D. and A. Draxler (eds.) (2002), *Technologies for Education: Potentials, Parameters and Prospects*, Paris: UNESCO and the Academy for Educational Development (AED).

OECD (2006), Programme for International Student Assessment (PISA). Retrieved from: http://www.pisa.oecd.org/pages/0,3417,en_32252351_32236130_1_1_1_1_1,00.html.

Partnership on Measuring ICT for Development (2010), Core ICT Indicators, Geneva.

UNESCO (1997), International Standard Classification of Education, UNESCO, Paris, 1997.

UNESCO — UIS (2009a), *Pilot Questionnaire on Statistics of ICT in Education*.

WSIS (2003), Geneva Plan of Action, Geneva: ITU

Annex 7.1: ICTs in education (ISCED levels 1-3)**

Country	% of ICT-qualified teachers		% of teachers trained to teach subjects using ICT		% of schools with computer-assisted instruction		% of schools with Internet-assisted instruction	
Africa								
Ethiopia	...		...		...		2	2008
Ghana	0.3	2009	...		...		...	
Mauritius	...	...	...		99	2008	85	2008
Arab States								
Bahrain	6	2008	97	2008	100	2008	100	2008
Egypt	24.5*	2008	37*	2008	63*	2008	...	
Jordan	6	2009	62	2009	86	2009	80	2009
Morocco	1*	2008	31	2009	...		...	
Oman	...		...		100	2008	62	2008
Tunisia	4	2008	13	2008	84	2008	81	2008
Asia and the Pacific								
Bhutan	...		...		50	2008	...	
Brunei	...		...		100	No yr.	100	No yr.
Korea (Rep.)	4	2008			100	2008	100	2008
Malaysia	3	2008	95	2008	100	2008	100	2008
Nauru	0	2009	7	2009	0	2009	0	2009
Singapore	...		100	2009	100	2009	100	2009
Thailand	3	2008	66	2008	...		...	
CIS								
Belarus	2	2008	59	2008	91.8*	2008	45	2008
Europe								
Albania	...		10	2009	86	2009	88	2009
Andorra	...		...		100	2009	100	2009
Austria	...		...		76	2007	...	
Bosnia and Herzegovina	...		4	2008	...		...	
Croatia	...		100	2009	100	2009	100	2009
Estonia	1	2008	...		...		...	
Finland	...		...		100	2008	100	2008
Lithuania	4	2009	91	2009	100	2009	99	2009
Malta	...		...		0	2009	0	2009
Poland	...		...		69	2008	65	2008
Slovak Republic	...		43	2008	...		...	
Sweden	...		...		100	2008	100	2008
Turkey	...		21	2009	...		...	
The Americas								
Argentina	3	2007	...		...		...	
Bolivia	0	2008	...		...		...	
Costa Rica	4*	2008	0	2008	...		...	
Dominican Republic	2	2008	...		0	2008	...	
Guatemala	...		...		3*	2009	...	
Paraguay	1	2008	...		...		...	
Uruguay	...		...		100	2008	100	2008
Other Economies								
Palestinian Authority	5	2009	...		...		23	2009

Note: ** The reference year is indicated for each data point. Existing data are presented for total schools (public and private), unless marked by an *, which indicates only public schools. "...": data not available.

Source: UIS Pilot Questionnaire on Statistics of ICT in Education and ITU Survey on the WSIS Targets.

Target 8: Ensure that all of the world's population have access to television and radio services[1]

Introduction

Target 8 specifically addresses the need to take advantage of broadcasting technologies — often referred to as "older" or traditional ICTs — to help countries move towards the information society. In some countries, broadcasting technologies will complement newer ICTs, while for others, especially those at early stages of ICT development, they might represent a valid alternative when newer technologies are not available or affordable.

Making radio and television (TV) services widely available is important for enhancing national identity, providing an outlet for domestic media content and informing the public about important news and information. The latter element is critical in times of emergencies. Broadcasting can also serve important educational purposes by transmitting courses and other instructional material (see Target 2). Radio and television programmes are a principal source of news and information for illiterate segments of the population. They complement the printed media and are particularly important in countries where few people use the Internet, or where local online content and content in local languages are limited.

Broadcasting is mainly referred to in WSIS Action Line 9 (Media). It is essential for promoting linguistic diversity and cultural identity, given its relatively high prevalence in relation to other ICTs. One of the elements of Action Line 9 is to: "*Encourage traditional media to bridge the knowledge divide and to facilitate the flow of cultural content, particularly in rural areas*."[2]

Target 8 is also relevant to Action Line 2 (Information and communication infrastructure), since broadcasting constitutes an important part of ICT infrastructure and widespread access to broadcasting services is fundamental for reducing the digital divide. Broadcasting is also related to aspects of this action line concerning the availability of adequate and affordable ICT equipment, given that radio and TV sets are needed in order to use broadcasting services. Action Line 2 calls, moreover, for encouraging and promoting "*traditional media*."[3]

Broadcasting can provide content relevant to local cultures and languages, thus linking Target 8 to Action Line C8 (Cultural diversity and identity, linguistic diversity and local content), one element of which is also to: "*Give support to media based in local communities and support projects combining the use of traditional media and new technologies for their role in facilitating the use of local languages, for documenting and preserving local heritage... and as a means to reach rural and isolated and nomadic communities...Enhance the capacity of indigenous peoples to develop content in their own languages*."[4] Broadcasting is arguably better placed than newer media to fulfill these roles, in view of the wider dissemination of broadcast devices in developing countries compared to Internet access.

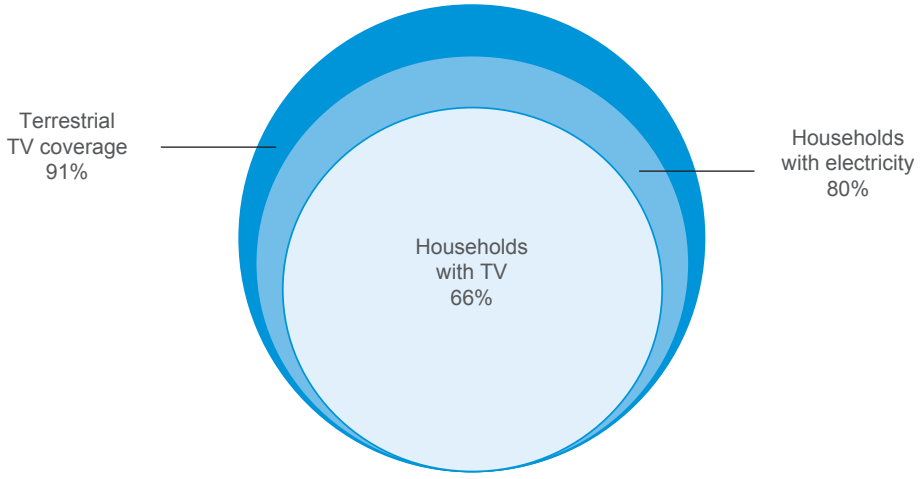
Although much of the discussion surrounding Action Line C3 (Access to information and knowledge) refers to newer technologies, traditional ICTs such as broadcasting are important for disseminating "*information and knowledge almost instantaneously*."[5]

Measuring Target 8 — Proposed indicators

A literal reading of Target 8 presents three methodological challenges. The first is that television and radio service is a general term. In the past, it would have meant access to analogue terrestrial broadcasting transmissions using a traditional radio or television set. Today's digital world has multiplied the possibilities. Some countries are migrating away from analogue, to digital terrestrial television, while in most developed nations and many developing ones a majority of households are receiving multichannel TV broadcasting via coaxial cable or direct-to-home (DTH) satellite networks (and more recently over broadband Internet connections). The ability to receive digital multichannel broadcasting has significant quality and content advantages compared to analogue over-the-air transmissions.

A second complication is the term access. Access implies the ability to receive a broadcasting signal and would be measured by the population within range of the signal. This has typically been measured on the basis of terrestrial access, but today satellites serve the whole world and provide ubiquitous coverage, and signals can be received by small satellite dishes. While coverage is important to determine if the prerequisite conditions for access exist, a radio

Figure 8.1: Television coverage and percentage of households with electricity and television, South Africa, 2007



Source: Adapted from SABC, Statistics South Africa.

or TV set is also essential to make use of the service. Furthermore, in the case of television, some form of electric current is also needed (e.g. minimally equivalent to the power of a car battery). Figure 8.1 illustrates the relationship between coverage, electricity and television set availability in the case of South Africa.

The third methodological concern relates to the unit of access. The target refers to *population*. While it can be useful to measure the percentage of the population who can listen to or view broadcasting, in practice this kind of data is not widely available across countries. While some broadcasting markets measure audience shares in terms of the number of people listening to or watching a service, this does not capture the total potential market.

A more common and almost universally available measure is the percentage of *households* that have a broadcast device. This information is typically asked for in censuses and household surveys. It has been a useful measure of access, since broadcasting is often a shared experience among family or friends. Furthermore, the existence of a broadcasting receiver in a household suggests that different family members have access. Having said that, the personalization of ICTs is resulting in more *individual* possession and usage of media devices. It is common in developed nations and high-income developing-country households to find more than one broadcasting receiver. What is now different is that individuals increasingly possess their own devices, such as mobile phones or laptop computers, which are also capable of receiving terrestrial broadcasting signals or streamed broadcasts over the Internet (Box 8.1).

Box 8.1: Broadcasting and the Internet

Broadcast-like services are continually evolving on the Internet. Some are extensions of traditional broadcasting, such as conventional radio or television stations with websites that feature streaming of audio or video programmes (i.e. webcasting). Others are unique to the Internet, such as Internet-only broadcast stations.

There are thousands of Internet radio stations. In 2008, some 33 million people in the United States listened to Internet radio stations at least once a week [Arbitron, 2008]. Many stations offer podcasts, providing users an opportunity to listen to the broadcast at a different time. Internet-only radio stations have been affected by copyright and licensing disputes with record labels, which have had an impact on their growth.[6]

A growing number of television broadcasters provide back episodes of popular programmes on their websites. Some broadcasters' websites also offer live programming, particularly for sporting events. Hulu, a US-based joint venture of several broadcasting companies, offers thousands of videos.[7]

There is also a lot of unique audio and video on the Internet that does not fit into the traditional broadcasting realm. One of the most popular is YouTube, which started as a peer video upload site but now also has mainstream broadcasters such as BBC posting content.[8]

While the Internet initially took ideas from broadcasting and applied them to the Internet, the reverse is now increasingly true. Some broadcasters flash their website across their programmes indicating where users can go for past episodes or more information about the programme. Multichannel TV operators have picked up on peer video such as YouTube by allowing subscribers to upload self-produced videos, which can be downloaded from on-demand channels.

The popularity of the Internet for watching video is growing. In Germany, for example Internet users watched 6.4 billion videos on the Internet in August 2009 alone.[9] The leading site was YouTube, with 2.7 billion videos viewed. Half of the top ten sites were those of traditional broadcasters, including local TV companies SAT1 and RTL.

Traditional and new media synergies have expanded another step with the emergence of Internet-ready televisions. In addition to traditional TV, these new hybrids can also search the Internet for the viewer, and display Internet content such as YouTube videos.[10] Users that do not have Internet-ready televisions can access films and videos from rental sites over the Internet using streaming devices.

So far, no Internet-only site has established a reputation for originally created news and information through their own network of correspondents around the world and professional studios. Traditional broadcasters are desperately trying to strengthen their web presence or strike collaborative deals with Internet sites in order to pre-empt this from happening. Inexpensive digital cameras and camera phones would make it easy to get content from collaborators around the world, but thus far Internet-only broadcasters lack the credibility that traditional media outlets enjoy.

Another consideration is community broadcast experiences in developing countries, where TV and radio access may be available in public institutions such as a community centre or school. Data at the household level may therefore understate the true reach of broadcasting in a country. However, data that would measure public access at a national level is practically non-existent.

The indicators and definitions that the international community uses to measure basic access to broadcasting service are the *proportion of households with a radio* and the *proportion of households with a TV*. These data are widely collected in censuses and household surveys. There are various nuances to the data that can affect their accuracy but at this time are not considered to cause serious comparability issues. For example, households may have televisions in areas without terrestrial broadcasting coverage and use them only to watch prerecorded material on video recorders or DVDs or to connect to game stations. Radio and TV reception chips can be embedded in electronic equipment such as mobile phones, computers or music players, or reception devices can be installed in the USB ports of computers.

It is important, however, to go beyond simple household ownership of a radio or TV, and to track the availability of multichannel television services. "Multichannel" refers to the ability to receive more than just analogue terrestrial free-to-air channels. Multichannel services can be provided by digital terrestrial television (DTT), cable television (CATV), direct-to-home (DTH) satellite or Internet-Protocol television (IPTV). Multichannel TV services are important because they provide higher-quality services and more content, important factors for increasing the demand for television services.

In some countries, these data are compiled from household surveys. In others, they are available from administrative statistics compiled by telecommunication and broadcasting regulatory authorities, industry associations or broadcasting operators. There are various nuances that affect the comparability of the data. For example, some countries consider only pay TV subscriptions, whereas there are a number of DTH systems that offer free-to-air channels and for which viewers do not need to pay a subscription charge. There are also inconsistencies in how multichannel multipoint distribution service (MMDS) (i.e. wireless pay television) subscribers are reported. In some countries, subscribers may have cable TV, but only for the rebroadcast of analogue terrestrial channels, or similarly may receive

Table 8.1: Indicators (and definitions) to monitor access to TV and radio services

Indicator	Definition
1. Proportion of households with a radio (*Partnership* indicator HH1)	A radio is a device capable of receiving broadcast radio signals, using popular frequencies, such as FM, AM, LW and SW. It includes a radio set integrated in a car or an alarm clock but excludes radios integrated with a mobile phone, a digital audio player (MP3 player) or in a computer
2. Proportion of households with a TV (*Partnership* indicator HH2)	A TV (television) is a standalone device capable of receiving broadcast television signals, using popular access means such as over-the-air, cable and satellite. It excludes TV functionality integrated with another device, such as a computer or a mobile phone
3. Proportion of households with multichannel television service, broken down by: • Cable television (CATV) service • Direct-to-home (DTH) satellite dish television service • Internet-Protocol television service (IPTV) • Digital terrestrial television (DTT)	Multichannel television refers to services that provide additional programming beyond the free-to-air analogue terrestrial channels. Multichannel TV services should be broken down by CATV, DTH, IPTV and DTT • Cable television service refers to multichannel programming delivered over a coaxial cable for viewing on television sets • Direct-to-home satellite services are received via a satellite dish capable of receiving satellite television broadcasts • Internet-Protocol TV is the delivery of multimedia services such as television/video/audio/text/graphics/data delivered over an IP-based network • Digital terrestrial television is the technological evolution and advance from analogue terrestrial television, which broadcasts land-based (terrestrial) signals

only analogue terrestrial channels through a satellite master antenna television (SMATV) system. In a few cases, the number of subscriptions may be underreported by operators in order to avoid regulatory fees or payments due to content providers, or because they are not licensed to provide service.

The three indicators identified to monitor access to TV and radio services are listed in Table 8.1. The first two are part of the Core List of Indicators adopted by the *Partnership on Measuring ICT for Development* [Partnership, 2010]. At the international level, the data collection is under the responsibility of ITU.

Status of Target 8

This section analyses the current level of radio and television coverage and household penetration around the globe. It also examines the worldwide status of multichannel television (terrestrial digital, cable, satellite and IPTV) and the emergence of mobile TV, which is not included in the list of indicators to monitor Target 8 but could be considered a useful indicator in the future. Given that TV penetration is very high in developed countries, the primary focus is on developing countries.

In respect of access to broadcast signals, Target 8 has largely been achieved. Although recent data are not available, terrestrial analogueue radio and TV coverage figures already stood at 95 and 89 per cent, respectively, in 2002. If satellites are taken into account, then practically the whole world is covered by broadcasting. For example, the WorldSpace system covers most of the world (except North America and Australia) with radio service through three geostationary satellites. The beam of its AfriStar satellite, launched in 1998, covers all of Africa and has 59 channels. There are numerous DTH satellite systems in operation around the world, offering both radio and TV channels.

Regarding the proportion of households with a radio, the majority of developed countries have stopped compiling this statistic, since penetration levels are very high (usually close to 100 per cent) and there is more interest in newer ICTs, particularly the Internet.

In the developing world, recent data on the proportion of households with a radio (Chart 8.1) show that, in the majority of countries, more than 75 per cent of households have a radio. Only few countries with available data, including Cameroon, India and Mongolia, have less than half of their households equipped with a radio.

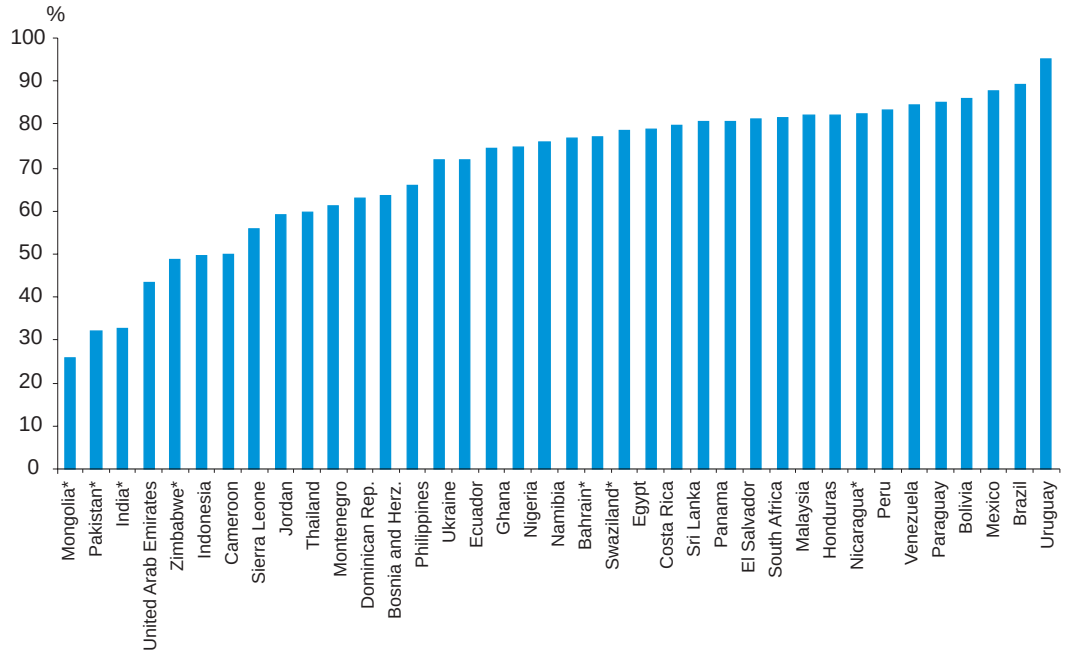
In some developing countries, the proportion of households with a radio is actually decreasing. This may partly be explained by methodological issues. While, according to the ITU definition, a radio is "*a device capable of receiving broadcast radio signals….It includes a radio set integrated in a car or an alarm clock and digital audio player (MP3 player), but excludes radios integrated with a mobile phone or in a computer*" [Partnership, 2010] , some countries still collect data only on standalone radio devices.

The decline in radios for some countries may also suggest that, if the conditions are right in terms of affordability, coverage, content and electricity, then households may prefer TV viewing over radio listening. Radio service has often been cited as the most important medium for low-income developing nations, given that it does not require electricity and radio sets are relatively inexpensive. Yet television seems to be more popular when available. Data for the Philippines, for example, show that TV is the main medium for acquiring knowledge and information even though household radio penetration was higher.[11]

The difficulty with radio statistics is illustrated by Bangladesh, a least developed country (LDC). As opposed to what may be expected, there are more households with a television in Bangladesh (30 per cent) than with radio (23 per cent) [NIPORT, 2009].[12] Adding to the confusion is the fact that more households have a mobile phone (32 per cent) than either a TV or a radio.[13] According to a study, less than a third of radios worked and only around a fifth of the population listened to the radio, compared to over 60 per cent who watched television. The study notes that this may be explained by a "*rapid increase in the opportunity to watch TV in the country and the failure of the public radio to attract people*." [Golam Nabi Jewel, 2006]

Despite the difficulties with radio statistics, radio continues to play an important role in many LDCs, particularly in rural areas where electricity is limited (see Box 8.2 and Chart 8.4).

Chart 8.1: Proportion of households with a radio, 2007-08



Note: *Data refer to 2006. Data in this chart are presented for all countries where data were available, except for LDCs since they are featured in Chart 8.4.
Source: ITU World Telecommunication/ICT Indicators database and OSILAC, ECLAC.

Box 8.2: Community radio

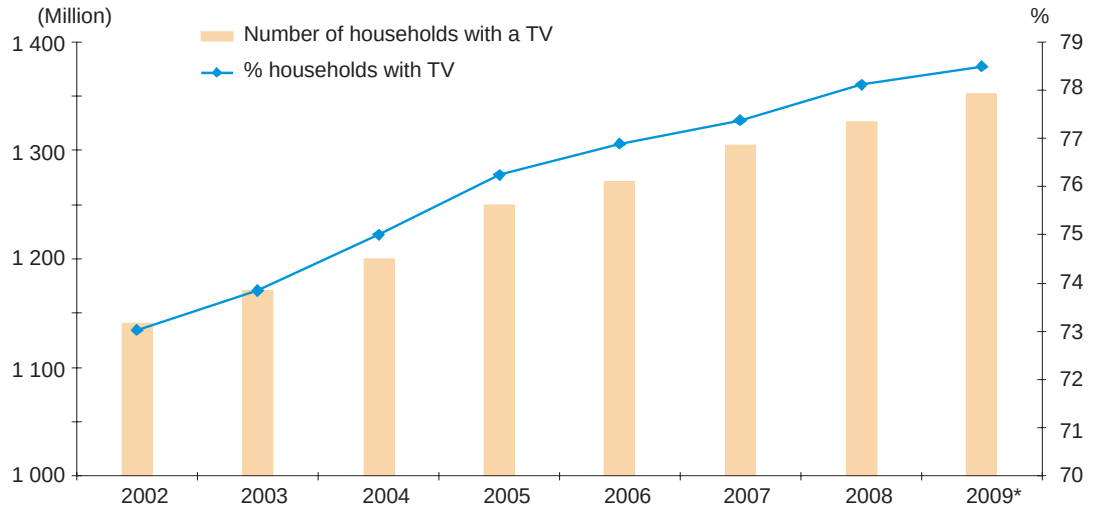
Radio remains the prevalent broadcasting device in many least developed countries (LDCs). A transistor radio does not require electricity and is cheaper than a television. There are initiatives to reduce the operating cost of a radio to near zero through devices that do not require batteries. According to Freeplay, manufacturer of a wind-up radio, people in LDCs spend on average six per cent of their income on batteries (USD 24/year).[14] Freeplay has distributed over 400 000 batteryless radios to some 40 developing countries since 2003, directly benefiting more than six million people.

While radio devices have become more affordable for the developing world, users need something to listen to, particularly since conventional radio stations may not reach rural and remote areas. In some countries, community radio has been able to fill the void. Community radio is typically programmed and operated by local people, broadcasting informative content that is relevant to those that live in the area.

Advocates of community radio point to a measurable impact on the local population in terms of improving lives through the provision of important information such as agricultural advice, as well as the power to effect positive behaviour change. For example, the Population Media Centre has community radio operations in 15 countries in Africa, Asia and the Pacific and Latin America, and reaches people through soap-opera type programmes on topics such as gender, HIV and family planning. It found that the radio programmes positively influenced behaviour and were a more appropriate and cost-effective solution than other media. [CIMA, 2007]

While some governments have a lenient attitude towards community radio, others have been more restrictive, either forbidding it or imposing restrictive licensing conditions that include high spectrum charges for the use of radio frequencies or limit the coverage area of broadcasts.[15]

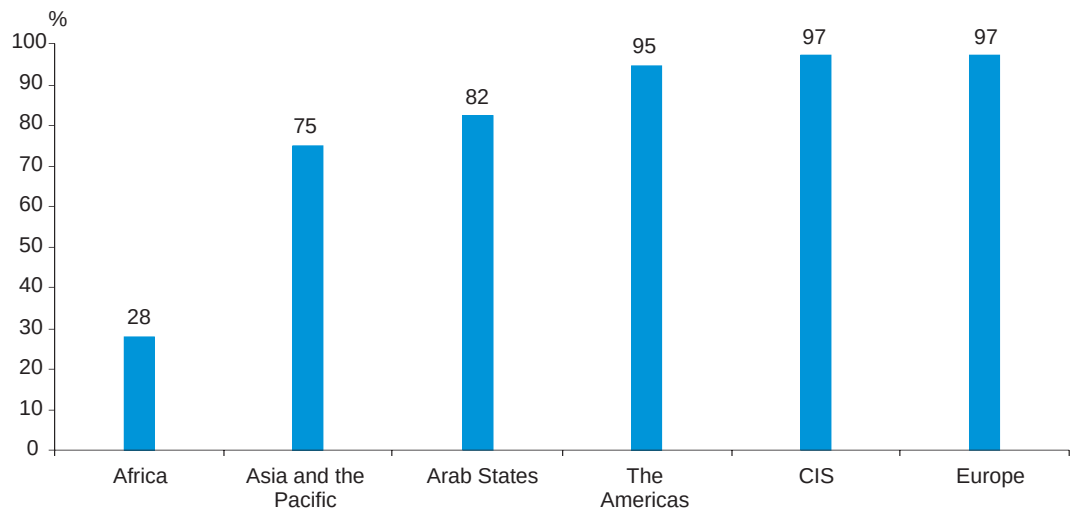
Chart 8.2: Proportion of households with a TV, 2002-2009



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

Data on the *proportion of households with a TV* are more widely available and comparable than radio data. By 2009, there were some 1.4 billion households with a TV around the world, providing some five billion people access to a TV at home.[16] This resulted in a household penetration of 79 per cent, up from 73 per cent in 2002 (Chart 8.2). Europe, the Americas and the CIS all have a household television penetration of over 90 per cent, while in the Arab States and Asia and the Pacific penetration stood at 82 and 75 per cent, respectively. Africa, where 28 per cent of households have a TV, stands out for having the lowest levels of household TV penetration (Chart 8.2).

Chart 8.3: Proportion of households with a TV, by region, 2009*

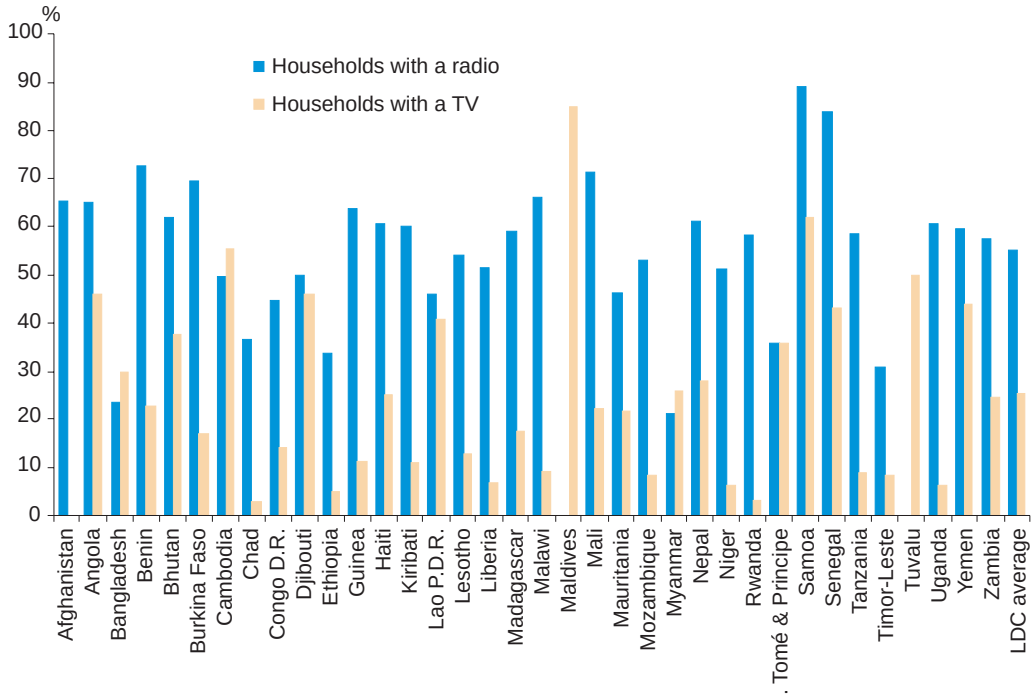


Note: *Estimate.
Source: ITU World Telecommunication/ICT Indicators database.

While many countries in the world have a higher proportion of households with a TV than with a radio, the contrary is true for most African countries and LDCs.

A comparison of the majority of the world's 50 least developed countries (LDCs) shows that radio is much more prevalent than TV. In addition, there are important differences in penetration rates among countries. They range from three per cent of households with a TV in Chad, to 86 per cent in the Maldives. The differences are smaller in terms of the proportion of households with a radio, which range from 21 per cent in Myanmar, to almost 90 per cent in Samoa, for countries where data are available (Chart 8.4). The LDC average shows that about one in three households has a TV, compared to two out of three households with a radio. Also, only ten per cent of LDCs have a

Chart 8.4: Proportion of LDC households with a radio and a TV, 2007-08 or latest available year



Note: For LDCs that are not featured in this chart, no data are available.
Source: ITU World Telecommunication/ICT Indicators database and DHS.

Box 8.3: TV in .tv (Tuvalu)

Tuvalu's some 10 000 inhabitants live on nine islands in the south Pacific with a total land area of around 25 km^2, making it one of the smallest countries in the world. The nation's Internet country code top-level domain (ccTLD) is the catchy ".tv". Tuvalu struck a deal with Internet entrepreneurs to sell the domain name in 1999 in return for the payment of USD one million every three months.[17] The idea was that television companies would be interested in having the domain. By January 2009, some 100 000 IP addresses had been assigned to the .tv domain name, including the music channel MTV and Liverpool Football Club.[18]

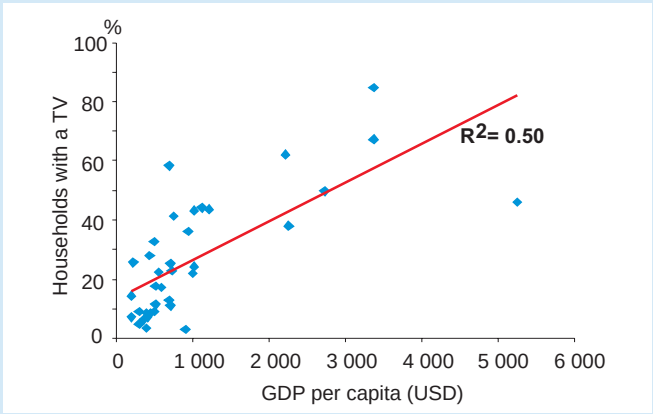
Ironically, there is no terrestrial television service in Tuvalu. Nevertheless, around half of households have a television [Tuvalu Government, 2006]. Some use satellite dishes to watch overseas networks.[19] It appears that many Tuvaluans are also using their television set to watch pre-recorded material and play games. There were just as many households with a DVD player as a TV, and 14 per cent had a PlayStation.

household television penetration higher than 50 per cent, as against half of LDCs with a household radio penetration higher than 50 per cent.

Although radio penetration is higher in LDCs, the inconsistency of the data makes it difficult to draw definite conclusions. In Laos, as household TV penetration goes up, radio — or at least possession of simple battery-powered radios — goes down:

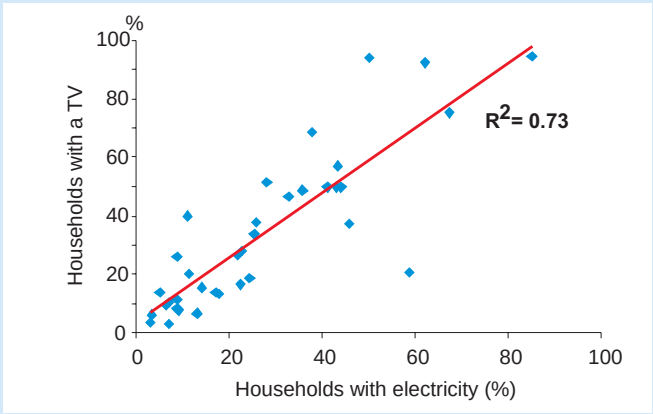
> "*Household ownership increased from 31% to 41% for televisions... At the same time, ownership of radios ... went down. This should not be viewed as a sign of impoverishment. Rather, with higher income, households substitute radios with televisions...*" [Schoenweger, 2006].

Chart 8.5: Proportion of LDC households with a TV compared to GDP per capita (USD), 2008 (or latest available year)



Source: ITU World Telecommunication/ICT Indicators database and IMF (GDP per capita data).

Chart 8.6: Proportion of LDC households with electricity, compared to households with a TV, 2008 (or latest available year)



Source: ITU World Telecommunication/ICT Indicators database and IMF (GDP per capita data).

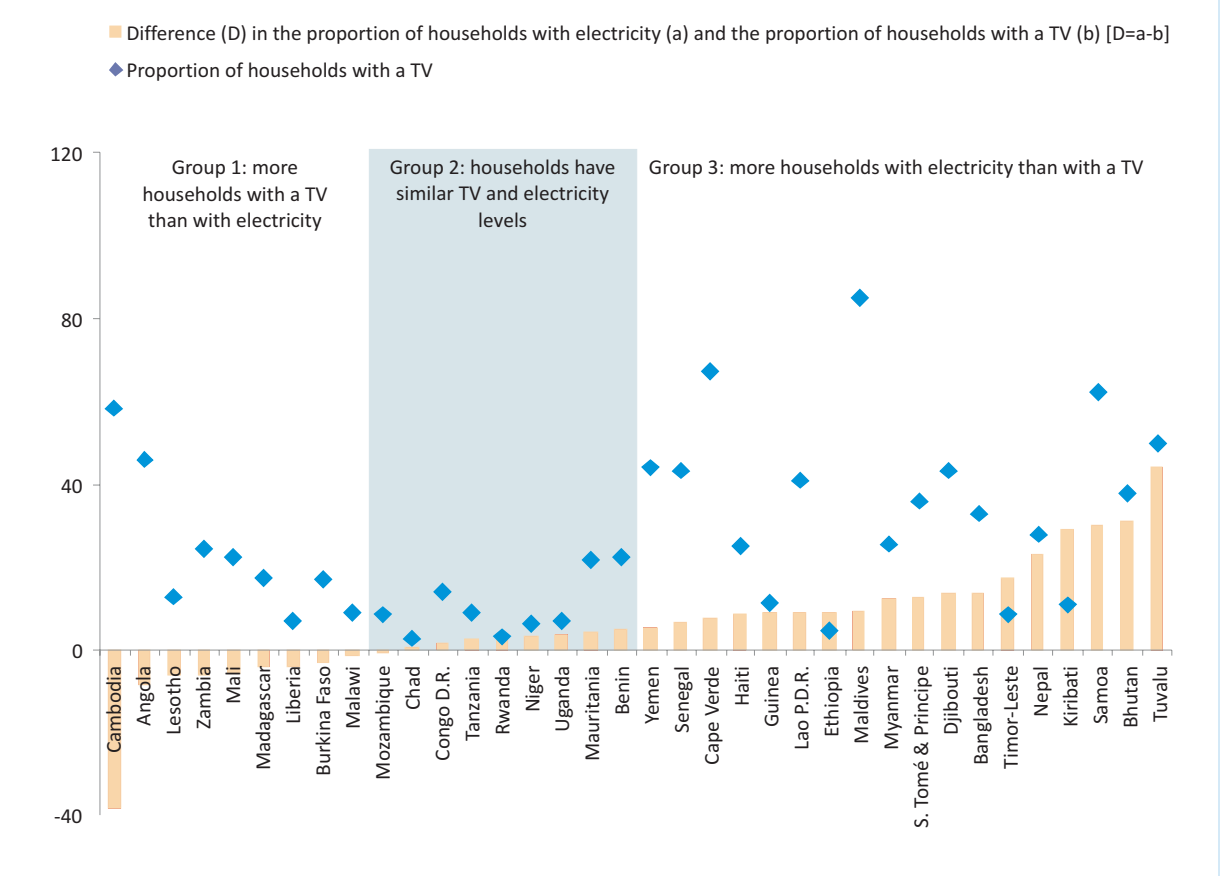
In Tuvalu, half of the households have a TV even though there is no terrestrial television (see Box 8.3).

Although LDCs are the world's poorest nations, it may be surprising that income alone does not significantly explain the lack of access to broadcasting, and seems to have less impact than other factors such as the availability of electricity and diversity of content. Statistically, there is less of a relationship between household television ownership and income in the LDCs than there is with electricity (Charts 8.5 and 8.6). The importance of electricity and its close relationship to TV is confirmed by numerous studies: TV is typically the second major reason (after lighting) that households opt for electricity.[20]

Differences in household TV penetration at similar income levels reflect the uncertainty regarding the impact of income levels. Among the LDCs, Angola is richer than the Maldives (based on 2008 GDP per capita income). Yet the Maldives has a household TV penetration of 39 per cent, higher than Angola, mainly due to the availability of electricity. Household electrification is over 90 per cent in the Maldives, compared to just 38 per cent in Angola. Another example is Cambodia, Haiti and Kiribati. They all have similar per capita incomes, yet Cambodia's household TV penetration is over twice that of Haiti and five times more than Kiribati. What is interesting about this example is that Cambodia actually has a lower household electrification rate than Haiti or Kiribati. But TV content is much more abundant in Cambodia. The country has seven terrestrial channels plus a recently launched DTH service, compared to three terrestrial channels in Haiti and no domestic television service in Kiribati. This vastly greater amount of content has driven Cambodian households to overcome a lack of grid electricity by looking for other sources to power television sets, particularly car batteries.[21]

It is instructive to examine the gap between households with electricity and households with

Chart 8.7: Gap between LDC households with electricity and households with television, %, latest available year

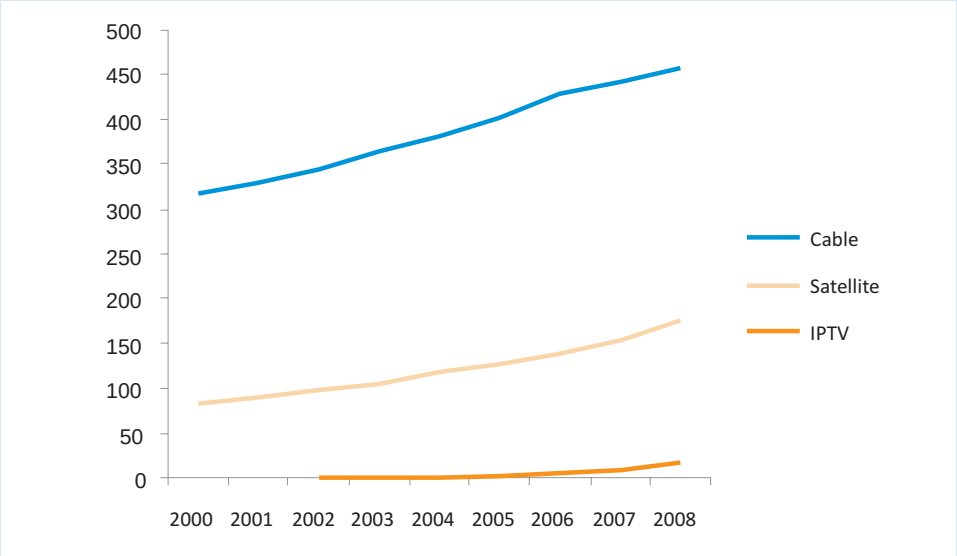


Source: ITU World Telecommunication/ICT Indicators database.

television in the LDCs (Chart 8.7). Many of the countries with the biggest gap — i.e. having a far higher level of household electrification penetration than household TV penetration — are in the Pacific, where there are few or no domestic terrestrial television stations (Group 3). Although households have the electricity to power television sets, there is not enough compelling content to encourage them to own a TV. At the other extreme are countries where household television penetration exceeds electricity (Group 1). It seems that compelling broadcast content is available to drive households to find other ways to power television sets. One such example is Cambodia, as mentioned earlier. A third group are those countries where television availability in households is close to electricity availability (Group 2). Here, the constraint seems to be both electrical and monetary. Household TV penetration rises with electricity availability, but either there is not enough compelling content, or incomes are too low to drive the demand for off-grid electricity or to raise television ownership above electricity availability. These insights about different barriers to TV uptake can help policy-makers identify barriers to higher TV penetration levels and thus make the right policy decisions.

In conclusion, it would be erroneous to assume that the broadcasting digital divide is attributable solely to income. Though income is indeed a barrier, particularly for the poorest of households (including in middle-income nations), data suggest that electricity is an even bigger barrier and that content, though difficult to quantify, also seems to play a major role. Steps to rectify the digital broadcasting divide must consider all these factors if they are to be successful.

Chart 8.8: Households with cable TV, satellite TV, and IPTV, millions, world



Source: ITU World Telecommunication/ICT Indicators database.

Multichannel television

A noteworthy trend over the last decade is the development of multichannel television. The number of households with multichannel TV rose from 400 million in 2000 to 650 million in 2008 (Chart 8.8). Around two out of five television households were multichannel in 2000, compared to almost half by 2008.

The increase in multichannel TV has contributed to an increase in content, which in turn has increased the demand for television services, as exemplified by a number of countries in South Asia (Box 8.4).

Cable, satellite, IPTV, terrestrial digital and mobile television are analysed in more detail below. While mobile television — because of its limited availability worldwide — is not included in the indicators to be tracked, it is an important technology that could be considered in the future.

Cable TV

Cable television (CATV) is the leading multichannel option, with 448 million CATV households around the world by 2008. The statistics are somewhat misleading, though, since in some instances CATV is used to retransmit terrestrial channels without adding any new programming. Also, in some of the biggest markets such as China and India, many cable subscriptions are analogue. However the cable industry has been reacting to increased competition from DTH satellite and IPTV by upgrading networks. The ability to provide broadband access has also spurred cable operators to make the necessary improvements to their technology.

China is by far the largest CATV market, accounting for some 64 per cent of the world's subscribers. Cable is well developed in the Americas, Asia and the Pacific and Europe regions, but virtually non-existent in the Arab States and Africa. There is scarce traction to invest in new cable television networks in the Arab States and Africa, given the high cost and the success of DTH satellite TV in those regions. One drawback to the non-availability of CATV is that competition is reduced in the multichannel TV market. This can result in higher prices for other options. The lack of CATV also means that high-speed Internet service deployed over cable modem will also be unavailable, which reduces inter-modal competition in the broadband Internet market.

Box 8.4: More multichannel, more content, more demand: examples from South Asia

Although the number of television households continues to grow in all developing nations, the South Asia region is particularly noteworthy. Most of the South-Asian nations were in the top ten in the absolute increase in household TV penetration between 2000 and 2008. From less than a third of households in South Asia with a television in 2000, today over half have one, including over 75 per cent in Sri Lanka and 85 per cent in the Maldives (see Table 1 Box 8.4). Factors behind this big increase in home TV availability include rising incomes in the region and the extension of electricity to more households. Another key parameter is an explosion of content that has driven household demand for television. Direct-to-home (DTH) satellite broadcasting in particular has witnessed explosive growth. Over half of the television homes in the region receive multiple channels through either cable or DTH.

India is a case in point. Although it is the world's second largest cable TV market, DTH has recorded impressive gains there. This is all the more striking considering that DTH only started in 2004. Today, the country has the most competitive DTH market in the world, with six licensees. There are 12 million DTH homes receiving digital broadcasting, compared to only one million digital cable homes (the rest are analogue systems). Some 61 per cent of India's television homes are multichannel. The government broadcaster Doordorshan has launched its own free-to-air DTH service, and all that is required to access it is a satellite dish.

Although Sri Lankan homes are second only to the Maldives in the region in terms of TV set availability, the nation has lagged behind in multichannel penetration.[22] This is beginning to change with the entry of Dialog TV, a DTH service. Launched in 2007, it had some 120 000 subscribers by the end of 2008. The set-top box and antenna cost USD 130, but payments can be spread out over a year. The subscription for the basic service, which includes 27 channels, is one of the cheapest in the world at USD 4.35 per month. Users can also customize their channel selection through numerous plans for as little as LKR 50 (less than USD 0.50).

Multichannel TV has also been on the rise on other South-Asian nations. Bhutan has 52 cable TV operators and Nepal 152, whereas the Maldives has seen an impressive rise in cable and DTH homes, from less than 10 per cent of TV households in 2000 to around 60 per cent today. In Bangladesh and Pakistan, almost a third of television homes are multichannel.

The success of the South-Asian countries reveals that low incomes need not be a barrier to greater broadcasting access. All of these nations are low-income countries, including four LDCs. The South-Asian countries still have some distance to go to achieve ubiquitous television in their households. But they have made impressive progress in this decade, a major factor being liberalization of multichannel television leading to explosive growth in content which is driving demand.

Table 1 Box 8.4: Television indicators for South Asia

Country	Households with TV (%)			Multichannel as % of TV households, 2008
	2000	2008	Change (2000-2008, or latest available year)	
Bangladesh	18	30***	12	35
Bhutan	17*	38***	21	68
India	31	55	24	61
Sri Lanka	41	77***	36	2
Maldives	57	85**	28	59
Nepal	11	28**	17	19
Pakistan	40	58	18	31
Weighted average	**30**	**53**	**23**	**55**
Simple average	**31**	**53**	**22**	**39**

Note: *Data refer to 2003. **Data refer to 2006. ***Data refer to 2007.
Source: Adapted from Demographic and Health Survey (Bangladesh, Nepal), Zee TV (India), Department of National Planning (Maldives), BLSS (Bhutan) and CASBAA (Pakistan).

Satellite

Direct-to-home (DTH) satellite broadcasting covers the world and is growing in popularity. The number of households around the world with DTH satellite dishes rose from 82 million in 2000 to 177 million in 2008.[23]

The most rapid growth has been in developing nations, where terrestrial channels are limited and cable TV is non-existent, or where cable systems are antiquated with limited channels and features. Digital satellite broadcasting also offers more channels, better quality and increased functionality compared to analogue cable. Satellite offers the possibility for most developing countries to provide nationwide broadcasting coverage. Where markets are large enough, it is cheaper to deploy DTH than to build out a cable network. Pan-regional satellite services, which are developing across the world (Box 8.5), help to achieve economies of scale and the large number of channels ensures that demand for local content is satisfied.

Though some developing countries may have too small a market to justify the launch of a national system, they could take advantage of existing regional systems. National broadcasters can arrange to have their channels made free-to-air via DTH. For example, Nilesat carries the national channels of almost all Arab countries. On the other hand, there are small markets which have been successful in launching DTH due to the economies of scale of incorporating a wider area. Fiji TV, for example, commenced analogue television operations in 1994. A decade later it had achieved 85 per cent population coverage and was catering to some 700 000 people. To cover the remaining 15 per cent would have been difficult due to their remote locations and the lack of electricity. Instead, Fiji TV launched a DTH service in 2004 called Sky Pacific, which today has 16 channels. Sky Pacific covers all of Fiji and most of the Pacific Islands, including Tonga, Samoa, Cook Islands, Kiribati, Tuvalu, Vanuatu, Solomon Islands, Nauru, Niue, Tokelau and New Caledonia. The potential market size is around 7.6 million people, over 90 per cent of the Pacific region. In one year, coverage increased from 700 000 to over seven million.[24]

IPTV

A relatively new option for multichannel television is Internet-Protocol TV (IPTV). This service is delivered over a high-speed fixed ADSL or fibre-optic connection and provided by broadband operators, directly to consumers. IPTV is a managed service, which distinguishes it from video services delivered over the public Internet. The first IPTV networks were launched in 2002. At the beginning of 2008, IPTV was being commercially offered in over 40 countries with some 9.9 million subscribers.[28]

Europe is the leading region for IPTV, accounting for half of all subscriptions at the start of 2008. IPTV currently has limited potential for wide market reach in many developing countries due to inadequate fixed broadband connections. However, the vast size of some developing countries such as Brazil or China suggests that even though relative broadband penetration is low, the sheer number of subscriptions is enough to generate interest. At the same time, although the number of broadband subscriptions may be small in other developing countries (apart from Brazil and China), IPTV has been successful in terms of take-up: Mauritius has low IPTV penetration due to the fact that only three per cent of households have broadband, but 56 per cent of those broadband customers are IPTV subscribers.

Digital terrestrial television

Digital terrestrial television (DTT) provides better quality compared to analogue broadcasting. Other benefits of DTT include additional channels, radio stations and interactive features.[29] In order to receive DTT, analogue television antennas are replaced with digital ones. Furthermore, consumers must replace analogue televisions with a DTT-capable television or purchase a set-top box. This distinguishes DTT services from cable, satellite television and IPTV, since subscribers to the latter services do not need to make a change if the service provider already transmits in digital format.[30] Given the expense of the conversion and the need to educate consumers, most governments that have adopted DTT are phasing it in over a period of several years. They typically launch an awareness campaign to inform consumers and in some cases also provide subsidies for some people to purchase DTT receivers.

At the 2006 ITU Regional Radiocommunication Conference (RRC-06), European, African and Middle Eastern nations agreed to phase in digital broadcasting. They signed a treaty agreement calling for a nine-year phase-in of digital broadcasting, beginning 17 June, 2006 with analogue broadcasts to cease in 2015. According to the press release issued at the conference:

Box 8.5: Pan-regional direct-to-home (DTH) systems targeted at developing regions

There are a number of regional DTH satellite services catering for several countries within the following regions:

- **Americas**: *DirectTV*, the largest DTH broadcaster in the United States, also offers its services in Argentina, Brazil, Chile, Colombia, Mexico, Venezuela and other Latin American countries through its *DIRECTV Latin America* (DTVLA) subsidiary, using three satellites. It has leveraged its US experience to launch features such as DVRs and HD in the region. At the same time, it has adapted to the circumstances in Latin America by launching a prepaid service, and prepaid accounted for 8 per cent of total subscribers in 2008. DTVLA had 5.6 million subscribers in 2008, including 1.6 million in Brazil and 1.8 million in Mexico. Spain's *Telefonica* and Mexico's *Telmex* also offer DTH service in some countries in the region.

- **Arab States**: There are several Pan-Arab DTH services. For example, Egypt's *Nilesat*, started in 1996, broadcasts over 450 digital TV and over 100 radio channels of which three quarters are free-to-air. One of the features of these systems is that they carry practically all of the main local terrestrial channels from the region. DTH service has proven very successful in the Arab States, with over 20 million homes (i.e. over half of all households with a TV) receiving satellite signals in 2008.[25] Factors have included a lack of cable television, synergy of a single language to leverage content and relaxed government regulation of the broadcasting industry.

- **Africa**: There are a couple of main pan-regional satellite operators in the region. Launched in 1996, South African-based *MultiChoice* provides digital broadcasting in 48 sub-Saharan countries. It operates through joint ventures in Botswana, Ghana, Kenya, Namibia, Nigeria, Tanzania, Uganda and Zambia and through agents in other countries. Its *Digital Satellite Television service* (DStv) features over 60 video channels and some 65 radio channels. It had around 700 000 subscribers in 2008 (excluding South Africa). The French *Canal+* group broadcasts around the world over several satellites, including to 23 of 29 countries where French is the official language, and is using the Eutelsat satellite for broadcasting services in sub-Saharan Africa. Direct-to-home broadcasting using 60-80 cm dishes is available in 20 western and central African countries, while programming is also available over MMDS networks or through MultiChoice in 40 African countries. There are more than 70 programmes and radio services broadcast with pricing between €8 - 65 per month. Canal+ has around 950 000 subscribers in French Overseas Departments and Africa.

- **Asia and the Pacific**: Unlike other regions, there is no major pan-regional satellite operator in the Asia and the Pacific region. One reason is that there is a greater variety of languages in the region. Another issue has been restrictive licensing policies for pan-regional operators.[26] Instead, there are a number of national DTH systems, some of which attract subscribers from neighboring countries.[27] One county where DTH has boomed is India. DTH has yet to make significant inroads into most of the predominantly Chinese-speaking economies in the region such as China, Macao (China) or Singapore.

Source: ITU research.

"*…digitization of broadcasting in Europe, Africa, Middle East and the Islamic Republic of Iran by 2015 represents a major landmark towards establishing a more equitable, just and people-centered information society. The digital switchover will leapfrog existing technologies to connect the unconnected in underserved and remote communities and close the digital divide.*"[31]

European nations had already begun the switch to DTT before 2006. Some have completed the switchover and many will have ceased analogue transmissions before 2015. Practically all Middle Eastern nations are digital-ready, insofar as the majority of their households with TVs already receive digital television through DTH satellite.

Although the Africa region was a signatory at the RRC-06, it has the lowest analogue household television penetration rates in the world and some African countries are concerned about a lack of government action for meeting the deadline.[32] The Americas and Asia and the Pacific regions have not entered into any binding treaty agreements regarding region-wide cutovers to DTT.

In Asia and the Pacific, the developed economies are on the way to full DTT migration over the next few years. China announced its DTT standard in 2007 and provided coverage in a few cities for the 2008 Olympics. In 2008, officials an-

nounced that the switchover would be completed in three to five years.[33] Although India adopted the DVB-T standard back in 1999, DTT is operational only in a few urban areas and no date has been announced for switchover. Instead, efforts seem to be focused on providing digital TV through DTH satellite.

In North America, the United States completed its DTT conversion on 12 June, 2009 when analogue terrestrial broadcasts ceased. In Canada, this is scheduled to happen on 31 August, 2011. In Latin America and the Caribbean, many countries are still in the process of selecting a DTT standard or have only recently done so. Brazil has launched DTT, with the end of analogue broadcasts scheduled for 2016.[34]

Mobile TV

The ability to transmit live radio and television programmes to mobile handsets could eventually help to increase access to broadcasting. A growing number of mobile handsets have the capability to create and display video images. The video can be created from a camera built into the handset, downloaded from digital cameras or the Internet, or streamed over mobile networks. Mobile broadcasting goes a step further, by sending live programming to the mobile handset.

Mobile handsets with radio reception chips to receive domestic analogue broadcasts have been available for some time. A more recent phenomenon is the delivery of digital TV to mobile handsets equipped with a reception chip. Japan, the Republic of Korea and the United States are the trendsetters in deploying this technology.

The Republic of Korea became the first country in the world to offer mobile TV in 2005. The service is delivered via either terrestrial or satellite digital broadcasts, using Digital Mobile Broadcasting technology (T-DMB and S-DMB)[35], to mobile handsets with a reception chip. The number of mobile TV users in the Republic of Korea stood at 17 million at the end of 2008, of whom almost two million were receiving satellite broadcasts. Many other developed countries have followed suit. In Japan, the mobile TV service was launched in April 2006. The service is known as "1-seg" because it uses one of the thirteen segments that make up the Japanese digital broadcasting standard channel — *Integrated Services Digital Broadcasting-Terrestrial* (ISDB-T).

Mobile TV was launched in the United States in 2006, with some operators partnering with *MobiTV*, which provides broadcast signals either over the existing cellular network (thus expanding the number of handsets that can be used, since a reception chip is not required) or to handsets with reception chips. *MediaFLO* is another mobile TV service that uses spectrum freed up by the digital conversion in the United States. It provides the service to mobile operators, who in turn market it to their customers. There were an estimated 11 million mobile TV viewers in the United States in 2008. [Nielsen, 2009]

In Europe, a number of countries have launched mobile TV using *Digital Video Broadcast-Handheld* (DVB-H) technology, which provides broadcasts of live digital terrestrial television channels. Countries that have launched commercial mobile TV services include Albania, Austria, Finland, France, Hungary, Italy, the Netherlands and Switzerland.

Several developing countries have launched mobile TV services (see Table 8.2) and a number are conducting trials (e.g. Ghana, Indonesia, Libya, Malaysia, Peru, South Africa, Uruguay). Ironically, some countries have launched digital mobile TV before making terrestrial digital television available.

A key consideration for the mass take-up of mobile services in developing countries will be cost. The price of a TV-capable mobile handset will inevitably be higher than that of an entry-level handset on account of the need to support video and, typically, for a TV signal reception chip. The decision will likely be based on the price of alternatives (e.g. a digital television set or computer) and the desirability of mobility. Service pricing will also be a fundamental factor. In some countries, mobile-delivered television is free, while in others there are service plans. Options such as advertiser-sponsored programming or tiered pricing (making some channels free while charging for others) might be alternatives.

Since only a limited number of countries have started launching mobile TV services by 2010 (with even fewer monitoring subscriber numbers), no indicator has been proposed. However, the number of mobile TV subscriptions or the *proportion of mobile TV subscriptions as a percentage of total mobile cellular subscriptions* could be useful indicators in the future.

Table 8.2: Mobile TV deployments, selected developing countries, status as of 2009

Country	Standard	Provider	Channels	Price	Notes
Ghana	T-DMB	Black Star, One Touch	6 video and 4 audio	Monthly subscription charge GHC 4 (USD 3.95)	Accessories and the handset necessary for viewing, known as FonTV, cost GHC 350 (USD 345.66) and include free service for the first three months.[36]
	DVB-H	DStv Mobile (MTN and Multichoice)	...	...	Accra.
India	DVB-H	Doordarshan	8	Free-to-air	Launched in May 2007. Currently available in Delhi. Initial handsets were around INR 30 000.
Iraq	DVB-H	Alsumaria TV	20 audio and video	1 month validity for IQD 18 000 (USD 15.11)	Service officially launched nationwide on 28 May 2009. Pay TV based on monthly subscriptions. Based on scratch cards (prepaid). Broadcast business model: handset not "sponsored" by the Mobile Operator (uses MicroSD cards). Covers Baghdad, Basra, Al Mousel, Diwanieh, and the Kurdistan area in Northern Iraq (Duhuk, Erbil, Sulaymanieh).[37]
Kenya	...	DStv Mobile (Multichoice and Safaricom)	10	KES 1 000 per month) (USD 12.68)	Covers Nairobi and Mombasa.
Mauritius	3G	Emtel	10	MUR 0.30 (USD 0.10) per 100 kB	Broadcasting over 3G network.[38]
	...	Orange	14	MUR 250 (USD 7.82)	MUR 2 per minute.[39]
Morocco	DVB-H	SNRT	5	Free-to-air	Launched May 2008 with coverage in Casablanca, Rabat, Oujda, Tanger and Meknès, with plans to eventually provide coverage to all areas covered by terrestrial digital TV.[40]
Namibia	DVB-H	DStv Mobile (Multichoice and MTC)	10	...	Covers Windhoek. Launched March 2008. Samsung P910 (NAD 2 499).[41]
Nigeria	DVB-H	DStv Mobile, partnership between MTN and Multichoice.	10	Subscription fee NGN 1 500 (USD 9.85) per month,	Launched April 2008. Coverage in Abuja, Lagos, Ibadan. Uses ZTE F912 handset.[42]
Philippines	DVB-H	Mobile operator Smart with MediaScape	11 TV	Monthly subscription PHP 488 (USD 10.69)	Commercial launch in April 2008. Available in Manila, Baguio, Tagaytay, Batangas, Cebu, Davao. Approximately 20 000 DVB-H enabled units. Works with Nokia N92 offered free for postpaid. For prepaid, suggested retail price of the Nokia N92 is PHP 22 990.[43]
Viet Nam	DVB-H	Operator is VTC (Viet Nam Multimedia Corporation)	9 TV and 4 radio	Monthly subscription of USD 5	Available in Hanoi, Ho Chi Minh, Haiphong. Launched December 2006.

Note: "...": no data/information available.
Source: Adapted from http://www.dvb-h.org/services.htm.

Conclusions and recommendations

The availability of broadcasting in terms of coverage is nearly complete, with practically the whole planet covered by a signal. Although gaps remain in terrestrial coverage in some countries, these are filled for by global satellite coverage.

Coverage does not count for much, however, if it is not accompanied by the ability to purchase a receiver and listen to or watch broadcasts. Here, the constraints are economic and infrastructural, and some households in developing countries cannot afford even the cheapest of radio receivers let alone a TV set. This is all the more problematic in that many of the poor live in rural areas where there may be no terrestrial coverage and where people would have to pay an even higher price for a satellite receiver. For those who can afford the set, the lack of electric current is problematic in many rural areas of developing nations, particularly for TV reception. Nonetheless, once a set is purchased, then no other payments are necessary if there is free-to-air content available terrestrially or via satellite.

In terms of the availability of devices, the target has been achieved in developed countries, since almost all households have a TV and a radio at home. Globally, penetration levels are relatively high for the proportion of households with a radio, and exceed 75 per cent in the majority of developing countries except LDCs. Only few countries, even amongst the LDCs, have less than half of their households equipped with a radio. However, time-series data suggest that the number of radio sets is decreasing in many developing regions, except for Africa and the LDCs, where a radio continues to be a very important access device. The least developed countries also continue to have higher penetration rates for radios than for TVs, contrary to many other countries.

In terms of television devices, all regions except Africa have well over half of households equipped with a TV and the target has been largely achieved in the Americas, the CIS and Europe, where penetration exceeds nine out of ten households. It should be considered that not every household may desire a television even if they meet all of the other conditions for possessing one (e.g. income, electricity, coverage). Moreover, broadcasting reception chips are being embedded in devices such as mobile handsets and computers, so some households may not need a conventional TV set. A figure in the high nineties should therefore be considered as indicating that the target is achieved. Based on the 2005-2008 compound annual growth rate, Europe, the Americas and the CIS are expected to reach a theoretical 100 per cent household penetration of television sets before 2015, with the world average reaching almost 90 per cent. Both the Arab States and the Asia and the Pacific region would surpass 90 per cent penetration by 2015, while the household television penetration in Africa would reach around 40 per cent.

The delivery of multichannel television has spread rapidly over the last decade and by 2008 almost every second household with a TV had multichannel services, compared to around two out of five in 2000. Some countries have already made the transition to digital television, while others have established deadlines for some time in the next decade. For example, Africa, the Arab States and Europe have committed to switching to digital television by 2015. However, even if many developing nations were to meet digital TV deadlines, it is unlikely that terrestrial transmission coverage will be much more extensive than today's analogue coverage, since countries only have to switch over existing transmissions rather than build out new coverage. While terrestrial digital TV provides major improvements over analogue, therefore, it will not result in drastically increased coverage.

The biggest regional gap in broadcasting access is found in Africa. However, the high averages in other regions disguise significant differences in household broadcast availability across countries. In terms of development status, the LDCs have the lowest household broadcasting penetration. Of all countries in the world with a household television penetration of less than 50 per cent, all were LDCs or African countries.

It would be erroneous to assume that the broadcasting digital divide is due purely to income. Though income is a barrier, particularly for the poorest of households (even in middle-income nations), data suggest that electricity is an even greater barrier and that content, though difficult to quantify, also seems to play a major role. As the Asian Broadcasting Union highlighted:

Viewers don't "buy" brands or technology — they "buy" content. Technology is simply the gateway to deliver entertainment services and programming.[44]

If they are to be successful, steps to rectify the digital broadcasting divide must consider all these factors, and a number of conclusions can be drawn and recommendations made.

In countries where there is a single government broadcaster and multichannel alternatives are either non-existent or prohibitively expensive or illegal, there is not much demand for television. On the other hand, where governments have adopted a liberal attitude towards broadcasting, content is more varied and households find ways to get round income or electricity constraints.

Countries could do more to encourage more content and more competition in the provision of content. In a number of countries, broadcasting stations are limited to government-run operators. Allowing the private sector also to operate stations will increase demand for broadcasting and encourage government broadcasters to offer more compelling content. Governments should also encourage more competition in the multichannel market segment. Competition is restricted in a number of countries, in different ways. Barriers include prohibiting satellite dishes and not allowing new pay-TV operators. These barriers raise the costs of existing multichannel platforms, inhibiting access for low-income population segments.

The transition to digital television offers potential benefits for consumers in terms of more available channels and special features. Although many governments are committed to moving to digital television and some have even completed the transition, it is unlikely that some developing countries will meet deadlines, in view of the cost of upgrading. At the same time, is not clear why countries would want to build out terrestrial infrastructure given the ubiquity of satellite. In India, for example, the cost of expanding terrestrial coverage would be high and take at least a decade to complete. Satellite broadcasting appears to be a more reasonable option, and the national broadcaster Doordarshan has launched a free-to-air DTH service. Some 10 000 dishes have been distributed free to public institutions such as community centres and schools in areas not covered by terrestrial broadcasting.[45]

Satellite offers the possibility for most developing countries to provide nationwide broadcasting coverage. Although some may have too small a market to justify the launch of a national system, they could take advantage of existing regional systems, or national broadcasters can arrange to have their channels made free-to-air via DTH.

Governments might also consider the use of subsidies and other options for increasing access to terrestrial digital and multichannel television, and a number of countries have subsidized digital terrestrial TV reception equipment. Multichannel operators can also contribute to making services more affordable by offering free-to-air channels, providing low-priced options and making prepaid services available.

The basic indicators proposed for measuring Target 8 — household radio and television set availability — provide a reasonable picture of access. However, there is also a critical qualitative aspect to this target. In a globalized world, it is insufficient to have access to local channels only. Therefore, the conversion to digital TV and the deployment and availability of multichannel television also need to be monitored.

Notes

1 Substantial inputs to this chapter have been provided by Michael Minges.

2 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c9.

3 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c2.

4 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c8.

5 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c3.

6 See: http://www.businessweek.com/technology/content/mar2007/tc20070307_534338.htm.

7 See http://www.hulu.com.

8 See http://news.bbc.co.uk/2/hi/business/6411017.stm.

9 See http://www.comscore.com/Press_Events/Press_Releases/2009/10/36_Million_German_Internet_Users_Viewed_More_Than_6_Billion_Videos_Online_in_August_2009.

10 See http://online.wsj.com/article/SB123111603391052641.html.

11 In 2003, household radio penetration was 71.3%, compared to 63.1% for television. See: Philippines National Statistics Office (NSO) and ORC Macro. 2004. *National Demographic and Health Survey 2003.* Calverton, Maryland: NSO and ORC Macro.

12 National Institute of Population Research and Training (NIPORT, 2007), Mitra and Associates, and Macro International. 2009. *Bangladesh Demographic and Health Survey 2007.* Dhaka, Bangladesh and Calverton, Maryland, United States: National Institute of Population Research and Training, Mitra and Associates, and Macro International.

13 A mobile operator in the country recently launched a mobile phone with an integrated FM radio as well as camera for BDT 3 199 (USD 45). "Grameenphone launches GP-branded handset," *Press Release*, 31 August, 2009.

14 See http://www.freeplayenergy.com/aid-and-development.

15 See id21insights, *Voices for change. Tuning in to community radio*, id21 insights, no. 58. November 2005. Available from: http://www.eldis.org/id21ext/publications/index.html.

16 See: http://www.itu.int/ITU-D/ict/material/Telecom09_flyer.pdf.

17 See http://archive.salon.com/tech/view/2000/07/24/dot_tv/index.html.

18 See http://ftp.isc.org/www/survey/reports/current/report.byname.

19 See http://www.mediascape.ac.nz/cms/index.php?page=tuvalu-media.

20 See http://go.worldbank.org/CBT6X32PL0.

21 According to the Cambodian Renewable Energy & Rural Electrification project, "in 85% of the villages, car batteries are the most common sources of electricity. Almost 55% of households use a battery and about 32% of the households have a B/W TV set," see: http://www.recambodia.org/energoverview.htm.

22 One reason has been a high number of free-to-air terrestrial channels with two main government-run and eight private TV stations. See BBC News. Media. Sri Lanka country profile. http://news.bbc.co.uk/2/hi/south_asia/country_profiles/1168427.stm#media.

23 Based on ITU data and data published by ASTRA (http://www.ses-astra.com) and EUTELSAT (http://www.eutelsat.com).

24 See http://www.cba.org.uk/conferences_and_events/2006_CBA_conference/documents/mesakenawari.pdf.

25 The explosion of television channels in Arab countries is leaving some viewers bewildered. See http://www.zawya.com/Story.cfm/sidZAWYA20090827040916/Ramadan%20ratings%20war%20grips%20Tunisian%20TV%20market.

26 For example, Skywave, a regional DTH subsidiary of AsiaSat, provides service in Hong Kong (China) and Macau (China) but business "*...remained static in 2008, and is expected to do so for the foreseeable future, on account of the highly restricted market in which it operates*." See AsiaSat 2008, Annual Report.

27 See http://www.dancewithshadows.com/tech/tata-sky-dishtv-dubai.asp.

28 See http://www2.prnewswire.com/cgi-bin/stories.pl?ACCT=104&STORY=/www/story/04-18-2008/0004795720&EDATE.

29 In the United Kingdom, users can receive 20 DTT channels (instead of only four with analogue television), ten radio stations and text services such as TV listings and interactivity. See http://www.digitaluk.co.uk/__data/assets/pdf_file/0008/19583/10-16-07_whitehaven_preswitch.pdf.

30 For example, Luxembourg found it easy to switch over to DTT since almost all of its households were already receiving digital signals through cable and satellite subscriptions. See www.mediacom.public.lu.

31 See http://www.itu.int/newsroom/press_releases/2006/11.html.

32 See: http://www.postzambia.com/content/view/9929/61/.

[33] See http://www.hktdc.com/info/mi/a/bacn/en/1X002ILX/1/Business-Alert-China/Digital-Terrestrial-TV-To-Cover-Entire-China-In-Three-To-Five-Years.htm.

[34] See http://www.teleco.com.br/tvdigital.asp.

[35] See http://eng.t-dmb.org.

[36] See http://www.pcworld.com/businesscenter/article/146267/ghana_is_now_home_for_digital_mobile_tv.html.

[37] See http://www.mobision.tv/en/we-are-mobision-your-mobile-tv.html.

[38] See http://emtel-ltd.com/3g.php?category=19.

[39] See http://www.orange.mu/mobile/mobile_tv.php.

[40] See http://snrt.wmaker.net/La-SNRT-deploie-le-reseau-de-la-Television-Mobile-Personnelle-DVB-H_a6986.html?print=1.

[41] See http://www.mtc.com.na/cell_pop.php?page_id=25.

[42] See http://www.mtnonline.com/index.php/dstvmobile.html.

[43] See http://smart.com.ph/gold/services/MyTV_FAQs.htm.

[44] http://www.wipo.int/edocs/mdocs/copyright/en/sccr_im_ge_09/sccr_im_ge_09_presentation5.ppt.

[45] "What is DD DIRECT+ ?," DDI News. http://www.ddinews.gov.in/DTH/DDDIRECT (accessed 4 September, 2009).

References

Arbitron Radio Listening Report (2008), *The Infinite Dial 2008: Radio's Digital Platforms*, Edison Media Research, 2008.

Nabi Jewel, G. (2006), Community Radio: Ready to launch in Bangladesh. *Bangladesh NGOs Network for Radio and Communication*, November 2006.

Centre for International Media Assistance (CIMA, 2007), *Community Radio: Its Impact and Challenges to its Development, Working Group Report*, 2007.

Central Statistics Division, Ministry of Finance, Economic Planning & Industries, Tuvalu Government (Tuvalu, 2006), *Household Income and Expenditure Survey (HIES) 2004/2005: Final Report*, September 2006.

Nielsen (2009), *Television, Internet and Mobile Usage in the U.S. A2/M2 Three Screen Report*, 1st Quarter 2009.

National Institute of Population Research and Training (NIPORT, 2009), Mitra and Associates, and Macro International, 2009. *Bangladesh Demographic and Health Survey 2007*. Dhaka, Bangladesh and Calverton, Maryland, United States.

Partnership on Measuring ICT for Development (2010), Core ICT Indicators 2010, Geneva.

Schoenweger, O. (2006), *Imported Mass Media and Communication Services and Product in the Lao PDR — Social and Economic Impacts*. UNDP, 2006. Available at: http://www.nsc.gov.la/NHDR.htm.

Target 9: Encourage the development of content and put in place technical conditions in order to facilitate the presence and use of all world languages on the Internet[1]

Introduction

Internet access is the physical precondition for being able to use the Internet and enjoy its benefits. With the rapid growth in the number of Internet users, reaching an estimated 26 per cent of the world's population by the end of 2009 [ITU, 2010], the amount of content[2] on the Internet has also been increasing, boosted by broadband Internet applications and the emergence of Web 2.0[3] and social networks. There are no agreed figures for the number of webpages,[4] but the best testimony to the incredible size of the web is the fact that search engines have now ceased indexing a significant portion of it.

Internet access is only part of the story, however. The true essence of the Internet is that it fosters communication between humans (and with networked objects), and allows them to obtain and exchange meaningful information. This raises the question of the relationship between content and users. It is imperative that all users worldwide should be able to find Internet content which is meaningful to them. Hence, this content has to be available in their mother tongue, which in turn means that content in local languages is required.

This is the issue of linguistic diversity in cyberspace addressed by WSIS Target 9. The aim is to achieve the greatest possible diversity in order to serve the online needs of people everywhere. This is a relevant and indeed pressing issue for establishing a global information society, since it is directly linked to the basic principle of equality of rights in society, and indirectly to the ecology of cyberspace.

UNESCO, which conducted the process that culminated in the *Convention on the Protection and Promotion of the Diversity of Cultural Expressions* [UNESCO, 2005], is coordinating WSIS Action Line C8, which identifies many priorities to be considered for achieving the target, including the following:[5]

- Develop and implement policies that preserve, affirm, respect and promote diversity of cultural expression and indigenous knowledge and traditions through the creation of varied information content.
- Support local content development, translation and adaptation, digital archives, and diverse forms of digital and traditional media by local authorities.
- Provide content that is relevant to the cultures and languages of individuals in the information society.
- Nurture the local capacity for the creation and distribution of software in local languages, as well as content that is relevant to different segments of population.
- Cooperate with indigenous peoples and traditional communities to enable them to more effectively use and benefit from the use of their traditional knowledge in the information society.
- Promote technologies and research in such areas as translation, iconographies, voice-assisted services and the development of necessary hardware and a variety of software models, including proprietary, open-source software and free software, such as standard character sets, language codes, electronic dictionaries, terminology and thesauri, multilingual search engines, machine-translation tools, internationalized domain names, content referencing as well as general and application software.

Some of the recommendations in Action Line C8 are directly aimed at indigenous populations, who are generally not well represented on the Internet and deserve special attention. Most of the action line refers directly to ways of fostering or encouraging the development of content (or the translation of existing content), and some provisions also address the crucial issue of software. Other WSIS targets, such as Target 4 (Connect public libraries, cultural centres, museums, post offices and archives with ICTs) also have a direct link to Target 9 in promoting linguistic diversity and local content online.

Target 9 and the corresponding action lines are set in an extremely fast-changing context, with rapid growth of Internet users and content. As a result of the concept of users evolving to include objects,[6] the current Internet Protocol addressing scheme has been stretched to its limits, and IPv6[7] has been implemented (besides other protocol improvements) in order to change the order of magnitude of the possible number of different networked entities,[8] which will allow this exponential growth to continue for many years to come.

The persistence of the so-called "digital divide" [ITU, 2010] is also, at least partly, related to the issue of languages and content on the Internet, in particular with regard to online equality [Pimienta, 2009). Equality is often interpreted in terms of physical access, focusing on the gap between those who have access to the technology and those who have not. Policies have been set accordingly to increase access, for example by putting in place shared resources (e.g. telecentre projects and community access points — see also Targets 1 and 4), more affordable technologies (e.g. low-cost PCs) or more pervasive technologies (e.g. cell phones).

However, in order to reduce the digital divide, barriers beyond mere access also need to be addressed to give all users the potential to benefit from information and communication. Users need the skills to use the technology and exploit the benefits it offers.[9] The issue of content availability in the user's language is fundamental: without content, access itself becomes useless. There is no simple technological or practical answer for content production in cyberspace, an activity which mirrors the complexity inherent in the economic behaviour of individuals.[10] While ICT4D[11] specialists tend to agree that local content production[12] is desirable, the question of how to provide incentives to achieve it in practice remains unresolved, for now.

One reason for the relatively low policy priority given to this issue is the lack of indicators on languages on the Internet. To date, the digital divide has often been measured in terms of access rather than use and content, even though the divides for the latter two are likely to be greater than the access divide.

For example, while Africa accounted for two per cent of total Internet users in 2007 (and 11 per cent of the world's population), its share of content production, in both national and local languages, was even lower. Furthermore, only 0.6 per cent of total worldwide content in English or French was in African servers (as estimated by *FUNREDES/Union Latine*).[13] The *Language Observatory Project* (LOP)[14] estimated that the percentage of webpages accounted for by local African languages (or at least the small subset of them which are localized)[15] ranged from 0.06 per cent to 0.006

per cent of total Internet content. Even though in some cases these rates may have increased somewhat since then, they are likely to have remained very low. In the case of local languages, the proportion may even be smaller, given the speed of growth of Internet content in the main languages present on the Internet.

Some people consider English as a *lingua franca*[16] in the digital world, thus minimizing the importance of the issue of linguistic diversity and the availability of local content. However, while English is a major language for business or science and the official language of many countries in Asia and Africa, it has been estimated that less than 15 per cent of the world's population understand it.[17] Furthermore, in many countries where English is the official language, a large proportion of the population does not actually use it (the same holds true for the use of French in many francophone African countries or in Haiti, for example). If meaningful access to the digital world is considered a prerequisite for becoming an active citizen of the information society, then the issues of access and content in local languages or mother tongue are central to democracy in the information society.

Evidence from UNESCO studies[18] suggests that not being educated in one's mother tongue is a serious handicap. If the Internet, which has become an important indirect source of information and knowledge and a practical component in education systems, is meant to be for everyone, then it must speak everyone's language, again highlighting the importance of this target.

The top barriers to ICT uptake, or reasons cited for not having the Internet at home, are a lack of perceived need; cost (of equipment and/or service); and a lack of skills [European Commission, 2009]. The results from a recent survey by the US Federal Communications Commission (FCC) also highlight that, in order to further increase connectivity, it is necessary to teach people who are not yet connected how to navigate the web and find online information that is valuable to them, so that they learn to appreciate the benefits offered by connectivity [Horrigan, 2010] (see Box 9.1).

Given that a lot of content on the Internet, and "Internet-related vocabulary," is in English (or at least this might be the perception),[19] countries with higher levels of English language scores could be expected to have higher Internet adoption. There is indeed a positive correlation between the percentage of households with the Internet and the number of Internet users, on the one hand, and proficiency in English, on the other, as proxied by TOEFL[20] scores.[21] This shows that being able to understand and use English terms could be a factor in Internet uptake and highlights the importance of increasing the number of languages on the Internet.

Target 9 deals with two separate but related issues: first, the ability to use a given language on the Internet, and second, the provision of appropriate content. The first can be addressed with technical solutions, whereas the second requires a comprehensive set of conditions, many of which are not purely technical. It is one thing to ensure that the technical conditions for a language to be used on the Internet (localization) are in place,[22] but another for this language to gain all the attributes of major languages on the Internet (full representation). See Box 9.2 for more details.

Box 9.1: Understanding digital concepts

In addition to a lack of information about the benefits that can be obtained from using the Internet and a lack of digital literacy skills, the level of English language skills and the availability of local content could also be related factors in Internet usage levels, especially as English is sometimes considered as the *lingua franca* of the Internet. Using the recent US FCC survey results, [Horrigan, 2010] finds that even in the United States where English is the first language, broadband users exhibit varying degrees of understanding of digital concepts, which, in turn, influences what they do online. For example, survey respondents received a series of questions asking them how well they understood various terms related to computers and the Internet. The following shares of broadband users said they understood the listed terms very well: *refresh* or *reload* — 61 per cent, *operating system* — 44 per cent; *Internet browser cookie* — 42 per cent; *JPEG file* — 41 per cent; *spyware* or *malware* — 40 per cent; and widget — 16 per cent. The study found that those with greater understanding of these terms were more intensive users of the Internet. Some 29 per cent of broadband users said they did not understand any of the listed terms very well, while 24 per cent understood five or six of the terms very well. The former group was found to be doing only about half of the online activities that the better informed group did. These findings suggest that skills, including language skills, play a role in how the Internet is being used.

Box 9.2: Requirements for the presence of languages on the Internet

There are many requirements for full representation of a language in cyberspace. A codification scheme for the alphabet and an appropriate keyboard layout are necessary but not sufficient conditions. Indeed, there is a set of conditions which, combined with an appropriate policy framework, will eventually permit the existence of content commensurate in just proportion with a language's population of speakers. These are [Diki Kidiri, 2007]:

- a written form for the language (languages which are only oral do not receive the full range of benefits of digital processing);[23]
- a comprehensive codification for the alphabet and fonts (for reading and writing of documents);
- basic linguistic software for the language (word processor, e-mail management, messaging, browsing);
- a supported keyboard with the alphabet of the language;
- advanced linguistic software (for spellchecking, syntax checking, alternative choices for sequence of letters, online dictionaries, etc.);
- accessibility resources in the language for users with disabilities (such as software for the blind);
- human resources trained to perform the (above) activities of creation and implementation;
- an informed and motivated user community driving content production (this in turn drives indirect requirements for education packages in the language for digital literacy, information literacy and content production);
- comprehensive content responding to the needs of the user community;
- content duly indexed by existing search engines (or alternative search engines specialized in the language);
- articulation with other languages (in particular, translation software from/to a set of other languages);
- sufficient funding from governments or international organizations to support the process leading to the fulfilment of all these conditions.

The task of achieving this target is complex and can only be fully accomplished with the involvement of all stakeholders. Indeed, a sufficient number of users have to be more than just content consumers, and also take responsibility for content production, generating culturally meaningful content and useful services (for example for online commerce and tourism). User involvement would ideally occur as a bottom-up process, but for many languages the critical mass is not present and other key elements may be lacking, such as the existence of qualified leaders who pull the process and/or the existence of a government sensitive to the importance of the issue and willing to put in place the appropriate policies and incentives, in consultation with all relevant stakeholders.

Measuring Target 9 — Proposed indicators

Internationally comparable and recent data on languages and content on the Internet are not widely available. Indicators on access to ICTs are more readily available than indicators on the use of ICTs, ICT skills or digital and information literacy.[24] This dearth of indicators may also have contributed to a relative lack of policy attention given to supporting linguistic diversity on the Internet. Measurement of languages on the Internet is also complicated by technical difficulties, which are likely to worsen over time as the Internet continues to expand in size.

To measure this target, initial focus could be placed on collecting two basic indicators:

1. Proportion of Internet users by language

2. Proportion of webpages by language (Box 9.3)

These indicators could also be collected for different Internet "subspaces" such as the blogosphere, social networks and newsgroups. Ideally, a breakdown by user characteristics (country, region, gender, age, family of languages) would also be available, and compiled at regular intervals so as to follow the rapidly evolving trends in cyberspace.

Box 9.3: Measuring the number of webpages by language

The basic method for measuring the percentage of webpages in a given language involves crawling the space to be measured and applying identification and counting techniques. Basically, if the language has a specific script for encoding, the pages are counted from that parameter. If the same script is shared by many languages (like for instance the Latin script), a language-recognition algorithm is required to identify the different languages sharing the same script.

The major inconvenience of this method is the time required to crawl. Today, this factor even makes the method prohibitive as the size of the space to be crawled expands indefinitely. Alternative techniques are required to apply the crawling method in a smaller space while remaining statistically representative. Some methods use a small randomly obtained sample of the web, but the result is statistically questionable.

LOP focuses on minority languages in top-level domains only (even removing countries with too large a webspace like China). Results, even if they are not fully representative, have shown a very low penetration of local languages on the web for Asian and African languages. It has been demonstrated [Nandasara *et al*, 2008] [Suzuki *et al*, 2002], that the local language percentages follow "Zipf's Law" — the n-th ranked language speaker is one n-th of the population of the top-ranked language. This suggests that the number of webpages written in each language follows a progressive power-law curve where the order of magnitude of presence of local languages continues to decrease; the authors refer to this as the "digital language divide."

Finally, other methods have applied the power of search engines to a set of words which are carefully selected to hold the best semantic and syntactic equivalence across languages. This is the approach that has been followed by FUNREDES/Union Latine, which was able to offer consistent measurements, with more complex indicators, between 1998 and 2007, albeit only for a subset of languages. The continuing expansion of the size of the web is showing the limits of all of these methods, however, and further discussion is required to identify ways to produce reliable figures.

For more details see [Paolillo, *et al*. 2005] and [Pimienta, 2008].

However, a number of additional indicators would be required as well in order to measure linguistic diversity in cyberspace fully. These indicators should, ideally, reflect the behaviour of end users with regard to languages in cyberspace. This includes considerations such as: users' mother tongue and second languages spoken, language set for software interfaces, percentage of e-mails read or written by language, percentage of visited webpages by language. Indirect indicators could also be complied, for example, by looking at the online availability of e-government information and applications in different languages, and to what extent related applications are available for minorities or immigrants in their mother tongue.

Status of Target 9

Unfortunately, the field of linguistic diversity indicators is still in its infancy and data are scant. Before looking at the languages that can be found on the Internet, it is useful to get an overall picture of languages in today's world. The most recent indicative figures on living languages in the world are given in Table 9.1, and the regional distribution in Chart 9.1. A country-level comparison of the number of Internet users and the number of living languages suggests that there is a correlation between Internet penetration rates and language diversity, many countries (for example, in Africa) with low Internet penetration having high language diversity, and vice versa.

Overall, the following facts can be reported about the state of languages in the world as at 2009: [25]

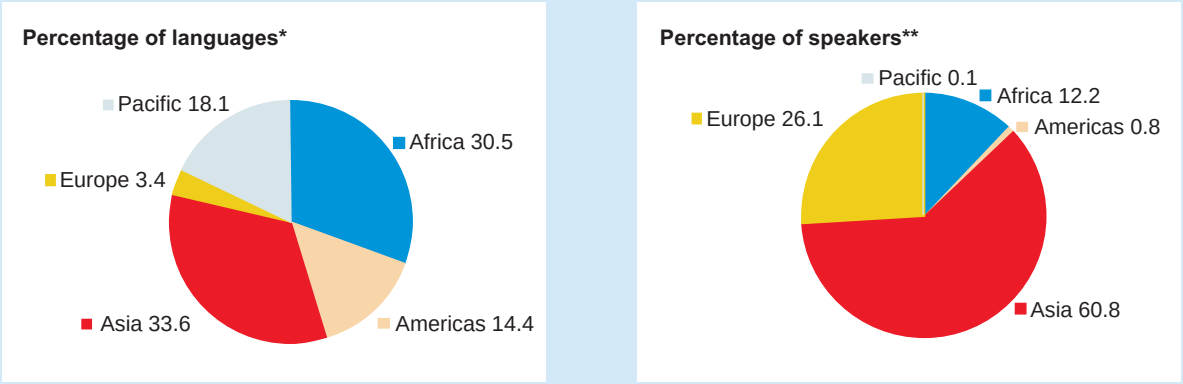
- 1 per cent of languages are spoken by at least 10 million people
- 1 per cent of languages are spoken by 94 per cent of world population
- 96 per cent of languages are spoken by 4 per cent of world population
- More than 50 per cent of languages are spoken by less than 10 000 people

Table 9.1: Distribution of languages by number of first-language speakers, 2009

Population range	Living languages		Speakers	
	Number	%	Number	%
100 million to 1 billion	8	0.1	2 308 548 848	38.7
10 million to 100 million	77	1.1	2 346 900 757	39.4
1 million to 10 million	304	4.4	951 916 458	16.0
100 000 to 1 million	895	13.0	283 116 716	4.8
10 000 to 100 000	1 824	26.4	60 780 797	1.0
1 000 to 10 000	2 014	29.2	7 773 810	0.1
100 to 1 000	1 038	15.0	461 250	0.01
10 to 100	339	4.9	12 560	0.0
1 to 10	133	1.9	521	0.0
Unknown	277	4.0		
TOTAL	**6 909**	**100**	**5 959 511 717**	**100**

Source: [Lewis, 2009].

Chart 9.1: Regional distribution of languages, 2009



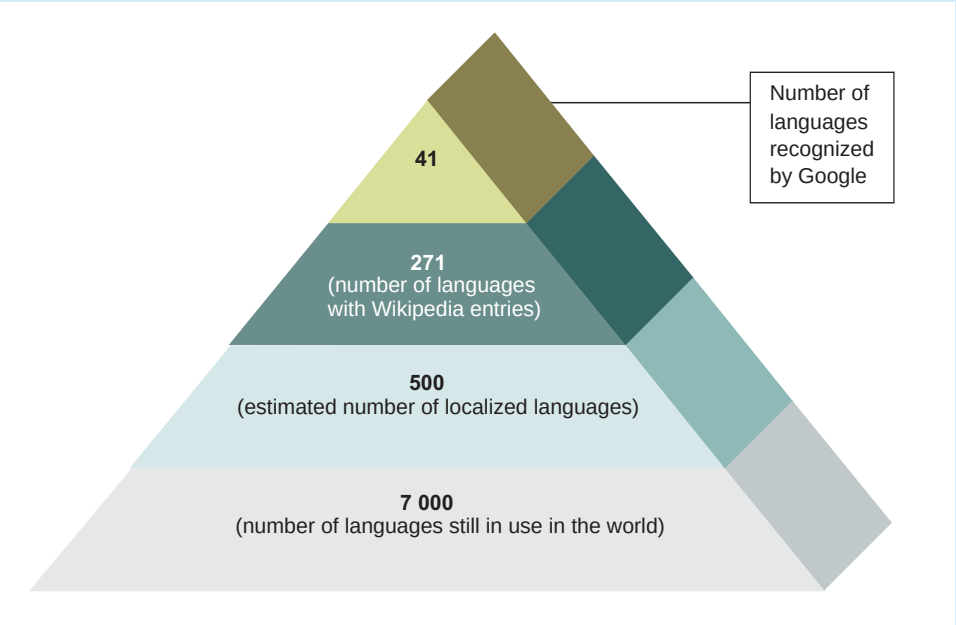
Note: * Living languages that originate in the specified area. ** People who use languages that originate in the specified area as their first language regardless of where in the world they may live.
Source: [Lewis, 2009].

- 70 per cent of languages are spoken in only 20 (developing) countries
- Less than one third of languages have a written form.[26]

There is no straightforward way of mapping these languages onto their online existence as there are very few data and indicators on the state of languages online.

Indeed, indicators of linguistic diversity in cyberspace are very limited. A visual representation of the relative number of languages represented in various ways in the virtual world, compared to the number of living languages in the real world, is given in Figure 9.1.

Figure 9.1: Key figures for languages on the Internet, 2010



Note: There is no agreement among demo-linguists[27] on the size of the language universe, but the figures usually range between 6 000 and 9 000. Differences are explained by the difficulty of defining the distinction between a dialect and a language. The number of localized languages is an estimate.
Source: Ethnologue, SIL International (Summer Institute of Linguistics), Wikipedia and Google.

Technically, measuring the online presence of languages is complicated. Unicode[28] does not encode languages but scripts, a script being a collection of characters, some of which could be shared by different languages. In many cases, a single script may be used to write tens or even hundreds of languages (e.g. the Latin script). In other cases, only one language employs a particular script (e.g. Hangul, which is used only for the Korean language).[29] The approximate figure of 500 localized languages represents, therefore, the set of languages whose character sets are covered by the set of 140 scripts which have been encoded so far, 90 of them related to written languages.

One of the striking developments since the conclusion of WSIS is the growth of user-driven content and the emergence of social networking sites. Although it is not possible to ascertain from available data whether the sites were accessed in local languages, the Asia and the Pacific region registered the largest number of unique visitors between June 2007 and June 2008 (Table 9.2). The Middle East and Africa showed the strongest growth in the numbers of unique visitors (66 per cent), followed by Europe (35 per cent) and Latin America (33 per cent), though the Middle East and Africa and Latin America are growing from much lower numbers. According to Facebook's Timeline [Facebook, 2010a], the number of active users grew from one million people in December 2004 to 400 million in February 2010. Of the active users, 100 million access Facebook through mobile devices [Facebook, 2010b]. Facebook is growing strongly in the Asia and Pacific region and at the start of 2010, for example, there were 17 million users in Indonesia with a monthly growth rate of 13 per cent. Other high growth rates were observed for India and Thailand (both 12 per cent) and Malaysia (10 per cent) [Facebook, 2010c].

Given the significance of user-driven content, it is also important to look at the linguistic representation of social networking sites, for example. Thus, as of early 2010, 52 languages were available for translation in Google translate, and the Internet browsers Internet Explorer and Mozilla supported 63 and 70 languages, respectively. Furthermore, many "international" websites, such as Amazon, eBay, Google and Facebook, now propose localized versions, often also in local languages. Thus, Facebook was available in 67 languages, Blogger in 50, Youtube in 19, Flickr in 8, Twitter in 6, and Linkedin in 4 languages.

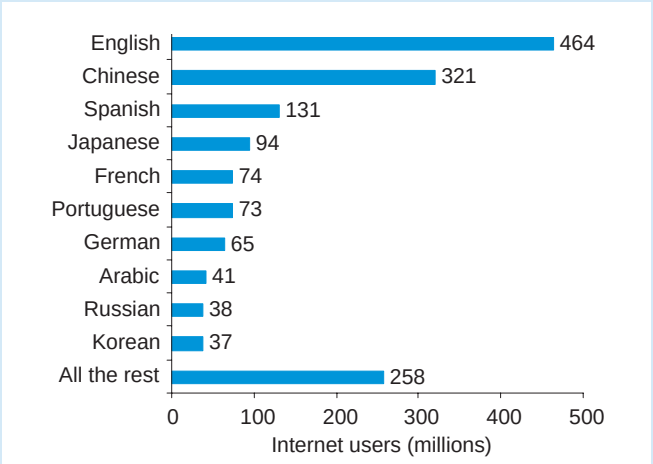
Table 9.2: Growth of social networking sites, by region, June 2007-June 2008,
Total worldwide audience, age 15+, home and work locations

	Unique visitors (thousands)		
	June 2007	June 2008	Percentage change
Worldwide	464 437	580 510	25%
Asia and the Pacific	162 738	200 555	23%
Europe	122 527	165 256	35%
North America	120 848	131 255	9%
Latin America	40 098	53 248	33%
Middle East and Africa	18 226	30 197	66%

Source: comScore World Metrix [ComScore, 2008).

Microsoft also plans to translate Windows 7 and Office 2010 into a further 59 local languages by June 2011, in addition to the 101 languages (including Azeri, Georgian, Macedonian, Uzbek, Bosnian, Punjabi and Kyrgyz) into which its most popular software packages have already been translated.[30]

Chart 9.2: Top ten languages on the Internet, 2009



Source: Internet World Stats, www.internetworldstats.com/stats7.html.

As the field of linguistic diversity indicators is still in its infancy, the only indicator which has been available thus far (and without any reliable degree of precision) is the distribution of Internet users by language. This was offered, with a transparent methodology, by Globalstat, until 2005,[31] and subsequently by Internetworldstats, although limited only to the figures for the top ten languages in terms of users (Chart 9.2), and without much information on the methodology and sources.[32]

Some of these figures are available over time. Between 1996 and 2007, the percentage of English-speaking Internet users[33] has dropped from 80 per cent to around 30 per cent,[34] reflecting the fact that non-English speakers are increasingly getting online.

As for the number of webpages per language, the published data have shown huge discrepancies since the first studies published back in 1996 (see [Pimienta *et al*, 2010] for more details).

The most promising effort has been made by LOP, which has been able to produce unique figures for minority languages in top-level domains of Africa and Asia. However, the rapidly increasing size of the web makes it more and more difficult to crawl entire top-level domains. The most consistent publisher of data, and the only one with the capacity to produce indicators by subcategories, has been FUNREDES/Union Latine. However, its scope is limited to Latin languages, German and English, and, unfortunately, as its methodology is based on search engines, since 2007 it is no longer in a position to produce reliable figures. Indeed, in recent years the indexes of search engines have stopped reflecting a substantial proportion of the online universe and the results are beginning to show obvious biases and errors in their search occurrence counting figures.

Therefore, just as Internet stakeholders are starting to acknowledge the importance of the production of reliable indicators for linguistic diversity in order to set policies and measure their impact, the task of producing such indicators

is becoming even more difficult. New creative approaches are urgently required in order to overcome the technical barriers to measurement created by the exponential growth of cyberspace.

It is also possible to look at what can be referred to as "linguistic productivity," given by the number of webpages in a given language divided by the number of Internet users in that language. This could offer an indicator of content production.

The FUNREDES/Union Latine studies have produced indications of the production of webpages per language[35] (Tables 9.3 and 9.4). A comparison of the figures over time shows that productivity initially rises in the phase of Internet user growth, and subsequently declines once a certain penetration threshold has been reached. This supports the hypothesis that increasing user access could be the first step towards content creation, followed by digital literacy programmes focusing on why and how to create content in cyberspace. The studies have shown, for instance, that French content was first driven by Quebec, then by Belgium and Switzerland and finally by France, following the growth of Internet penetration in the respective countries. With respect to Spanish content, Portuguese-speaking Brazil produced more Spanish content than most of the smallest countries of Latin America. In 2001, the US produced one tenth of the number of webpages in Spanish produced by Spain, although at that time it had more Spanish-speaking Internet users than Spain. At the same time, Mexico, a country with the highest immigrant population in the US, has a very low content productivity. The findings could be used to design language policies in cyberspace. For example, Spanish content would have been boosted by programmes targeting content production by Spanish-speaking immigrants in the US. Finally, Germany, where English is not the first language, shows an extremely high productivity of English webpages, and, in fact, all OECD countries are producing a significant proportion of their pages in English.[36]

Table 9.3: Production of webpages in French, by region and by country, 2007 (percentage of pages — productivity*)

By country		By region	
France	60% — 1.1	Europe	75%
Canada	20% — 1.1	America	22%
Belgium	7% — 0.6	Africa / Arab States	0.3%
Switzerland	5% — 0.9	Asia / Pacific	0.2%
Other	8% — 0.8	Other	2%

Note: * Computed as the ratio of % of production per % of Internet users in the given language.
Source: FUNREDES/Union Latine.

Table 9.4: Production of webpages in other languages, by country, 2007 (percentage of pages — productivity*)

Spanish		English		Portuguese	
Spain	56 % — 3.4	United States	66 % — 1.0	Brazil	71 % — 0.9
United States	10 % — 0.4	United Kingdom	7 % — 0.6	Portugal	15 % — 1.0
Argentina	9 % — 0.9	Canada	4 % — 0.7	United States	4 % — 5.0
Mexico	8 % — 0.5	Australia	2 % — 0.3	Spain	4 % — 3.7
		Germany	1 % — 39.0		

Note: * Computed as the ratio of % of production per % of Internet users in the given language.
Source: FUNREDES/Union Latine.

Table 9.5: Twenty ccTLDs with the strongest average annual growth of registrations, 2005-2009

	ccTLD		CAGR 05-09*	% ccTLD/population 2009**
1	Former Soviet Union	su	102.4	na
2	China	cn	95.9	1.0
3	Tajikistan	tj	88.2	0.3
4	Viet Nam	vn	77.5	0.1
5	Russia	ru	55.8	1.7
6	India	in	54.4	0.0
7	Réunion	re	52.7	0.4
8	Iran (I.R.)	ir	49.4	0.2
9	Venezuela	ve	48.8	0.5
10	Poland	pl	44.5	4.1
11	Latvia	lv	41.0	3.5
12	France	fr	40.0	2.5
13	Portugal	pt	39.4	2.7
14	Guadeloupe	gp	39.1	0.3
15	Lithuania	lt	39.0	3.3
16	Palestinian Authority	ps	36.1	0.1
17	Bosnia and Herzegovina	ba	35.3	0.3
18	Kenya	ke	34.1	0.0
19	Albania	al	32.8	0.1
20	Peru	pe	31.1	0.1

Note: * India 05-08; ** India 2008. CAGR: Compound Annual Growth Rate.
Source: ITU, based on data provided by ZookNIC: www.zooknic.com.

Another way of monitoring the development of local content is by using country code top-level domains (ccTLDss)[37] registered in each country as a proxy.[38] This is based on the assumption that domain-name registration reflects to some extent the availability of local web presence and hence local content even though it provides no information about the languages used. Based on the 98 countries for which data were available in both 2005 and 2009 (or 2008 in some cases), the 20 ccTLDs displaying the strongest average annual growth rates between 2005 and 2009 (except India: 2008) are given in Table 9.5. Most of the countries concerned are growing from very low starting levels, even though in Poland, Latvia, Lithuania, Portugal and France there are already more than two ccTLD registrations per 100 inhabitants.

The 20 ccTLDs with the highest growth rates for the number of ccTLD registrations per 100 inhabitants between 2005 and 2009 are given in Table 9.6. Some of the countries where the number of registrations per 100 inhabitants was already high in 2005 continued to experience strong growth. Many of the relatively smaller European countries may be found in this list.

If ccTLDs are accepted as a proxy for the availability of local content, a greater number of ccTLD registrations per 100 inhabitants could be expected to be statistically associated with higher levels of household Internet usage. Plotting Internet users per 100 inhabitants against the number of ccTLD registrations per 100 inhabitants for 2009 (Chart 9.3) shows a positive correlation (Spearman rank correlation = 0.8, and very highly statistically significant). This shows that there is indeed a rather strong statistical association between these two variables, pointing to the

Table 9.6: The twenty countries with the largest increase in ccTLD registrations per 100 inhabitants, 2005-2009

	Country	% ccTLD/population 2005	% ccTLD/population 2009	Difference (percentage points)
1	Netherlands	10.0	21.2	11.2
2	Switzerland	9.9	17.8	7.9
3	St. Vincent and the Grenadines	0.9	8.4	7.5
4	Denmark	11.6	18.6	7.0
5	Sweden	4.1	9.8	5.7
6	United Kingdom	7.3	12.8	5.5
7	Austria	5.5	10.6	5.1
8	Luxembourg	4.5	9.6	5.0
9	Germany	11.1	15.9	4.9
10	Belgium	4.5	8.9	4.5
11	Australia	2.9	7.1	4.2
12	Norway	5.3	9.2	3.9
13	New Zealand	4.9	8.8	3.9
14	Czech Republic	2.1	5.8	3.7
15	Iceland	4.5	8.2	3.6
16	Poland	0.9	4.1	3.2
17	Greenland	4.4	7.2	2.8
18	Faroe Islands	3.2	6.0	2.8
19	Estonia	2.5	5.3	2.8
20	Hungary	2.0	4.8	2.7

Source: ITU, based on data provided by ZookNIC: www.zooknic.com.

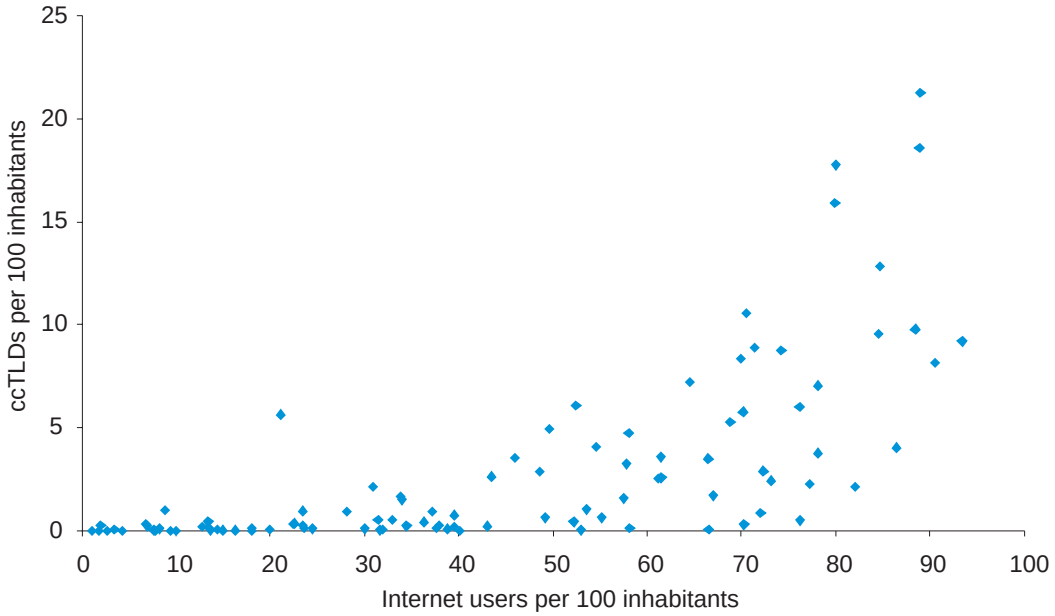
potential importance of providing local content for Internet use. Just as local languages are important, the availability of local content can also be considered key to Internet development and for achieving Internet and ICT-related development goals.

It is not known in which languages these domains exist. However, efforts to measure Internet webpages in certain languages[39] over several years also point to a correlation between the growth in the number of users and the growth of content. Nevertheless, over time, and as the Internet user penetration rate becomes higher, the correlation diminishes and less content per user is produced. This suggests that promoting user-created content is a good candidate for policy consideration, at least in the early stages of Internet and local content development.

Comparison of the production of webpages in Spanish and French shows a higher production of webpages in French, which could be interpreted as the result of policies to boost content creation such as those developed by the *Organisation Internationale de la Francophonie*.[40] See also Box 9.4.

Local content creation also requires more basic digital and information literacy as key components of digital inclusion policies. Appropriate education and technical training could encourage new Internet users to be both producers and consumers of content, sometimes referred to as "prosumers." Beyond formal education systems, libraries can also have an important role to play in promoting digital and information literacy and in creating local content, thus establishing a strong linkage between Targets 9 and 4.

Chart 9.3: Internet users and ccTLD registrations per 100 inhabitants, 2009*



Note: *This includes the 98 countries for which data were available both in 2005 and 2009 (or in some cases 2008). The 2009 Internet users penetration rates are ITU estimates.
Source: ITU, based on Eurostat and national sources and data provided by ZookNIC: www.zooknic.com.

Box 9.4: Active policies to boost content creation: The case of Catalan

In 2006, an original generic name was created "*to serve the needs of the Catalan linguistic and cultural community on the Internet.*"[41] It is an interesting case, since Catalan is a fascinating success story of how a language which had been threatened during the years when Spain was ruled by dictatorship has been able, through appropriate linguistic policies, to make a complete revival. The result of measurements of Catalan webpages in 2006 and 2007 by FUNREDES/Union Latine (see http://funredes.org/lc) has shown a productivity greater than that of Spanish worldwide, though not greater than that of Spanish in Spain, and it was too soon to measure a strong impact in terms of Catalan content progression. Indeed .cat is the first TLD intended to promote a given language and its results in terms of boosting the presence of Catalan on the web deserve to be followed carefully as lessons can be learnt for other languages.

It is not known whether the existence of a specific top-level domain would trigger content creation in a given language, but the promotion effect alone could be an important factor, as witnessed by proposals which have been inspired by .cat, for Welsh (.cym) or Quebec (.qc).

Conclusions and recommendations

Although there is still a long way to go before achieving Target 9, a huge step has been accomplished with the WSIS process insofar as the issue of linguistic diversity has been acknowledged and has been given much higher priority on the global Internet-related policy agenda.

This is the result of a combination of several factors. Many players in the field have worked to draw attention to the issue of linguistic diversity on the Internet, from governments (like the Canadian Government *International Develop-*

ment Research Centre, IDRC[42] in Asia[43] and Africa[44] with its Pan programmes) to civil society (like, for instance, the World Network for Linguistic Diversity, MAAYA).[45] The drastic changes in Internet demographics in recent years have also contributed to raising awareness of this issue, especially the rapid increases in the number of Internet users from the Asia and Pacific and the Arab States regions.

Until recently, the (technical) complexity of the issue and measurement costs, coupled with the idea that English can act as a *lingua franca* for the Internet, have held back progress on this target. However, attitudes are changing and the subject has gained higher visibility at the last three annual meetings of the Internet Governance Forum, which is driving WSIS multistakeholder participation, and at the WSIS Forum meetings held annually in Geneva.[46]

Some changes have already taken place. The issue of internationalized domain names (IDN) has received considerable attention. More than half of the 1.7 billion people who use the Internet speak languages with non-Latin scripts,[47] highlighting the importance of making provision to support all languages on the Internet. In 2009, the Internet Corporation for Assigned Names and Numbers (ICANN) approved plans to open up Internet domain names to non-Latin script characters and allow domain names in Arabic, Chinese and other scripts.

The implementation of domain names in local languages, which is now under way, is likely to increase demand for linguistic diversity on the Internet, adding a bottom-up driver to the top-down efforts made at the political level and in the context of the WSIS process. The number of initiatives to promote linguistic diversity is rapidly increasing, and this process can be expected to show some tangible outcomes by 2015, with likely increases in the number of languages that can be used on the Internet, the availability of local content, and the number of language versions of the main software and applications used on the Internet.

Nonetheless, the lack of available indicators to measure Target 9 makes it difficult to track progress on its achievement, at both the international and national levels. While there may be some anecdotal evidence and success stories, which may serve as good-practice ideas for other initiatives, there are not enough data to allow an objective assessment of where the target currently stands. The main global stakeholders need to work together, highlight the importance of the issues at stake, guide countries in what policies they could implement, and potentially come up with and implement a plan for concrete actions. Indeed, the objective of linguistic diversity in cyberspace warrants support on the global ICT and Internet-related policy agenda, not least to be able to exploit synergies among the various stakeholders.

Collecting indicators in this field calls for a recommendation to the main global stakeholders. Following the Barcelona symposium held in September 2009,[48] an urgent effort is required to set up an action plan which should include:

- incentives to the scientific community for initiating research projects geared to creating indicators for measuring languages and content on the Internet;
- direct actions coordinated by international organizations to support projects for the development of indicators;
- mainstreaming linguistic diversity in all aspects of ICT and information society measurement efforts.

International organizations can further contribute by making governments more aware of the importance of linguistic diversity in cyberspace. This could include suggestions for programmes supporting the issues, and appropriate guidelines.

Strategies also need to be designed to support the IDN implementation process and use it as a starting point for building a more comprehensive perspective on the subject. In addition to the implementation of IDNs, many efforts are emerging in different countries and sectors. It would be important to take stock of these initiatives and improve coordination between them.

ICT4D donors should consider mainstreaming linguistic and cultural diversity in their project frameworks, as was done for gender issues. One possibility would be to consider giving higher funding priority to projects that specifically take linguistic diversity and local content into account. Developing countries' diasporas could also play a strategic role in all ICT4D efforts, and should be involved in content production for local languages.

Technological innovation aimed at bringing communities not yet represented on the Internet online, and at improving digital literacy, including through the development of mobile web technologies, should be promoted.

Finally, the role of translators should be valued in the context of linguistic diversity, as well as cybervolunteer networks[49] that can help with the promotion of languages online. The Bamako International Forum on Multilingualism[50] was established in January 2009. An action plan was drawn up containing a chapter entitled "For a multilingual cyberspace," including a broad set of recommendations which could serve as valid inputs.[51] As a follow-up, and as a way to push the transformation of recommendations into an action plan, the main stakeholders should set up and commit to a coordinated roadmap, including continuous monitoring of progress in linguistic diversity and local content in cyberspace.

Notes

1 Substantial contributions to this chapter were made by Daniel Pimienta from FUNREDES, with inputs from Daniel Prado (Union Latine), Jean-François C. Morfin (Intlnet), Viola Krebs (ICVolunteers), and Deirdre Williams (St Lucia). ITU is also very grateful for the ccTDL data provided by Matthew Zook from ZookNIC.

2 On the Internet, content is any information (webpages, messages, software...) that is available for retrieval by the user, in any format (e.g. text, image, audio, video).

3 The term *Web 2.0* refers to what is perceived as a second-generation of the web, characterized by dynamic, shareable and user-generated content, such as in social networks.

4 It is worth noting that the size of the "invisible web" — the part of the web containing dynamic pages which are not indexable (such as data bases) — is estimated as being 500 times larger than the visible web [Bergman, 2001].

5 See WSIS Geneva Plan of Action, 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c8, §23.

6 The term "Internet of objects," or "Internet of things," alludes to the idea that many devices (such as household coffee machines or refrigerators) will eventually be accessible via the Internet through innovative applications. See http://www.itu.int/wsis/tunis/newsroom/stats/The-Internet-of-Things-2005.pdf for more details.

7 Internet Protocol version 6 (IPv6) is the next-generation Internet layer protocol for packet-switched networks and the Internet.

8 IPv4 addresses use 32 bit/s, while IPv6 uses 128 bit/s, allowing 2128 (about 3.4×1038) addresses.

9 See the eleven barriers to use of ICT for human development, presented in a spiral form in [Pimienta, 2009].

10 It is not straightforward to describe individual decisions to produce and browse or not in a particular language. Nonetheless, incentives could be put in place to stimulate the production of local content, and/or content in local languages.

11 Information and Communication Technologies for Development (ICT4D) refers to the application of ICTs for development in general and poverty reduction in particular.

12 Local content production does not imply that the locally produced content is only consulted locally. As a matter of fact, empirical data lead to the observation that locally produced content in a globalized world tends to be consulted globally. The existence of diasporas and of people interested in research and study of local cultures from abroad are only two of the reasons to explain that phenomenon.

13 All references from *FUNREDES/Union Latine* can be consulted in the FUNREDES/Union Latine Observatory of Linguistic and Cultural Diversity at: http://funredes.org/lc.

14 The Language Observatory Project (http://www.language-observatory.org/) is a consortium of universities initiated and coordinated by the University of Technology of Nagaoka, Japan. For more information, see http://gii2.nagaokaut.ac.jp/gii/.

15 "Localizing content" refers to the process of translation into the local language and adaptation of the content to the local culture. "Localizing language" is meant in this chapter as the process of allowing a language to be usable in the digital environment, and it refers then basically to a technical process of codification of the corresponding character set.

16 A *lingua franca* is a language systematically used to communicate between persons not sharing a mother tongue.

17 While figures for speakers of a given language (especially a second language) vary considerably and up-to-date figures are hard to find, the low rate of change allows the use of less recent figures. In 1996, David Graddol, writing for the British Council, estimated "speakers of English" to be 750 million (source "The Future of English" — http://www.britishcouncil.org/learning-elt-future.pdf), which, compared with the 5.7 billon world population for 1996, gives a percentage of 10 per cent. Ethnologue, citing sources from 1999, gives a figure of a little more than 508 million English speakers (341 million first language) which, compared with the 6 billon of world population for 1999, gives a percentage of less than 8.5 per cent. [Malherbe, 1999] offered the figure of 600 million, which set against the 1999 world population gives a percentage of a little more than 10 per cent. Union Latine (cited in [Pimienta, 2009]) gave a figure of 670 million in 2008, which also means a proportion of just over 10 per cent. Other sources may give higher figures (for example [Prado, 2010] provides estimates of 824 million or 729 million for 2009 depending on the assumptions made), which is why it is necessary to leave a margin by stating less than 15 per cent. In a similar context, [Graddol, 2006], using data from the World Tourism Organization, states that three-quarters of tourism situations involve non-English speakers in non-English-speaking countries.

18 Children who are not educated in their mother tongue have lower grades as well as a higher rate of failure to go on to the next level (see http://www.unesco.org/en/languages-in-education/).

19 Practical, or technical, computer language also does not exist in all languages. For example, words such as *copy, paste, file, mouse, drive, operating system, network, burning a CD, download, broadband, Instant Messenger,* etc. are often taken from English. This might constitute a barrier to people who do not speak English or do not feel at ease using English terminology.

20 *Test Of English as a Foreign Language*. See http://www.ets.org. This is an imperfect proxy, because TOEFL exams tend to be taken by those who plan to live, work or study abroad. Therefore, it tends to be a relatively small proportion of individuals in a country who take TOEFL exams. Furthermore, this proportion may vary widely across countries, and is likely to reflect other factors such as the resources allocated to English teaching. Nonetheless, in spite of these limitations, TOEFL test scores currently constitute the only widely available measure of English proficiency where English is not the mother tongue.

21 [OECD, 2006] and [van Welsum and Xu, 2007] use TOEFL scores as a proxy for English language skills, and [Lee, 2009] uses TOEFL scores to proxy the effect of English proficiency on economic growth.

22 In Asia and Africa, IDRC supports the localization of local languages through initiatives which gather many partners from various countries, in a collaborative manner. The Asian group is also strongly involved in the process of the development of IDNs. Both groups organize regional meetings which contribute to the necessary awareness-raising among stakeholders.

23 However, broadband evolution and the combined management of audio and video may eventually open the door for some type of digital processing for oral languages, while the Internet is becoming less and less text centred.

24 Digital literacy consists of equipping people with ICT concepts, methods and skills to enable them to use and exploit ICTs. The related concept of information literacy consists of providing people with concepts and training in order to process data and transform them into information, knowledge and decisions. It includes methods to search and evaluate information, elements of information culture and its ethical aspects, as well as methodological and ethical aspects for communication in the digital world.

25 Based on data from [Crystal, 2006], Ethnologue and UNESCO.

26 Some sources state than only one tenth of languages have a written form.

27 People with linguistic skills researching on the demographic elements of languages.

28 UNICODE (http://unicode.org), one of the pillars of the progress made in multilingualism, is a non-profit association formed as a consortium which sets standards for encoding character sets and scripts.

29 See http://unicode.org/standard/supported.html and http://unicode.org/iso15924/iso15924-num.html for more complete explanations and for the set of supported scripts.

30 Balancing Act Africa, Issue No. 481, 20 November 2009 (http://www.balancingact-africa.com/).

31 Thanks to the "Wayback engine" of archive.org, it is possible to see a snapshot of one of the latest products: http://web.archive.org/web/20041019013615/www.global-reach.biz/globstats/index.php3.

32 http://www.internetworldstats.com/stats7.htm.

33 These figures refer to both first and second language English speakers.

34 The last figure for 2009, given by InternetWorldStats, is 27.6 per cent of English-speaking users on the Internet (source http://www.internetworldstats.com/stats7.htm).

35 Limited to English, French, Portuguese and Spanish.

36 See http://funredes.org/lc for more details.

37 Top-level domains (TLDs) are divided into two classes. Generic top-level domains (gTLDs) include for example ".com" or ".org," while country code top-level domains (ccTLDs) are used and reserved for countries or dependent territories expressed as two letter country codes [OECD, 2009].

38 This is an imperfect proxy, as it does not take generic top-level domains (gTLDs) registered in each country into account, nor the fact that these registrations can be influenced by factors such as registration pricing policies. The relative shares of ccTLDs and gTLDs vary across countries. Nonetheless, domain-name registrations are an indicator of interest in adopting a web presence and ultimately an indicator of the development of the Internet [OECD, 2009].

39 See http://funredes.org/lc and the observation of Latin languages, German and English.

40 The *Organisation Internationale de la Francophonie* (OIF), a governmental organization bringing together 56 States, contributes to promoting diversity. Its four main action lines include one for "digital technologies." OIF was present during the WSIS process as an advocate of linguistic and cultural diversity in cyberspace. Supporting content creation in French and in the local languages of the Member States is an indirect part of the objective "to support and value digital expression of francophone communities." This translates, for example, into a programme to fund initiatives in the field (Information Highway Francophone Fund). Progress in content development in Spanish and French, and the productivity of French content relative to other languages, suggests that policies to support the production of local content can have measurable effects.

41 See http://www.puntcat.cat/en_index.html.

42 http://idrc.ca.

43 http://www.panl10n.net/.

44 http://www.panafril10n.org/.

45 The MAAYA network brings together more than 25 partners with a dynamic of fostering collaboration in concrete projects. UNESCO, which is a member of the MAAYA network, is the UN body which promotes the theme of linguistic diversity, both in the real world (protecting endangered languages) and in the virtual world (for instance in a signed agreement with ICANN) and, as mentioned in the introduction, coordinates with ITU for WSIS Action Line C8. See http://maaya.org.

46 See for instance the plenary session chaired in Rio de Janeiro by the Brazilian Minister of Culture in http://www.intgovforum.org/Rio_Meeting/IGF2-Diversity-13NOV07.txt.

47 See http://news.bbc.co.uk/2/hi/8333194.stm.

48 International Symposium on Multilingualism and Cyberspace, see http://maaya.org/spip.php?article105.

49 In Latin America, the project "En mi Idioma" (in my language) enables the Misak community of Colombia to design a website for language education. Enlace Quiche, in Guatemala, trains bilingual teachers and supports the production of educational packages in Maya

languages. ICVolunteers.org coordinates a network of volunteers, involved in cybervolunteerism and translation (over 10 000 volunteers registered). Its language and migration project assists migrants with their language needs and makes use of the web to do so.

50 http://www.acalan.org/fr/confeven/forum/forum.php.

51 See http://www.acalan.org/fr/confeven/forum/plan_action.pdf.

References

Bergman, M.K. (2001), White Paper: The Deep Web: Surfacing Hidden Value. in Ann Arbor, MI: Scholarly Publishing Office, University of Michigan, University Library vol. 7, no. 1, August, 2001 http://quod.lib.umich.edu/cgi/t/text/text-idx?c=jep;view=text;rgn=main;idno=3336451.0007.104.

ComScore (2008), "Social Networking Explodes Worldwide as Sites Increase their Focus on Cultural Relevance," http://www.comscore.com/Press_Events/Press_Releases/2008/08/Social_Networking_World_Wide.

Crystal, D. (2006), "Language and the Internet," Second Edition, Cambridge University Press, 9/2006.

Diki-Kidiri, M. (2007), "Comment assurer la présence d'une langue dans le cyberespace?," Unesco CI.2007/WS/1., 2007, http://unesdoc.unesco.org/images/0014/001497/149786F.pdf.

European Commission (2009), *Europe's Digital Competitiveness Report*, European Commission, Brussels.

Facebook (2010a), Company Timeline page, http://www.facebook.com/press/info.php?timeline (accessed 2 March, 2010).

Facebook (2010b), Statistics page, http://www.facebook.com/press/info.php?statistics (accessed 2 March, 2010).

Facebook (2010c), "Facebook's February 2010 US Traffic by Age and Sex: All Groups Growing, Men More Quickly," http://www.insidefacebook.com/ (accessed 2 March, 2010).

Graddol, D. (2006), "English Next," British Council, http://www.britishcouncil.org/learning-research-english-next.pdf.

Horrigan, J. (2010), "Broadband Adoption and Use in America," Results of FCC Survey, OBI Working Paper Series No. 1.

ITU (2010), "Measuring the Information Society 2010," Geneva.

Lee, C. G. (2009), "English language and economic growth: Cross-country empirical evidence," paper prepared for the Conference on Globalisation, Development and Growth in Asia," held at the University of Nottingham, Malaysia Campus, January 14-15, 2009.

Lewis, M. (2009), "Ethnologue: Languages of the World, Sixteenth edition," Dallas, Tex.: SIL International. http://www.ethnologue.com/.

Malherbe, M. (1999), "Les langues de l'humanité," Editor: R. Laffont, Paris.

Nandasara, S.T., Kodama, S., Choong, C,Y., Caminero, R., Tarcan, A., Riza, H., Nagano, R.L. and Y. Mikami. (2008), "An Analysis of Asian Language Web Pages,".in The International Journal on Advances in ICT for Emerging Regions (ICTer), Volume 1, No 1, 2008.

OECD (2006), *2006 OECD Information Technology Outlook*, OECD, Paris.

OECD (2009), *OECD Telecommunications Outlook 2009*, OECD, Paris.

Paolillo, J., D. Pimienta, D. Prado, Y. Mikami and X. Fantognanet (2005), "Measuring linguistic diversity on the Internet," UNESCO, Paris, http://portal.unesco.org/ci/en/ev.php-URL_ID=20882&URL_DO=DO_TOPIC&URL_SECTION=201.html.

Pimienta, D. (2008), "Accessing Contents," in: Global Information Society Watch, APC, Hivos and ITeM. http://www.giswatch.org/gisw2008/thematic/AccessingContent.html.

Pimienta, D. (2009), "Digital divide, social divide, paradigmatic divide," in: International Journal of Information Communication Technologies and Human Development, V1, N1, January-March 2009. Older version accessible at: http://funredes.org/mistica/english/cyberlibrary/thematic/Paradigmatic_Divide.pdf.

Pimienta, D., Prado D. and A. Blanco (2010), "Twelve years of measuring linguistic diversity in the Internet: balance and perspectives," UNESCO, Paris. http://unesdoc.unesco.org/images/0018/001870/187016e.pdf.

Prado, D. (2010), "Présence des langues romanes dans la connaissance," presentation made at "Présence, poids et valeur des langues romanes dans la société de la connaissance," OIF, Paris, 30 April 2010.

Suzuki, I., Y. Mikami, A. Ohsato and Y. Chubachi (2002), "A Language and Character Set Determination Method Based on N-gram Statistics," in: ACM Transactions on Asian Language Information Processing, Vol.1, No.3, September 2002, pp.270-279.

UNESCO (2005), Convention on the Protection and Promotion of the Diversity of Cultural Expressions, Document CLT-2005/CONVENTION DIVERSITE-CULT REV., Paris.

van Welsum, D. and Xu T. (2007), "Is China the new centre for the offshoring of ICT-enabled services?," DSTI Information Economy Report, March 2007, OECD, Paris.

Target 10: Ensure that more than half the world's inhabitants have access to ICTs within their reach

Introduction

The extent to which citizens use ICTs is perhaps the most objective measure of a country's success in creating an information society. Therefore, the goal of ensuring that more than half of the world's inhabitants have access to ICTs within their reach is possibly the most relevant of the ten WSIS targets.

Target 10 is related to all of the WSIS action lines, since giving people access to ICTs is one of the most fundamental requirements for creating an information society. Indeed, for some action lines, there is a very direct linkage:

- Action Line C2 (Information and communication infrastructure: an essential foundation for the information society) is a basic requirement for providing access to ICTs.

- Action Line C3 (Access to information and knowledge) is arguably the most relevant to Target 10, since access to ICTs is essential for allowing "*...people, anywhere in the world, to access information and knowledge almost instantaneously. Individuals, organizations and communities should benefit from access to knowledge and information*."[1]

- Action Line C6 (Enabling environment) has a major bearing on Target 10, insofar as a suitable regulatory environment can encourage investment in the telecommunication sector and lead to more infrastructure availability. Universal service/access regulations can also assist in expanding access to more people. Laws and regulations governing electronic transactions promote greater user trust in ICTs.

Another important issue, however, is ensuring that once ICTs are within reach, they are actually used. Action Lines

C4 (Capacity building), C5 (Building confidence and security in the use of ICTs) and C8 (Cultural diversity and identity, linguistic diversity and local content) seek to ensure that people have the necessary skills, confidence and incentives to make use of ICTs.

While Target 10 sets a clear and quantifiable goal, i.e. "*more than half the world's inhabitants*" (indeed, it is the only WSIS target with a numerical objective), it is vague in terms of the technologies or services concerned ("ICTs"). This chapter proposes the following four indicators to measure and track target 10 of WSIS:

1. Mobile cellular telephone subscriptions per 100 inhabitants

2. Proportion of individuals who used a mobile cellular telephone in the last 12 months

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

4. Proportion of households with access to the Internet by type of access (narrowband, broadband)

All four are among the core list of ICT indicators drawn up by the *Partnership on Measuring ICT for Development* and are being collected directly from countries by ITU.[2] They refer to mobile cellular and Internet technologies, and cover not only access but also, and importantly, use of these ICTs. By introducing two indicators that measure the actual usage of ICTs, the proposed indicators go beyond the sole notion of "access." To reflect this aspect, the wording of the target could in fact be slightly amended to read: "Ensure that more than half the world's inhabitants have access to ICTs within their reach and make use of them."

Measuring Target 10 — Proposed indicators

Target 10, like most of the other WSIS targets, is vague. It calls for populations to have ICTs "within their reach." This concept is subjective and may be interpreted in different ways. One person's "reach" differs from another's. A five-minute walk to a public phone may be easy for a young adult, but arduous for a senior citizen or disabled person. The measurement basis can also vary: e.g. distance (to a communication service), or time (required to reach a communication service). In any case, most countries do not measure either time or distance from ICTs, so there is no way to consistently track the goal in such terms.

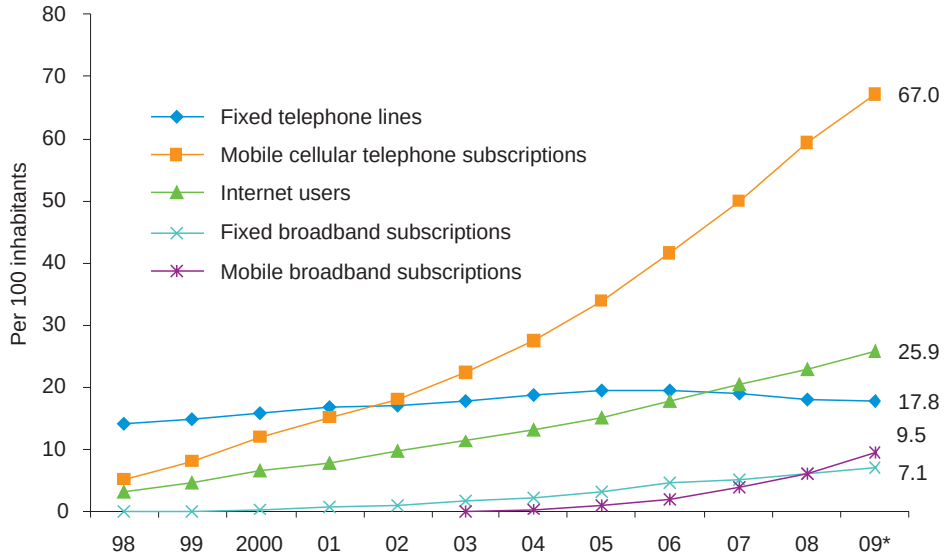
Chart 10.1 illustrates a number of alternative and popular indicators used to measure ICT uptake. It shows that ICT services have grown steadily over the last decade. With the exception of fixed telephone lines, penetration rates for ICT services, especially mobile cellular telephone subscriptions, have grown rapidly. Both fixed and mobile broadband are relatively recent technologies, but are also growing steadily. These findings suggest that communication services are spreading rapidly and that more and more people are using ICTs.

One ICT service that lends itself to a literal interpretation of "within their reach" is *mobile cellular communications*. A mobile subscription is usually personal, with the mobile handset carried by an individual. Few other ICTs can match this in terms of proximity. Moreover, despite some shortcomings, data on mobile cellular subscriptions are widely collected, so the target can be measured for practically every country in the world.

Measuring mobile uptake

A mobile subscription implies that a person not only has access to, but can also use, ICTs. This makes an indicator like the number of mobile cellular telephone subscriptions preferable to a coverage indicator, such as "percentage of the population covered by a mobile cellular signal"[3], which does not provide access information (i.e. the "reach" in the target would just be airwaves). While the number of laptop computers might also reflect the target's focus on proximity, many people do not have a laptop, either because they cannot afford one or choose not to have one. Furthermore, unlike a mobile phone, a laptop computer by itself does not have connectivity. Although there are cases where mobile subscriptions do not necessarily include a handset (e.g. when using a mobile broadband subscription connected to a computer, or machine subscriptions such as ATMs), in the vast majority of cases they do. Finally, there is considerable evidence that mobile is one service to which virtually all inhabitants over a certain age aspire. Therefore, one indicator proposed for monitoring Target 10 is: Mobile cellular telephone subscriptions per 100 inhabitants (*Partnership* indicator A2).

Chart 10.1: Global ICT development, 1998-2009



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

Although up-to-date mobile subscription data are widely available for practically every country in the world, there are methodological issues with this indicator. The main problem is that not every subscription maps onto one discrete individual, with the result that subscription data can overstate the actual number of people that possess a mobile phone. The main reasons for SIM-card duplications are:

- *Duplicate subscriptions*: For a variety of reasons, the same user can have more than one subscription, for instance to separate work from personal calls or to benefit from cheaper on-net tariffs in countries that have not introduced number portability. India, for example, does not offer number portability, so mobile subscribers cannot keep the same phone number when switching operators. Instead, subscribers buy new SIM cards, a trend that has been accelerated by the recent introduction of phones with multiple SIM cards.[4] ITU data show that, at the end of 2009, Belgium, for example, had a mobile cellular penetration of 112 per cent. According to the country's household survey, however, "only" 88 per cent of Belgians had used a mobile telephone over the last 12 months.[5] For countries where data are available, ITU analysis shows similar differences between mobile cellular penetration rates and mobile user data (See Chart 10.4).

- *Inactive subscriptions*: Not every subscription is active. This is a particular issue for prepaid subscriptions, where operators' practices differ regarding the length of time a subscription has to remain unused for it to be considered inactive.[6] While more and more operators and countries are trying to distinguish between active and non-active subscriptions, inactive accounts remain a data challenge.

- *Machine subscriptions*: A growing number of non-human devices such as automatic teller machines (ATMs) use mobile networks for processing transactions.[7]

Conversely, mobile penetration looks at individual ownership and thus understates the number of people who may actually have access to mobile communications, particularly in developing countries. People without their own mobile phone can easily use somebody else's, whether through a mobile public phone service or by borrowing a neighbour's or family member's mobile handset. This is especially relevant in developing countries, where mobile subscription penetration can sometimes understate overall accessibility to mobile communications. In the Democratic Republic of the Congo , for example, subscription penetration was 10 per cent in 2007 whereas the number of households with a mobile stood at 21 per cent.[8]

Box 10.1: Examples of non-voice mobile phone applications for development in Africa

- *Ushahidi*[11] (Swahili for "testimony") was launched in Kenya in response to post-election violence. Citizens can send information about incidents by text message using their mobile phone. This is then displayed on the Ushahidi website for the wider community. Ushahidi has been deployed for citizen monitoring of election violence in other countries.
- The *Pésinet*[12] project in Mali uses mobile technology to reduce child illness. "Agents de Pesée" (ADPs) are trained and provided with Java-enabled mobile phones to send information such as weight and symptoms about children in the community. The data are transmitted over mobile phones using the General Packet Radio Service (GPRS) network to a database which alerts doctors to any significant symptoms. A doctor can then send an SMS to the ADPs, who advise the family to bring the child to the health clinic for examination.
- Kenyan operator Safaricom developed the *M-Pesa* system to transfer "m-cash" over the mobile network without the need for a bank account.[13] Users can use their M-Pesa account to withdraw cash, buy airtime or send money to others. Safaricom reported 6.18 million registered M-Pesa users as of March 2009.
- In Senegal, *Manobi*[14] provides access to price data on various crops, collected from different markets across the country. Manobi personnel use mobile phones to send the price data to the Manobi database using the Wireless Application Protocol (WAP). Farmers use their mobile phones to query the database.
- Namibia became one of the first countries in Africa to offer digital television over mobile handsets. The *DStv mobile* service is a partnership between the local mobile operator MTC and the pan-African satellite provider Multichoice, and was launched in 2008.[15]

Note: Most of these examples were adapted from Beardon, Hannah (2009).

One way to overcome the limitations of mobile subscriptions as an indicator is to use a survey-based measure. The *Partnership* has defined such an indicator:

> Proportion of individuals who used a mobile cellular telephone in the last 12 months (*Partnership* indicator HH10).

The definition of this indicator specifies that the mobile phone does not need to be owned or paid by the person who used it, and may be "*available through work, a friend or family member. It may be owned collectively by several individuals or the use could be purchased from a public telephone call service.*"[9]

Information on mobile phone usage can be collected through national household surveys. Although an increasing number of countries are including questions on mobile phones in their ongoing surveys, data are still very limited, particularly in developing nations. For this reason, it is necessary to continue monitoring subscription data in order to have the widest coverage, while bearing in mind the limitations.

Today, mobile technology provides more than simple voice communications, and can therefore incorporate other unspecified ICTs called for in the target (e.g. Internet access, broadcasting). For example, around a fifth of United Kingdom mobile subscribers use their mobile phone to access news and information over the Internet or listen to music.[10] Box 10.1 lists several examples from Africa illustrating some non-voice mobile applications being used primarily for beneficial socio-economic purposes in that region.

Measuring Internet uptake

Mobile technology alone is insufficient to depict the full gamut of ICT possibilities. Although mobiles can be used for everything from voice to text messaging and from Internet access to watching television, there mere existence of a mobile subscription does not indicate what it is being used for. Given that a mobile handset implies voice communications as a minimum, that broadcasting is covered by Target 8 and that a computer by itself does not provide the full benefit of connectivity, then it is also relevant to focus attention on Internet access, which is arguably the

most important of all ICTs in terms of functionality and its potential development impact. Therefore, a third indicator proposed for measuring Target 10 is:

> Proportion of individuals who used the Internet (from any location) in the last 12 months (*Partnership* indicator HH7).

There are limitations with current Internet user data and, as is the case for mobile cellular use, the only reliable method for obtaining this information is through a national household survey. Many economies, including most developing countries, do not conduct regular (annual) and/or representative surveys on Internet use. Instead, data are often estimated based on Internet subscription data. These methods can be very unreliable, since there is no common yardstick for determining the multipliers, which can vary widely between countries.

Another important advantage of survey data is that they allow the target to be monitored at a disaggregated level. For example, it would be useful not only to monitor aggregate access to mobile phones and the Internet but also to understand how that access is distributed among different groups such as those living in rural areas, women compared to men, people in different age groups and of varying educational levels, etc. For this reason, countries are strongly encouraged to carry out regular and representative surveys to measure access to and use of ICTs by households and individuals.

It is widely recognized that broadband access to ICTs is crucial for delivering innovative applications and services, including in the area of ICT for development (ICT4D). At the same time, a number of studies have highlighted the spillover effects of broadband infrastructure and the impact it has on innovation and economic growth and on other sectors, including education and health.[16] Since the benefit of Internet access is so clearly amplified with a broadband subscription, it is important to add an indicator to measure the spread of broadband. However, measuring this presents some challenges in terms of methodology and data availability. Broadband is available via both fixed (e.g. ADSL, cable modem, fibre optic) and wireless (e.g. fixed wireless broadband such as WiMAX, 3G mobile) networks. Although in theory the type of high-speed access should not be an issue as long as it is in line with the minimum defined speed for broadband, there are limitations with 3G subscription data. In some countries, the number of 3G-enabled handsets is reported rather than the actual number of subscribers actively using 3G broadband services. Also, there are important differences in terms of speed and quality (for example, a fibre-to-the-home connection provides a different online experience from a mobile broadband connection), and a breakdown by technology is needed. The suggested indicator to track broadband uptake is therefore:

> Proportion of households with access to the Internet by type of access (*Partnership* indicator HH11).

The indicator distinguishes between narrowband, fixed broadband and mobile broadband, and should be collected through a survey.

The indicator meets the target's condition that the ICT be "within reach," since "at home" is arguably the closest, and the most convenient and accessible location possible. At the same time, "at home" is not the only (and, in developing countries, often not the predominant) location where people access the Internet. Broadband could also be available at work, at school, at a public location, at someone else's home, etc. While it makes some sense to assume that a 50 per cent penetration of households with broadband access corresponds to about 50 per cent of a country's inhabitants with high-speed access, the figure would therefore most likely underestimate the real extent of broadband.

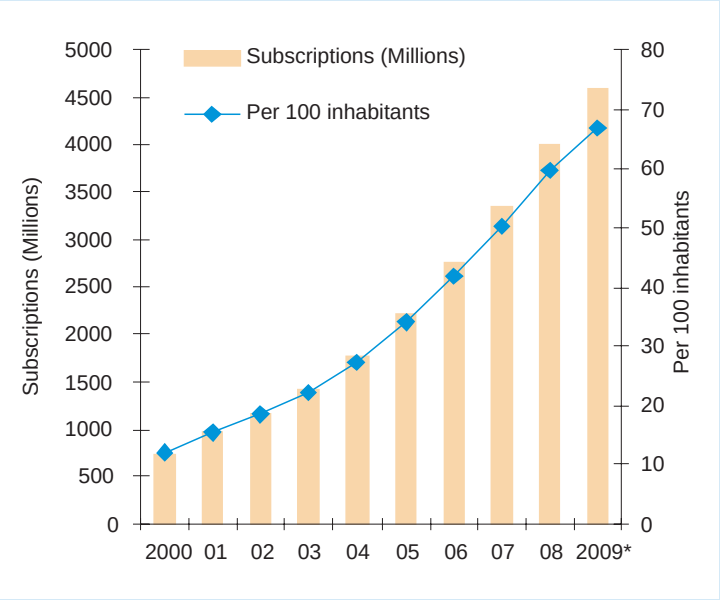
Status of Target 10

Mobile uptake

If one were to consider only the number of mobile cellular subscriptions and assume it to be equal to the number of actual mobile phone users, then the target of ensuring that half the world's inhabitants have access to ICTs would be met. By the end of 2009, there were two mobile subscriptions for every three people around the globe (Chart 10.2). Mobile cellular subscriptions around the world (some 4.6 billion) account for over three quarters of all telephone subscriptions. Developing countries surpassed the 50 per cent penetration mark in 2008, and by 2009 over 70 economies had surpassed the magi-

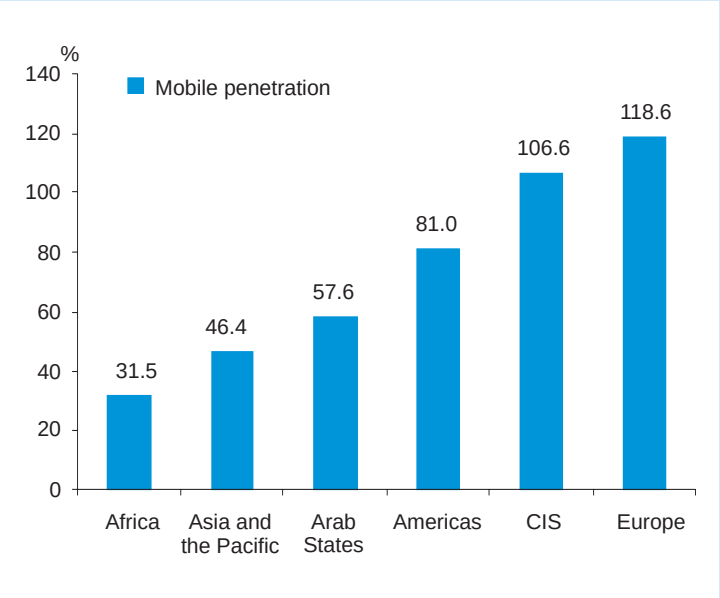
cal 100 per cent penetration mark, including a number of developing nations. Given this trend, it seems that eventually most countries will attain a penetration of 100 per cent.

Chart 10.2: Global mobile cellular subscriptions, 2000-2009



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

Chart 10.3: Global mobile cellular penetration, by region, 2009*



Note: * Estimate.
Source: ITU estimates based on World Telecommunication/ICT Indicators database.

In 2003, at the time of the first phase of WSIS, the number of mobile cellular subscriptions around the world was only around one for every five persons, and few anticipated the rapid take-up of mobile services. Mobile communications is an example of where many countries have "done the right thing," which explains its success. It is difficult to single out any one country insofar as, over time, most countries have come to adopt the necessary policies for sustaining mobile growth. However, identifiable success factors include a high degree of competition in the national mobile market, the adoption of a common technology, and the introduction of prepaid services (Box 10.2).

Two regions (Europe and the Commonwealth of Independent States) already have a mobile subscription penetration in excess of 100 per cent and in two more (Americas and Arab States), the number of mobile subscriptions was equivalent to, or above half of their inhabitants by 2009 (Chart 10.3). Only the Asia and the Pacific and Africa regions have yet to reach this figure. Based on the regional compound annual growth rates (CAGR) for the last three years, all regions except for Africa will have surpassed a mobile penetration of 100 per cent by the end of 2015. Based on the 2006-2008 CAGR, Africa's mobile cellular subscription penetration would reach 80 per cent by 2015.

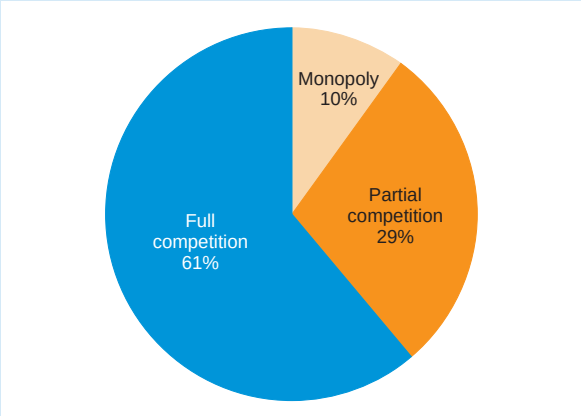
Since, as we have seen, the mobile subscription numbers do not correspond to the actual number of mobile users, a much better measure of mobile cellular uptake is the proportion of individuals who used a mobile cellular telephone. Currently, however, data are only available for a limited number of countries. A regional average can only be produced for Europe, where, by the end of 2008, 91 per cent of the population had used a mobile phone. In the Arab States, data are only available for Bahrain and Egypt, where 99 and 24 per cent of the population used a mobile phone, respectively. In all of the economies from Asia and the Pacific where data were available, more than half of the inhabitants had used a mobile phone. In the Americas, only Chile had more than 50 per cent mobile users, followed by Panama

Box 10.2: Mobile success factors

Over the last decade, no other ICT has grown as fast as mobile and connected previously unconnected areas in such a short space of time. There are a number of factors that have made the mobile boom possible:

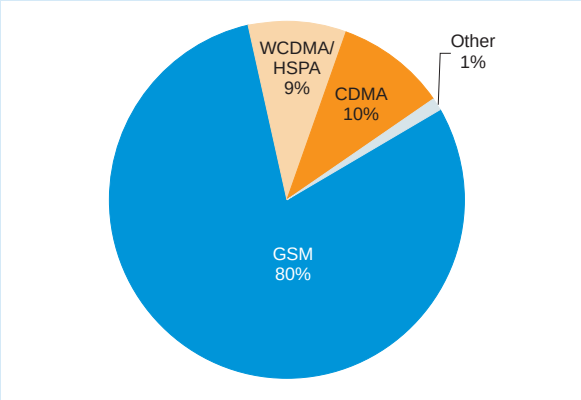
- **Competition**: The introduction of second-generation technology opened up greater opportunities for new market entrants due to increased capacity and better spectrum efficiency. Most countries introduced competition with the launch of GSM networks. For many countries, this was their first taste of competition in the telecommunication sector. Competition has lowered prices, increased services and expanded coverage, creating the right conditions for mobile communications to grow. As of 2009, 90 per cent of countries allowed competition in their cellular mobile market (Chart 1 Box 10.2).

Chart 1 Box 10.2: Percentage of countries with competition in the mobile market, 2009



Source: ITU World Telecommunication Regulatory database.

Chart 2 Box 10.2: Distribution of mobile subscriptions by technology, June 2009



Note: CDMA includes cdmaOne, CDMA2000 1X, CDMA2000 1xEV-DO and CDMA200xEV-DO Rev. A. Other includes TD-SCDMA, TDMA, PDC, iDEN and analogue.
Source: Adapted from GSM Association.

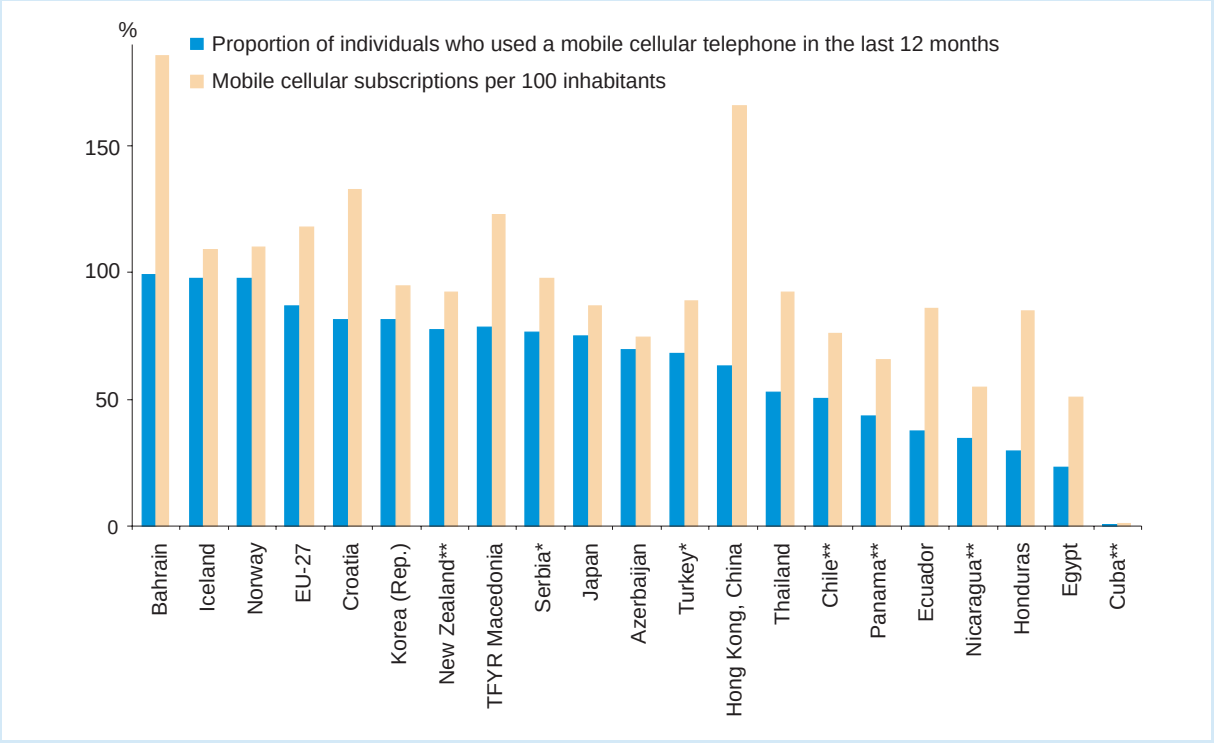
- **Common technology**: Europe established a common regional standard for second-generation digital mobile technology over a quarter century ago. This led to a de facto global standard for 2G mobile technology. Work on the *Groupe Spécial Mobile* (GSM) technology was launched by the European Conference of Postal and Telecommunications Administrations in 1982. EU governments worked closely to harmonize spectrum requirements and coordinate other technical issues for the successful adoption of GSM. The first GSM network was launched in Finland in 1991, and Australia became the first non-European country to join the GSM Association two years later. Today, nearly 800 operators in over 200 countries operate GSM networks.[17] GSM accounted for four out of every five mobile subscriptions around the world in June 2009 (Chart 2 Box 10.2).

- **Prepaid**: The introduction of prepaid billing in 1996 brought mobile to the masses. There are millions of people around the world who would not qualify for a postpaid mobile plan, let alone be able to afford the required monthly payments. The majority of subscriptions in developing countries are prepaid, and in some regions such as Africa almost all mobile subscribers are prepaid. For example, the Kuwaiti mobile group Zain operates in 15 African countries where over 99 per cent of its subscriptions were prepaid in 2008.

- **Applications**: The growing number of applications available with mobile networks has increased demand and usage. Roaming, text messaging and mobile broadband have become desirable applications for a growing number of people.

- **Equipment**: Mobile equipment, both on the network infrastructure side as well as devices, has grown in sophistication while continuing to drop in price. The emergence of Chinese equipment vendors such as Huawei and ZTE has driven competition in the infrastructure segment, dramatically reducing the cost of installing a mobile network. Innovations in handset technology include the development of sophisticated smartphones such as the Blackberry and iPhone, which are driving demand for mobile data services, together with falling prices for low-end models, making them more affordable for more users around the world.

Chart 10.4: Mobile cellular users versus mobile cellular subscriptions in Europe and countries where data are available, 2008



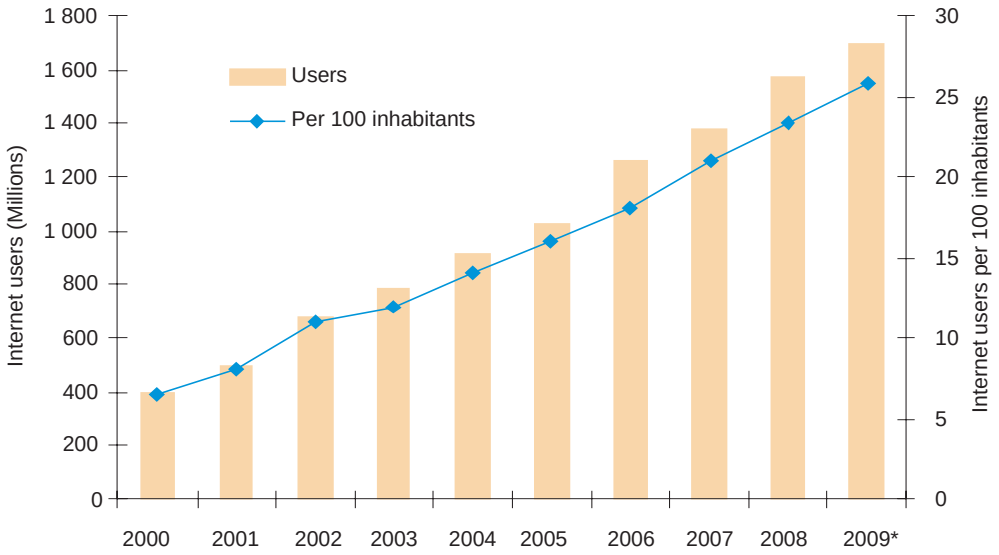
Note: *Data refer to 2007. ** Data refer to 2006. Countries' data refer to different target populations: ranges vary from 3 years old and over in Korea, to 16 to 74 years old in Europe.
Source: ITU World Telecommunication/ICT Indicators database.

(44 per cent), Ecuador (37 per cent), Nicaragua (35 per cent), Honduras (30 per cent) and Cuba (1 per cent). No African country has produced official data on the proportion of mobile users.

While, for the countries for which data are available, the number of mobile cellular subscriptions per 100 inhabitants always exceeds the number of mobile users, the differences in the ratio between the two indicators vary considerably, and it is not possible to derive an estimate of the number of mobile users from subscription data. For example, in a number of countries, including the Republic of Korea, Japan, and Azerbaijan, the percentage of users and subscriptions are relatively similar (70 per cent versus 75 per cent in Azerbaijan, for example). In other countries, including Hong Kong (China) and Honduras, the mobile cellular penetration is about three times the level of the mobile user penetration (Chart 10.4).

Because not many countries collect data on the number of mobile users, it is not possible to make a global or regional estimate (except for Europe). There are sufficient data for developed countries to indicate that most of them have achieved the 50 per cent threshold specified in the target. Existing data for about a dozen developing countries show that, in a number of them, including in Azerbaijan, Thailand and Chile, more than half the population is using a mobile phone. In Bahrain, which has one of the highest mobile cellular penetration levels in the world (187 per cent in 2008), 99 per cent of inhabitants use a mobile phone. In Ecuador, Nicaragua and Honduras, penetration rates at the end of 2008 stood between 30 and 40 per cent, suggesting that these countries are likely to reach the 50 per cent mark by 2015.

Chart 10.5: Global number of Internet users, 2000-2009*



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

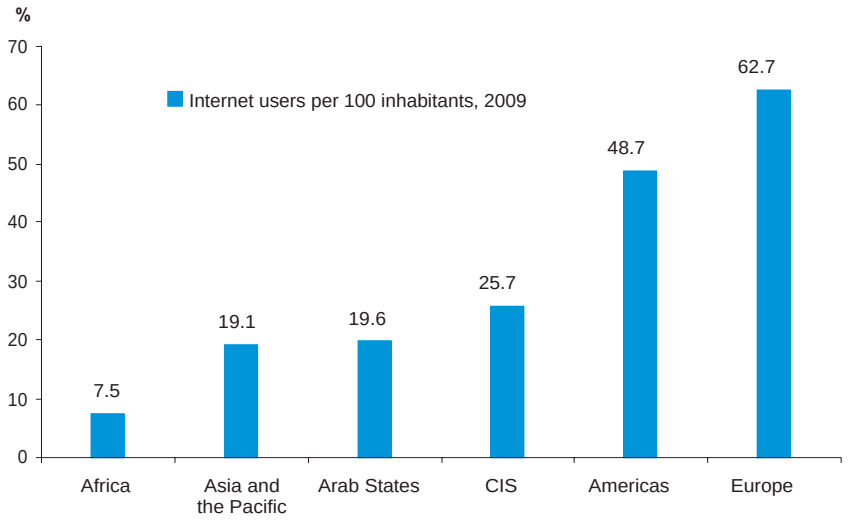
Internet uptake

Since the target of ensuring that more than half of the world's inhabitants have access to the Internet goes to the very essence of the information society, a country cannot be said to have an information society if the majority of its citizens are not online. Currently, access to the Internet is far less widespread than mobile communications. At the end of 2009, ITU estimated that some 1.7 billion people around the world were using the Internet, i.e. just over a quarter of the world's population (26 per cent, see Chart 10.5). In the developing world, less than 20 per cent (17.8 per cent) were online. By the end of 2009, only Europe had achieved the target, with average Internet penetration at 63 per cent (Chart 10.6). The Americas, at 49 per cent Internet penetration, had almost reached the target.

There are a number of factors that make the Internet an ICT which is more difficult to disseminate. In a number of countries, the Internet market, and particularly the backbone infrastructure and international gateway, remain under the monopoly of the incumbent telecommunication operator. Limited competition and scarce international Internet bandwidth tend to keep prices for Internet access high and often unaffordable in the area of fixed broadband access. The relatively high price of a computer, which remains the most popular access device for Internet users, makes it impossible for many people to have Internet access at home, and public access is the only way to go online. Using the Internet also requires a certain level of education (much more so than using a mobile phone), and the lack of relevant content in local languages is a major barrier to higher Internet user levels (see Chapter 9). To overcome these barriers, it is particularly important for governments to take a proactive role, for example by making the Internet more affordable, and by allowing as many people as possible to have home Internet access while at the same time ensuring public access in rural areas and for people with low income levels (Box 10.3).

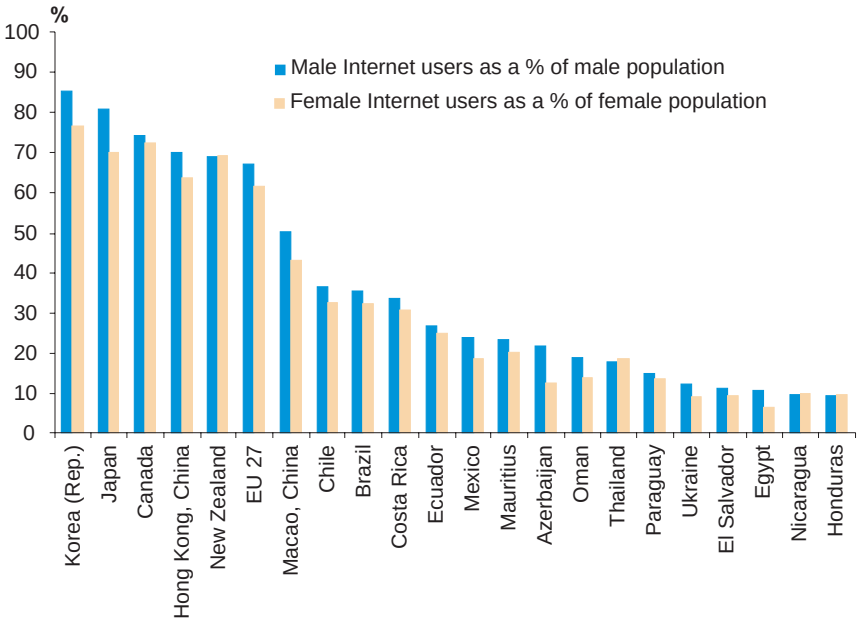
In ensuring that half the population has access to ICTs, it is also important to look at the gender dimension and to ensure that women, who represent about half of the world's population, have equal access. ITU's Internet user data broken down by gender show that in the majority of countries still more men than women use the Internet (Chart 10.7).

Chart 10.6: Internet user penetration by region, 2009*



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

Chart 10.7: Internet users by gender



Note: Latest year available.
Source: ITU based on Eurostat and national sources.

Box 10.3: Government support crucial for Internet uptake: examples from Morocco and Viet Nam

A number of governments have taken important steps in allowing more people to get online and to join the information society. They include Morocco and Viet Nam, two countries where Internet growth has been significant and where, by the end of 2008, Internet penetration had reached 23 and 33 per cent, respectively:

Morrocco — Although Morocco does not have the highest Internet penetration in the Arab States, it has had one of the fastest growing markets in the region over the last half decade. Penetration rose from just 2 per cent of the population in 2002 to almost a quarter (24 per cent) by 2008. One factor has been ongoing price cuts, with the incumbent Maroc Telecom making four major reductions in the price of Internet access between 2005 and 2008, in addition to offering frequent promotions such as free modems, a month's free subscription and higher bandwidth for broadband subscriptions at the same price. The price cuts have been triggered by competitive forces, regulatory requirements for wholesale access for Internet service providers and the government's part ownership of Maroc Telecom to influence it to encourage Internet access. Another factor is Morocco's strategic location at the crossroads of major submarine fibre-optic cables under the Mediterranean Sea. The country is connected to four undersea fibre-optic cables and has augmented its international bandwidth from 1 Gbit/s in 2004 to 25 Gbit/s in 2008. A veritable explosion in the number of cybercafes has also enhanced Internet usage, with an estimated 11 500 in 2007,[18] up from around 2 000 in 2004. The country's desire to be a major software offshoring centere has contributed to government support for ICTs. In addition, growing Arabic and French content has attracted users. There are signs that Internet growth is reaching a sustainable phase, with household computer and Internet access rising sharply between 2007 and 2008 from 17 to 27 per cent and from 7 to 14 per cent, respectively. The launch of 3G broadband has also driven Internet use and, by the end of 2008, 30 per cent of household Internet connections were 3G subscriptions.

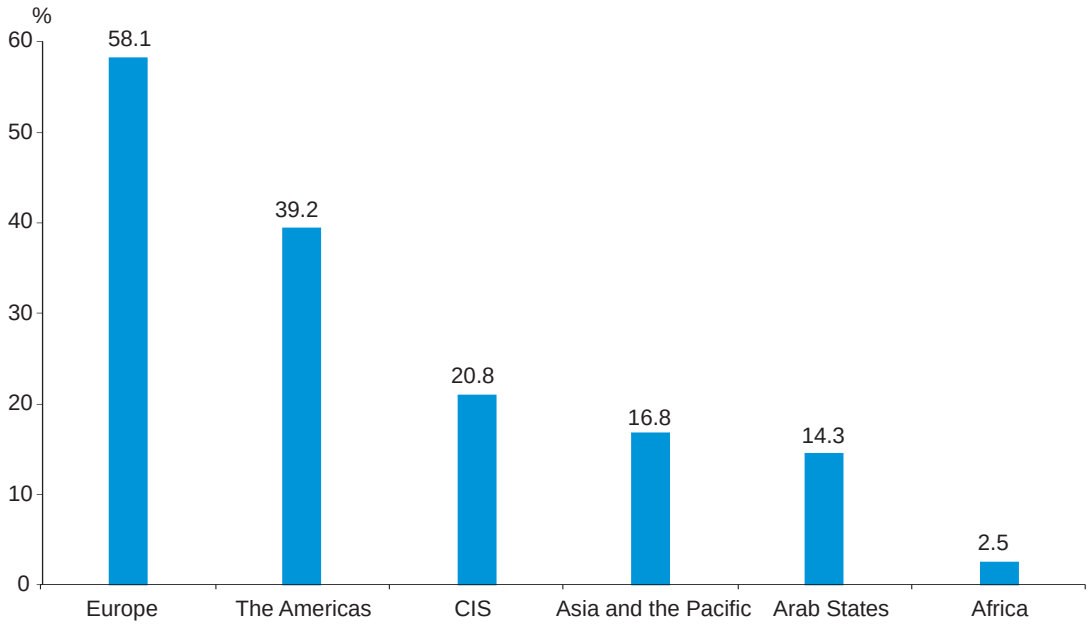
Viet Nam — According to the Viet Nam Internet Network Information Centre in the Ministry of Information and Communications, Internet penetration has risen by twenty points over the last five years, from 3.8 per cent of the population in 2003 to 24.4 per cent in 2008. International bandwidth increased even more spectacularly over the same period from 1 Gbit/s to 50 Gbit/s. One factor has been strong government support. The Vietnamese government has targeted the ICT sector as a key industry. It has rolled out infrastructure through state-owned firms and introduced a degree of managed competition between them. It has not neglected rural areas, with telephone services rolled out to all of the some 9 000 communes. The government recently signed an agreement with the Bill and Melinda Gates Foundation for a pilot project to provide Internet connectivity at 99 public access points in rural areas.[19] The project will also provide training on computer and Internet usage. The access points include post offices, libraries, schools and hospitals. Viet Nam's sustained economic output of over five per cent a year for the last two decades has driven a rise in incomes, making access to ICTs more affordable. Although government commitment and economic growth has contributed to the availability of infrastructure and affordability, Viet Nam faces a major barrier in terms of content, given that it has a unique national language and alphabet. However, literacy is high at 90.3 per cent, ranking it 69th in the world.[20] Access to alternative sources of news and information over the Internet has been a big driver of demand[21] and its large market of 21 million Internet users has attracted content development and applications.[22]

Source: ITU.

Although Internet penetration has almost quadrupled since 2000, it is growing too slowly (only a few percentage points of penetration per year), particularly compared to the explosive growth seen with mobile communications. However, with the spread of mobile Internet, it is likely that these figures will change significantly in the near future. It is therefore difficult to estimate future Internet user numbers on the basis of past growth rates, which mainly refer to fixed Internet usage.

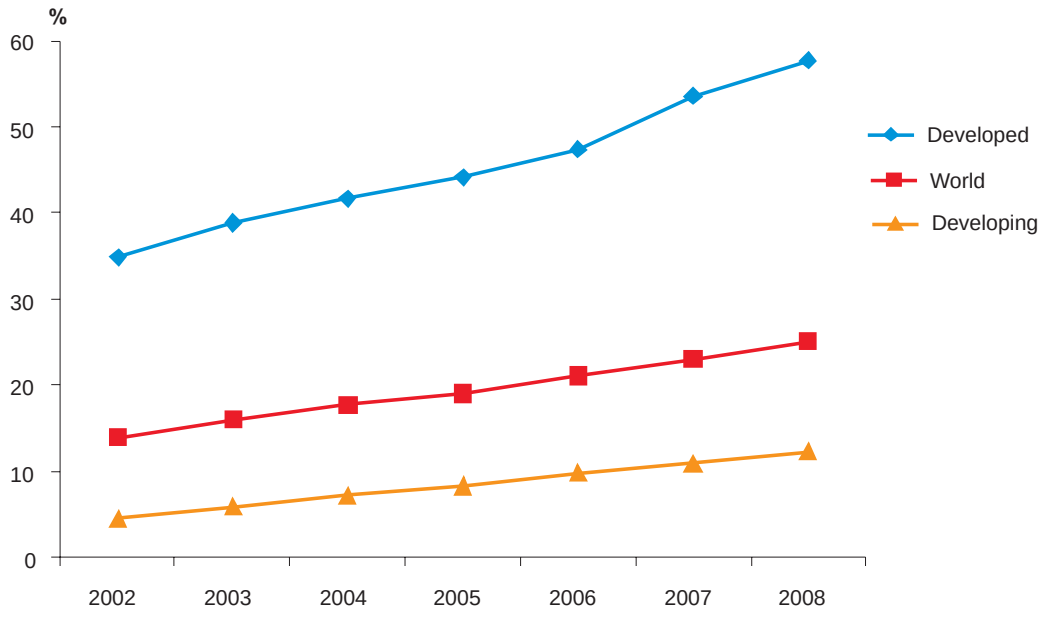
Data on the proportion of households with Internet access are available for the large majority of countries, either through national household surveys or ITU estimates based on proxy indicators, including the number of Internet subscribers. Household Internet penetration levels vary substantially between countries and regions. While by the end of 2008 almost 60 per cent of households in Europe had Internet access, only about 2.5 per cent of African households were connected to the Internet. Penetration rates stood at 14, 17 and 21 per cent in the Arab States, Asia and the Pacific and CIS, respectively, while countries in the Americas had on average close to 40 per cent of households connected to the Internet (Chart 10.8) There are also major differences within regions, particularly between developed and high-income economies, on the one hand, and the developing countries, on the other.

Chart 10.8: Proportion of households with Internet access, by region, 2008



Source: ITU World Telecommunication/ICT Indicators database.

Chart 10.9: Proportion of households with Internet access by level of development, 2008



Source: ITU World Telecommunication/ICT Indicators database.

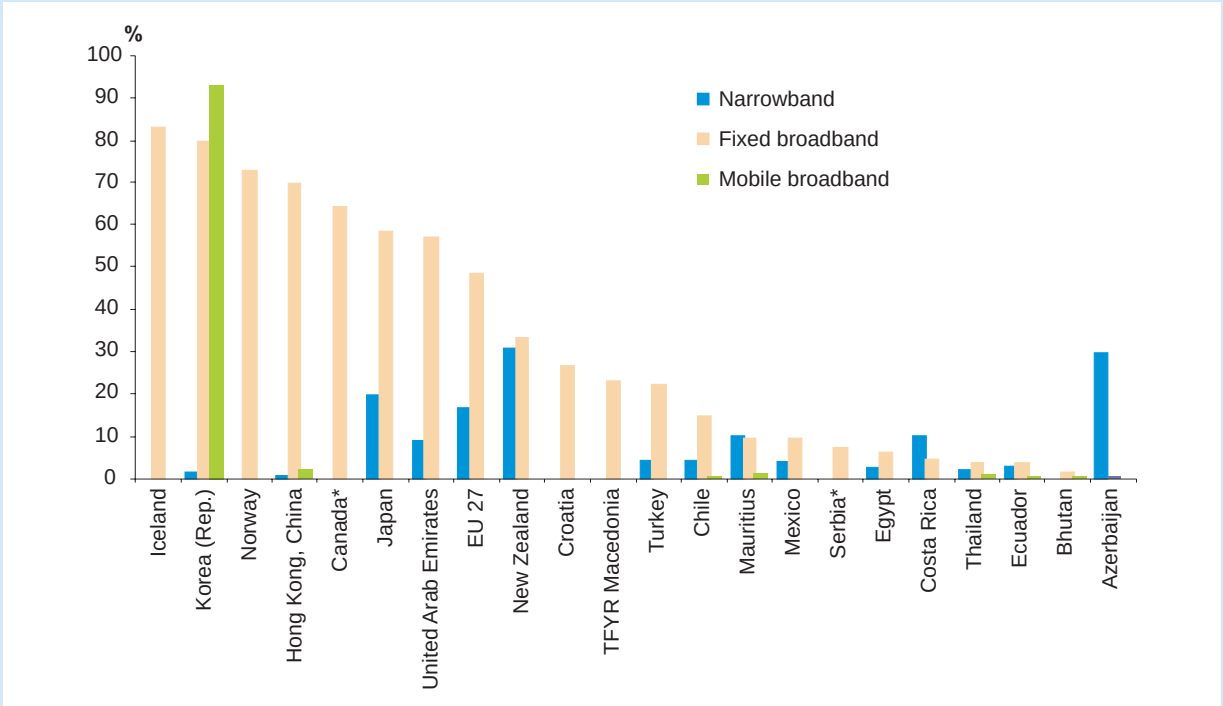
Even though, by the end of 2008, one out of four households in the world had access to the Internet on average, only one out of eight households in the developing countries were connected, compared to three out of five in the developed countries (Chart 10.9).

Fewer data are available on the proportion of households with access to the Internet by type of access. They show that a number of high-income economies, including the United Arab Emirates, the Republic of Korea, Japan, Denmark, Iceland, Hong Kong (China) and Canada have surpassed the 50 per cent penetration mark for fixed broadband access. In the Republic of Korea and Iceland, around 80 per cent of households were connected to the Internet through high-speed Internet access. All of the EU-27 countries collect data that distinguish between a fixed broadband and a narrowband connection, and the regional average was 49 and 17 per cent, respectively, by end 2008 (Chart 10.10), with the former gradually replacing the latter.[23]

The situation is very different in most developing countries that collect these data. Fixed household broadband penetration remains below five per cent in Costa Rica, Thailand and Ecuador. In Chile, about 15 per cent of households have fixed broadband access, followed by Mexico with 9.6 per cent.

Only few countries currently collect data on mobile broadband access at home, although this is likely to change in the near future, with more and more people using 3G mobile networks to connect to the Internet. In the Republic of Korea (a global leader in mobile broadband and one of the few countries to measure uptake), 93 per cent of households already have mobile broadband access. In other countries where data are available, including in Chile, Mauritius and Thailand, levels were still very low in 2008. At the same time, mobile broadband technology is expected to play a crucial role for countries in bringing more people online and achieving Target 10. The indicator proposed here measures both fixed and mobile Internet access in households. With the rapid uptake of mobile Internet, it is expected that the values of the indicator will increase rapidly in the near future.

Chart 10.10: Proportion of households with access to the Internet by type of access, 2008



Note: *Data refer to 2007. **Data refer to 2006. Whenever there are no data for the indicators "narrowband" and "mobile broadband", this may be either because the technology is not used (=> the penetration is effectively "zero"), or because the country does not collect these data (=> the value is unknown).
Source: ITU World Telecommunication/ICT Indicators database.

Conclusion and recommendations

Target 10 is vague in terms of defining which ICTs are to be monitored and the exact meaning of "within their reach." In this chapter, the target has been interpreted as to the "reachability" aspect and specifically which ICTs to measure. This is essential for monitoring the target in a concrete, clear and objective manner. The specific goal — more than 50 per cent of the world's inhabitants — has not been altered.

The choice of the four indicators to measure Target 10 was based on the availability of data and on their usefulness in tracking and measuring the target in a meaningful way:

Mobile cellular penetration (*mobile cellular telephone subscriptions per 100 inhabitants*) is the indicator that best matches the "availability within reach" aspect of the target. On the basis of this indicator, the target has been achieved since, by the end of 2009, worldwide mobile cellular penetration stood at 67 per cent. However, given that the number of mobile cellular subscriptions does not necessarily correspond to the number of subscribers, or indeed the number of users of mobile phones, this indicator does not measure how many people are actually making use of a mobile phone.

An indicator that provides a more accurate measure of the number of mobile users is the *proportion of individuals who used a mobile cellular telephone during the past 12 months*. As more and more countries collect this indicator through household surveys, it should replace mobile cellular penetration as the primary measure. Currently, too few countries collect data on actual usage to establish whether more than 50 per cent of the world's inhabitants use a mobile phone. Existing data, which are limited mainly to developed economies and only about a dozen developing economies, show that the Target 10 has been met in the developed world. Several developing countries have achieved the target, and others are steadily approaching it. If countries manage to sustain current growth in and demand for mobile telephony, the target could be met by 2015.

Since the information society is closely linked to Internet and the virtually unlimited amount of information it provides, the *proportion of individuals who used the Internet (from any location) in the last 12 months* was introduced to measure Internet uptake. There are problems with Internet user data, Europe being the only region where virtually all members carry out surveys to collect this information. In the absence of survey data, the number of Internet users may be estimated based on proxy indicators (usually the number of Internet subscribers). Data show that Target 10 has yet to be achieved in respect of Internet use since, by the end of 2009, only 1.7 billion people, or 26 per cent of the world's population, were online. While the developed countries have achieved the target, less than 20 per cent of people in the developing world were online by the end of 2009.

The indicator measuring the *proportion of households with access to the Internet by type of access* was introduced in order to measure the uptake of broadband Internet access, which is essential for people to benefit fully from the opportunities the Internet offers. Moreover, home access to the Internet satisfies the target's requirement that access be 'within reach'. Currently, only about a dozen developing economies collect data on the number of households with fixed broadband access, and even fewer collect data to track mobile broadband access at home. By the end of 2008, fixed broadband penetration in the EU-27 countries had reached 49 per cent, suggesting that many developed countries have only recently attained the target. Available data for some of the developing countries show that they are still a long way from following suit. However, current developments in the mobile sector and the increasing number of mobile cellular subscriptions are expected to have a major impact on broadband access. While the progression of mobile broadband is not yet reflected in the country data currently available, it is likely to have a crucial role in making the target achievable.

Recommendations to achieve Target 10

A number of recommendations may be put forward with a view to achieving Target 10. While most of them are specific to the four indicators identified to track the target, they also highlight the importance of the other WSIS targets and the link between the various WSIS action lines. To create a global information society and to ensure that more than half the world's inhabitants not only have access to ICTs, but also actually use them, will call for actions on various fronts. This includes building the necessary infrastructure and providing public access, expanding skills and creating relevant and local content.

Target 10: Ensure that more than half the world's inhabitants have access to ICTs within their reach

Mobile telephony has made impressive gains and is one of the fastest-growing consumer technologies ever introduced. To sustain that growth and reach the goal of all adults using a mobile phone around the world, the following policies need to be pursued:

- *Expanding mobile network coverage in developing countries, particularly in rural areas* (a recommendation which is also related to Target 1 — Connect villages with ICTs). Coverage can be expanded through regulatory tools, such as including coverage requirements in licence conditions, or through universal service funding to deploy networks in underserved areas. Countries that have not yet done so should also launch 3G networks and exploit the potential that mobile broadband networks offer, including high-speed access to the Internet.

- *Lowering barriers to entry and usage through policies to increase competition and lower costs*. Competition can be intensified by allowing more market entrants. About 30 per cent of countries today only have a duopoly or partial competition in their mobile market, and 10 per cent still lack any competition whatsoever (Chart 1 Box 10.2). Competition can also be intensified through a number of regulatory tools, such as requiring wholesale service provision to retailers such as mobile virtual network operators (MVNOs); allowing users to keep their own number when changing mobile networks (mobile number portability); and correcting monopoly market power over mobile call termination by establishing cost-based caps on wholesale prices.[24] High taxes in the form of import duties on handsets or special excise taxes on airtime have been documented as discouraging mobile take-up and usage.[25]

Like the printing press, electricity or the automobile, the Internet is a technology that has far-reaching impacts on society. The Internet, and especially broadband Internet, is increasingly accepted as a general-purpose technology that dramatically affects the way people communicate, do business, interact with governments, educate themselves and obtain information.[26] Unfortunately, these benefits have yet to spread to the majority of humankind. If the target of ensuring that half of the world's inhabitants have access to and use the Internet is to be achieved by 2015, governments will need to accelerate Internet and broadband take-up and pursue policies that will have a dramatic impact on usage. This includes ensuring that women, who represent about half of the world's population, have equal access. Policy actions include:

- *Increasing competition to lower the cost of access*. Although many countries claim to have competition in their retail Internet access market, the real bottleneck is in wholesale provision, particularly access to international connectivity, where competition is less prevalent. The cost of international bandwidth is one of the main underlying causes of high Internet (especially broadband Internet) prices in developing countries and needs to be reduced through greater competition in wholesale markets. When there is significant market power over key facilities such as submarine fibre-optic landing stations, appropriate regulatory remedies need to be adopted. Developing countries also need to seize the potential of wireless broadband for stimulating competition in the Internet access market. This is highly relevant considering that fixed broadband options are extremely limited in many developing nations. Countries that have not yet allocated the requisite spectrum for wireless should do so. Furthermore, countries need to consider using this opportunity to enhance broadband competition by licensing new players, setting aside some of the wireless broadband spectrum for new players or applying other incentives to attract new market entrants.

- *Expanding public access*. The cost of computers and Internet access is a major barrier to household take-up in developing countries. Governments need to adopt the appropriate policies and provide the necessary resources to encourage the establishment of sufficient public access points for Internet access, particularly in rural areas. This policy emphasis should be considered as a priority, given that it is linked to a number of other WSIS targets: Target 1 (Establish community access points), Target 2 (Connect schools with ICTs) and Target 4 (Connect public libraries, archives, museums, cultural centres and post offices with ICTs).

- *Providing citizens with the appropriate ICT skills.* In order to be used effectively, ICTs, particularly the Internet, require a basic level of ICT literacy. Many people around the world cannot use the Internet because they are illiterate. This is tied to education, where opportunities for learning must be made universal if ICT use is also to expand. ICTs must also be provided in schools and ICT skills development must form part of the curriculum. In addition, there are various segments of the population beyond school age who require training in ICTs. This is related to Target 7, which calls for adapting school curricula to meet the challenges of the information society.

- *Developing locally relevant content*. Greater availability of local content, in local languages, will drive more people to use the Internet. Governments can help by developing appropriate online services that will attract users to utilize the Internet, and by encouraging local content development through partnerships with the private sector, development agencies, non-governmental organizations, the academic and research sector and other partners. This will also help in achieving Target 9, which calls for more local content and language diversity on the Internet.

Notes

1 See WSIS Geneva Plan of Action , 2003, at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c3.

2 The *Partnership on Measuring ICT for Development* is a multistakeholder partnership launched in 2004. To achieve its main objective — namely, to increase the availability and quality of internationally comparable ICT data — it has developed a core list of ICT indicators. For more information on the Partnership and its core list of indicators, see: http://www.itu.int/ITU-D/ict/partnership/index.html and the introduction to this report.

3 For more information on this indicator, see Chapter 1 of this report.

4 Leahy, Joe (2010). *India's mobile sector gets a reality check*, Financial Times, 2 March, 2010.

5 The issue of duplicate subscriptions (multiple SIM cards) is confirmed by a 2007 study carried out by the operator Mobistar. The study found that in 2007 duplicate subscriptions in Belgium accounted for 14% of mobile penetration (84% instead of 98%). See: Mobistar. Analyst Presentation: Full year results 2007. 5 February 2008.

6 The *Partnership on Measuring ICT for Development* recommends three months. See [Partnership, (2010)].

7 Berg Insight estimates that the number of cellular network connections worldwide used for machine-to-machine communication will grow from 47.7 million connections in 2008 at a compound annual growth rate (CAGR) of 25.6% to 187.1 million connections in 2014. In the coming years millions of motor vehicles, utility meters, POS-terminals, security alarms and other machines will become networked. See: http://www.researchandmarkets.com/research/99ba52/the_global_wireles.

8 Ministère du Plan et Macro International. 2008. *Enquête Démographique et de Santé, République Démocratique du Congo 2007*. Calverton, Maryland, U.S.A.: Ministère du Plan et Macro International.

9 See [Partnership (2010)], page 25.

10 See: http://www.comscore.com/Press_Events/Press_Releases/2009/3/UK_iPhone_Users.

11 See: htt://pwww.ushahidi.com.

12 See: http://www.pesinet.org/wp/.

13 See: http://www.safaricom.co.ke/index.php?id=745.

14 See: http://www.manobi.sn/sites/sn/.

15 See: http://www.itweb.co.za/index.php?option=com_content&view=article&id=2508:namibia-takes-the-lead-in-mobile-television&catid=190:mobile-and-wireless-technology#prcontacts.

16 See for example the United States Federal Communications Commission's website on broadband, at http://www.fcc.gov/broadband/ and [OECD (2009b)].

17 See: http://www.gsmworld.com/membership/our_members.htm.

18 See: http://www.bladi.net/democratisation-d-internet-les-cybercafes-resisteront-ils.html.

19 See: http://www.gatesfoundation.org/press-releases/Pages/improving-public-internet-access-in-vietnam-090420.aspx.

20 See Human Development Report 2009, at: http://hdrstats.undp.org/en/countries/country_fact_sheets/cty_fs_VNM.html.

21 See: http://news.bbc.co.uk/2/hi/asia-pacific/6169057.stm.

22 See: http://www.reuters.com/article/pressRelease/idUS132289+28-May-2009+BW20090528.

23 For a list of the 27 countries included in the EU-27 group, see: http://europa.eu/abc/european_countries/index_en.htm .

24 For example, the European Commission finds that: "Higher mobile termination rates make it harder for fixed and small mobile operators to compete with large mobile operators. These divergences, and differing regulatory approaches, undermine the Single Market and Europe's competitiveness." http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/710&format=HTML&aged=0&language=EN&guiLanguage=nl.

25 GSMA, *Global Mobile Tax Review 2006-2007*. http://www.gsmworld.com/our-work/public-policy/regulatory-affairs/policy-recommendations-for-developing-countries/global_mobile_tax_review.htm.

26 See for example page 16 of the Executive Summary of [OECD(2009a)].

References

Beardon, H. (2009), Mobiles for Development: How Mobile Technologies Can Enhance Plan and Partners Work in Africa. Plan International.

Partnership on Measuring ICT for Development (2010), *Core ICT Indicators.* Geneva, 2010.

OECD (2009a), *OECD Telecommunications Outlook 2009*. OECD, Paris.

OECD (2009b), Network Developments in Support of Innovation and User Needs, Working Party on Communication Infrastructures and Services Policies. OECD, Paris.

Conclusions and the way forward

This World Telecommunication/ICT Development Report (WTDR) reflects the first effort to carry out a comprehensive global review of the international targets and goals agreed at the World Summit on the Information Society (WSIS) in Geneva and Tunis, based on a set of measurable indicators. Only five years away from the target date of 2015, this mid-term review will help policy-makers assess what has been achieved since the conclusion of WSIS in 2005. It also provides concrete suggestions on how to monitor progress, and on the policies that could be implemented to achieve the targets.

Overall, the analysis showed that considerable advances have been made in terms of global dissemination of ICT since WSIS. In particular, mobile telephony has spread worldwide, making it likely that by 2015 half the world population will be using mobile phones. Similarly, access to basic radio and TV services is widely available. The number of Internet users has also been growing continuously, Internet user penetration having doubled between 2003 and 2009 (from around 12 per cent in 2003 to around 25 per cent by the end of 2009).

Good progress has also been made in bringing Internet access to central governments and scientific and research institutions, and to some extent also to schools, hospitals, museums, libraries and archives, at least in the major cities. There are a large number of national initiatives to provide Internet access to museums and archives, in particular, including in the developing world. Given their relatively limited number worldwide (in relation to, for example, households or schools), and as the majority of them are located in the developed world, connecting all museums and archives by 2015 could be achieved with the right policy focus.

Nevertheless, by the end of 2009, 75 per cent of the world population (and more than 80 per cent of people in developing countries) were not yet using the Internet, and even fewer via a broadband connection. Yet broadband Internet is increasingly considered as a general-purpose technology, on a par with electricity, and even as a basic human right. With five more years to go before the 2015 target year, all stakeholders need to step up a gear in their efforts to bring high-speed Internet to a large number of people and institutions, especially in the developing world, and in particular to rural communities, schools, hospitals and local governments.

Furthermore, in order to harness the full potential of ICTs, and for countries to become knowledge-based societies, there is a need to move from simply ensuring the provision of infrastructure and ICT access to encouraging the effective use of ICTs. Increasing people's and organizations' use of ICTs and developing applications in such areas as e-health, e-learning, e-culture and e-government are thus essential, and have been included in the assessment of the targets. Finally, much needs to be done to make the Internet truly multilingual in order to create an inclusive information society.

In view of these findings, and to ensure that the WSIS targets and goals will be achieved by 2015, a concerted policy effort is required on the part of all national, regional and international stakeholders. This is especially important given the significant impact that ICT use has on other areas of social and economic development and, hence, the major role ICT development can play in achieving the Millennium Development Goals (MDGs), also set for 2015.

Each of the chapters of this report provides a set of specific policy recommendations for the respective target. Many of the policy areas outlined in the report, and which require urgent attention, were also addressed in detail in the WSIS outcome documents. Therefore, full implementation of the WSIS action lines will help to achieve the WSIS targets by 2015. Five years is a relatively short period for putting in place new policies and programmes and achieving widespread impact. However, ICTs are in high demand and, if made accessible, affordable and meaningful, are likely to be taken up and used quickly by citizens and institutions.

Given the importance of high-speed Internet access for full participation in the information society, universal access to broadband should be a key policy focus in all countries without exception in the years to come. At the international level, assistance should be provided to support developing countries in the establishment and implementation of national broadband plans. ITU's "*Build on Broadband*" initiative highlights the power of broadband as a tool for driving social and economic development, and urges governments to take the lead in forging partnerships with industry in order to develop national broadband networks and ensure affordable, equitable access for all citizens.[1] The newly created high-level *Broadband Commission for Digital Development*, led by ITU and UNESCO and supported by the UN Secretary-General, aims to promote the huge potential of high-speed communication networks for transforming economies and accelerating achievement of the MDGs. In time for the 2010 MDG Review Summit, the Broadband Commission will focus attention on fast-tracking the formulation and implementation of national ICT policies in line with the MDGs, and propose a set of actions and initiatives to implement universal broadband access based on a sector-wide approach.

Monitoring progress: towards 2015

A key objective of the report was to review the WSIS targets, revise them where necessary for measurement purposes, and identify a set of measurable indicators that could be used by national, regional and international stakeholders to monitor progress until 2015 — and beyond.

Not all the targets specify a quantitative goal such as "*more than half*" of the population should have ICTs within their reach (Target 10), or "all" of the population should have access to TV and radio (Target 8). Much emphasis was placed on "*connecting*" villages, schools, museums, hospitals etc. with ICTs, without however specifying the type of connectivity or ICT, nor *a fortiori* the use that should be made of the technology. Therefore, each target was interpreted in the context of today's ICT developments, and rephrased where necessary for the purpose of measurement and to identify the relevant indicators.

Some areas, although vital to the development of the information society, are not covered anywhere in the targets. The most critical example is the use of ICTs by businesses, which is essential for participating in today's knowledge-based economy and being competitive. This area is reflected in Action Line C7, under "e-business," which calls upon governments to promote the use of e-business, especially in developing countries. It is therefore proposed that a new target be added: "Connect all businesses with ICTs." Indicators to monitor this proposed new target have been defined by the *Partnership on Measuring ICT for Development* and are collected at the international level by the United Nations Conference on Trade and Development (UNCTAD).[2]

Other areas not addressed by the targets are e-agriculture and e-environment, which are also included in Action Line C7; building confidence and security (Action Line C5); and the ethical dimensions of the information society (Action Line C10). Progress in these areas should also be monitored and indicators defined to this end.

The *WSIS Mid-term Review Table* (at the end of this chapter) summarizes the main results of the report, including proposed revisions to the targets to facilitate measurement, the most relevant action lines, and the indicators proposed to monitor each of the targets. The proposals should be considered as preliminary, and will be subject to further consultation and refinement (see below).The table also provides an overall assessment of the status of the targets and the indicators for which data were available, by developed and developing countries. It shows that, whereas in developed countries most indicators have a high level of achievement, this is not the case in developing countries, where only few indicators have reached a high level of achievement and most indicators are still at a low level. This confirms the urgent need for policy action outlined throughout the report.

The mid-term review clearly suffered from limited data availability. Even though the most basic indicators were chosen, they are often not collected at the national (or international) level, or are outdated. It was therefore not possible to perform a comprehensive global assessment of all targets. The questionnaire sent out by ITU in preparation for the review was returned by 48 countries, but information was not always provided for all of the targets.

Without further and more extensive data collection at the national level, it will be difficult to assess whether the WSIS goals and targets will be met by 2015. This is a problem for developing countries in particular, where ICT penetration levels are lower and which are behind in meeting several of the targets.

One of the difficulties of measuring progress towards the WSIS targets has been the lack of concrete, measurable and well-defined indicators. The *Partnership on Measuring ICT for Development* has drawn up a core list of ICT indicators, and an increasing number of countries are using them to collect ICT statistics. However, the WSIS targets go beyond the *Partnership*'s current core list. This report represents the first effort made at the international level to define a set of quantifiable indicators related to each WSIS target. The proposed indicators can facilitate data collection and comparisons between countries, and countries should find them useful in their efforts to monitor their information society developments.

Monitoring progress towards the WSIS targets needs to be continued up to at least 2015. The international community needs to assist countries in the measurement process. The indicators presented in this report can serve as a starting point, but they need to be further refined, and perhaps expanded, in consultation with the WSIS community.

As a follow-up to the mid-term review presented here, it is therefore proposed that a sustained effort be made by the international community to develop a monitoring framework for the WSIS targets and assist the data collection process at the national and international levels. The *Partnership* is best placed to take on such a task. Indeed, in 2008, the United Nations Economic and Social Council (ECOSOC) recommended that the *Partnership* track progress towards the achievement of the WSIS goals and targets (Resolution 2008/3, § 29). In particular, it

"*Recommends that the Partnership on Measuring Information and Communication Technologies for Development consider the creation of benchmarks and indicators, including impact indicators, for further consideration and decision by the Statistical Commission, in order to track progress towards the attainment of the specific goals and targets set out in the outcome documents of the World Summit on the Information Society, particularly section B of the Plan of Action adopted in Geneva*."

Under the umbrella of the *Partnership*, ITU, the co-authors of this report (UNESCO, WHO, UNDESA and representatives from civil society, such as FUNREDES) and other *Partnership* members should work together to develop a measurement framework for the WSIS targets, in close collaboration with other relevant stakeholders. A final matrix for all targets and action lines should be presented as soon as possible and disseminated widely to help countries in their monitoring efforts. Data should be compiled on a continuous basis, and regular quantitative updates of progress on the goals should be prepared by the partners. A final report should then be prepared for 2015, setting forth a global assessment of progress achieved in reaching the WSIS targets and goals.

WSIS mid-term review table: Targets, action lines, proposed indicators and overall status

WSIS Targets	Proposed target revisions for monitoring progress	Most relevant WSIS action lines	Proposed indicators for monitoring progress*	Overview of level of achievement, 2009**	
				Developed countries	Developing countries
1. To connect villages with ICTs and establish community access points	*To connect **all** villages with ICTs and establish community access points*	C2. Information and communication infrastructure C3. Access to information and knowledge C4. Capacity building	1. Rural population covered by a mobile cellular telephone network, broken down by technology	High	High
			2. Rural households with a telephone, by type of service (fixed and/or mobile, mobile only, fixed only)	High	Medium
			3. Rural households with Internet access, by type of access (narrowband, broadband)	Medium	Low
			4. Localities with public Internet access centres (PIACs), by type of access and urban/rural	Medium	Low
			5. Location of individual use of the Internet in the last 12 months (including PIACs), by urban/rural	n.a.	n.a.
2. To connect universities, colleges, secondary schools and primary schools with ICTs	*To connect **all** ~~universities, colleges,~~ secondary schools and primary schools with ICTs*	C2. Information and communication infrastructure C3. Access to information and knowledge C7. E-learning	1. Schools with a radio used for educational purposes	High	Medium
			2. Schools with a television used for educational purposes	High	Medium
			3. Schools with Internet access, by type of access (narrowband, broadband)	High	Low
			4. Learners-to-computer ratio	High	Low
3. To connect scientific and research centres with ICTs	*To connect **all** scientific and research centres with ICTs*	C2. Information and communication infrastructure C3. Access to information and knowledge C7. E-science	1. Scientific and research centres with broadband Internet access	High	Medium
			2. Presence of a national research and education network (NREN), by bandwidth capacity (Mbit/s)	High	Medium
			3. Number of NREN nodes	n.a.	n.a.
			4. Universities connected to the NREN by type of connection (narrowband, broadband)	High	Medium
			5. Scientific and research centres connected to the NREN by type of connection (narrowband, broadband)	High	Medium
4. To connect public libraries, cultural centres, museums, post offices and archives with ICTs	*To connect **all** public libraries, cultural centres, museums, post offices and archives with ICTs*	C3. Access to information and knowledge C4. Capacity building C8. Cultural diversity and identity, linguistic diversity and local content	1. Public libraries with broadband Internet access	High	Low
			2. Public libraries providing public Internet access	Medium	Low
			3. Public libraries with a website	Medium	Low
			4. Cultural centres with broadband Internet access	n.a.	n.a.
			5. Cultural centres with a website	n.a.	n.a.
			6. Cultural centres providing public Internet access	n.a.	n.a.
			7. Museums with broadband Internet access	High	Medium
			8. Museums with a website	High	Medium
			9. Post offices with broadband Internet access	n.a.	Low
			10. Post offices providing public Internet access	n.a.	Low
			11. Archives with broadband Internet access	High	Medium
			12. Archives with a website	Medium	Low
			13. Content in archives that has been digitized	n.a.	n.a.
			14. Digitized information in archives that is available online	n.a.	n.a.
5. To connect health centres and hospitals with ICTs	*To connect **all** health centres and hospitals with ICTs*	C2. Information and communication infrastructure C7. E-Health	1. Public hospitals with Internet access, by type of access (narrowband, broadband)	High	Medium
			2. Health centres with Internet access, by type of access (narrowband, broadband)	High	Low
			3. Public hospitals using computers/the Internet to collect/process/transmit individual patient information	Medium	Low
			4. Health centres using computers/the Internet to collect/process/transmit individual patient information	Medium	Low

WSIS mid-term review table: Targets, action lines, proposed indicators and overall status (continued)

WSIS Targets	Proposed target revisions for monitoring progress	Most relevant WSIS action lines	Proposed indicators for monitoring progress*	Overview of level of achievement, 2009**	
				Developed countries	Developing countries
6. To connect all local and central government departments and establish websites and e-mail addresses	*To connect all local and central government departments and establish websites ~~and e-mail addresses~~*	C1. The role of public governance authorities and all stakeholders in the promotion of ICTs for development C2. Information and communication infrastructure C3. Access to information and knowledge C7. E-government	1. Government employees using the Internet	n.a.	n.a
			2. Government employees using computers	n.a.	n.a.
			3. Government institutions with Internet access, by type of access (narrowband, broadband)***	High	Medium
			4. Government institutions with a website***	High	Medium
			5. Government institutions using corporate networks (LAN, WAN, intranet, extranet)***	n.a.	n.a.
			6. Government institutions offering online services, by type of service (interactive, transactional, connected)***	Medium	Low
7. To adapt all primary and secondary school curricula to meet the challenges of the information society, taking into account national circumstances	*(no revision proposed)*	C4. Capacity building C7. E-learning	1. ICT-qualified teachers in primary and secondary schools	n.a.	n.a.
			2. Teachers trained to teach subjects using ICT	Medium	Low
			3. Schools with computer-assisted instruction	High	Medium
			4. Schools with Internet-assisted instruction	High	Low
8. To ensure that all of the world's population have access to television and radio services	*(no revision proposed)*	C2. Information and communication infrastructure C3. Access to information and knowledge C9. Media	1. Households with a radio	High	High
			2. Households with a TV	High	High
			3. Households with multichannel television service, by type of service	High	Low
9. To encourage the development of content and put in place technical conditions in order to facilitate the presence and use of all world languages on the Internet	*(no revision proposed)*	C3. Access to information and knowledge C8. Cultural diversity and identity, linguistic diversity and local content	1. Internet users, by language	Low	Low
			2. Webpages, by language	Low	Low
10. To ensure that more than half the world's inhabitants have access to ICTs within their reach	*To ensure that more than half the world's inhabitants have access to ICTs, **in particular broadband Internet**, within their reach **and make use of them***	C2. Information and communication infrastructure C3. Access to information and knowledge C6. Enabling environment C7. ICT applications: benefits in all aspects of life	1. Mobile cellular telephone subscriptions per 100 inhabitants	High	High
			2. Individuals who used a mobile cellular telephone in the last 12 months	High	Medium
			3. Individuals who used the Internet (from any location) in the last 12 months	High	Medium
			4. Households with access to the Internet, by type of access (narrowband, broadband)	High	Low

Note: *Refers to percentages unless otherwise indicated. **High/medium/low level of achievement of indicator based on reported values; n.a. = data not available to determine overall status. Based on data available and featured in the chapters of this report. ***Includes local and central government institutions.

Source: ITU.

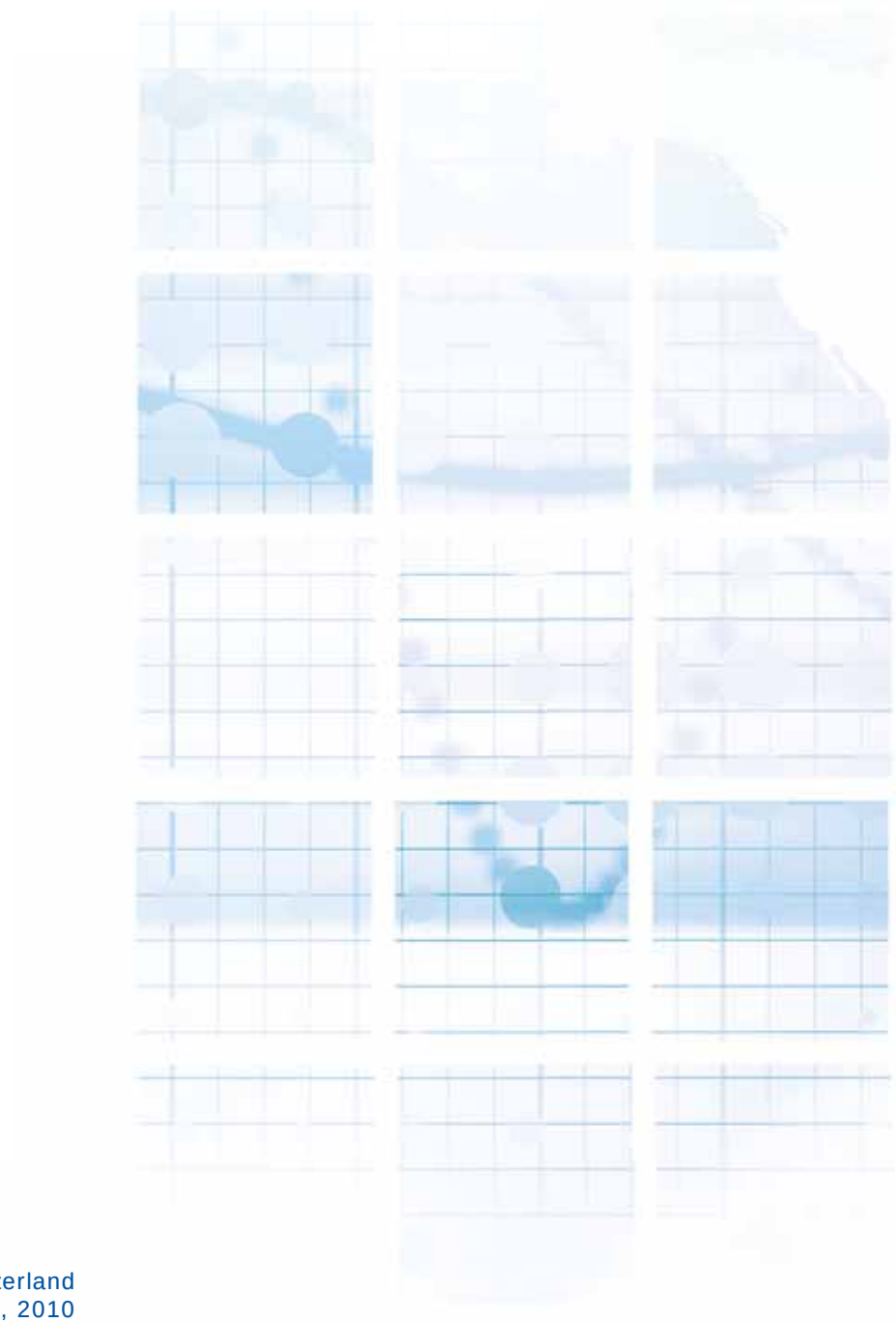
Notes

[1] For more information on the ITU *Build on Broadband* initiative, see http://www.itu.int/en/broadband/Pages/default.aspx.

[2] For more information on UNCTAD's work on ICT measurement, see http://measuring-ict.unctad.org.

Annex table 1. List of countries that responded to the ITU questionnaire on WSIS targets

Country	Organization
Albania	Ministry of Transports, Public Works and Telecommunication (MPPTT)
Andorra	Andorra Telecom
Austria	Austrian Regulatory Authority for Broadcasting and Telecommunications
Bhutan	Ministry of Information and Communication
Bolivia	Viceministerio de Telecomunicaciones
Bosnia and Herzegovina	Communications Regulatory Agency
Botswana	Department of telecommunications and Postal Services
Brazil	Agência Nacional de Telecomunicações (ANATEL)
Brunei	Authority of Info-Communications Technology Industry of Brunei Darussalam (AITI)
Bulgaria	Ministry of Transport, Information Technology and Communications
Croatia	Ministry of the Sea, Transport and Infrastructure
Cyprus	Department of Electronic Communications, Ministry of Communications and Works
Czech Republic	Ministry of Industry and Trade
Denmark	National IT- and Telecom Agency
Djibouti	Ministry of communication, culture, post and telecommunication
Egypt	MCIT information center
Finland	Finnish Communications Regulatory Authority (FICORA)
Germany	Federal Ministry of Economics and Technology
Haiti	Conseil National des Télécommunications (CONATEL)
Hungary	Prime Minister's Office, State Secretariat for ICT
Iraq	Central organization for statistics and information technology
Ireland	Commission for Communications Regulation
Korea (Rep.)	Korea Communications Commission
Kyrgyzstan	National Communication Agency
Latvia	Ministry of Transport
Lesotho	Lesotho Communications Authority
Lithuania	Information Society Development Committee under the Government of Lithuania
Malta	Malta Communications Authority (MCA)
Mexico	Coordination of the Information and Knowledge Society
Morocco	National Telecommunication Regulatory Agency (ANRT)
Myanmar	Myanmar Posts and Telecommunications Department
Nauru	Department of Information and Communication Technologies
Netherlands	Statistics Holland
New Zealand	Ministry of Economic Development
Nicaragua	Instituto Nicaraguense de Telecomunicaciones y Correos (TELCOR)
Paraguay	Comision Nacional de Telecomunicaciones (CONATEL)
Singapore	Infocomm Development Authority of Singapore (IDA)
Slovak Republic	Ministry of Transport, Posts and Telecommunications of the Slovak Republic
Slovenia	Post and Electronic Communications Agency of Republic of Slovenia (APEK)
St. Lucia	Ministry of Education and Culture
St. Vincent and the Grenadines	National telecommunications Regulatory Commission
Sweden	Statistics Sweden
Thailand	Ministry of Information and Communication Technology
Turkey	State Planning Organization
United Kingdom	Ofcom



Printed in Switzerland
Geneva, 2010