PARTNERSHIP ON MEASURING ICT FOR DEVELOPMENT

FINAL WSIS TARGETS REVIEW

ACHIEVEMENTS, CHALLENGES AND THE WAY FORWARD

WSIS+10 HIGH-LEVEL EVENT

PARTNERSHIP ON MEASURING ICT FOR DEVELOPMENT 10 YEARS 2004-2014

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International Telecommunication Union
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Forewords

"Over the last decade, ICTs have fundamentally improved the way we live, work and communicate. The achievements made since the World Summit on the Information Society are many. This report highlights the importance of providing universal and affordable access to ICTs to enable and accelerate economic, social and sustainable growth and development for everyone. ITU remains committed to connecting the world and to helping track achievements, monitor challenges and identify forward-looking targets for a better world."

Dr Hamadoun I. Touré
Secretary-General
International Telecommunication Union

"Education stands at the heart of the global development agenda – it is also the focus of two of the 10 WSIS targets. At this time of change, when all societies are seeking new sources of dynamism, we must harness the power of new information and communication technologies to reach the unreached and to enhance the quality of learning, inside and outside the classroom and throughout life. Building inclusive knowledge societies requires crafting the right ecosystems for making the most of new technologies, through teacher training, through media literacy, and through a focus on new skills and competencies."

Irina Bokova
Director-General
United Nations Educational, Scientific and Cultural Organization

"The demand for data on the information economy continues to expand as countries seek to leverage new information and communications technologies for their economic and social development. UNCTAD is proud of being a founding member of the Partnership on Measuring ICT for Development, and is committed to contributing to the further improvement of the availability of internationally comparable data in this area. This publication makes a valuable assessment of the current state of play with regard to the measurement of the progress towards the targets set by world leaders at the World Summit on the Information Society. It is hoped that the recommendations made will provide a sound basis for future advancements in ICT measurement."

Mukhisa Kituyi
Secretary-General
United Nations Conference on Trade and Development

Forewords

"Latin America and the Caribbean have made clear commitments to reducing the digital divide and fostering an inclusive information society. Although we have achieved several economic and social improvements in the last decade, sustaining these improvements poses major challenges to reorienting our development agenda. ICTs play a major role within this context and could help us achieve our goals for greater equality, social inclusion, economic development and environmental sustainability."

Alicia Bárcena
Executive Secretary
Economic Commission for Latin America and the Caribbean

"Reaching all people with high-quality, affordable health services is our aim, and ICT is critical in this effort. The connected world has already brought profound changes to the health sector, even as a new era of services, such as mobile health, is emerging. And it is clear that although countries have made impressive advances in eHealth, much work remains. WHO is pleased to join forces with ITU, governments and other stakeholders to address the challenges ahead."

Dr Margaret Chan
Director-General
World Health Organization

"The deadlines for achieving the MDGs and the WSIS targets are approaching, and it will be important to seek closer integration of ICT and development issues in the post-2015 development agenda. This should focus on utilizing ICT in service of sustainable development, for instance by transforming governance to better serve public policy through policy-driven electronic governance (EGOV). It should also ensure that extensive use of ICT does not hinder progress towards these goals, for instance through promoting the sustainable production and environmentally-sound recycling and management of e-waste. UNU is committed to supporting the UN system on e-waste, EGOV, and other critical ICT issues in the post-2015 era through policy-focused research and capacity development."

Dr David M. Malone
Rector
United Nations University
and
Under-Secretary-General
United Nations

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The members of the *Partnership* TG-WSIS are the DEN Foundation, ITU, MAAYA, OECD, UIS, UNCTAD, UNDESA, UNECA, UNECLAC, UNESCAP, UNESCWA, United Nations University (UNU), UPU and the World Health Organization (WHO).

The lead contributing agencies of the report are:

- UNECLAC – Introduction
- ITU – Chapters on targets 1, 3, 4, 8, 9 and 10
- UIS – Chapters on targets 2 and 7
- WHO – Chapter on Target 5
- UNDESA – Chapter on Target 6
- UNCTAD – Chapter on ICTs in businesses (proposed Target 11)
- Center for Electronic Governance, UNU-IIST – Conclusions and way forward.

The *Partnership* is grateful to a large number of contributors from within and outside the TG-WSIS who have collaborated in the preparation of this report:

The introduction was prepared by Jorge Patino from UNECLAC. The chapters on targets 1, 3, 8 and 10 were prepared by Han Ei Chew, consultant to ITU, with input from Tiziana Bonapace and Remi Lang (UNESCAP) on targets 1 and 3. The chapters on targets 2 and 7 were authored by Peter Wallet (UIS) with the statistical support of Beatriz Valdez Melgar (UIS). Substantive inputs and comments were also provided by Martin Schaaper (UIS). The chapter on Target 4 was prepared by Lisa Kreuzenbeck (ITU), Jose Anson and Paul Donohoe (Universal Postal Union, UPU), Stuart Hamilton (the International Federation of Library Associations and Institutions, IFLA), Marco de Niet and Gerhard Jan Nauta (DEN Foundation), with input from Makane Faye (UNECA). The chapter on Target 5 was prepared by WHO, in particular Misha Kay, with input from Joan Dzenowagis (WHO) and Elettra Ronchi (OECD). The chapter on Target 6 was prepared by Seema Hafeez from UNDESA. The chapter on Target 9 was prepared by David Souter, consultant to ITU, with input from Matthew Zook of ZookNIC. The chapter on ICTs in businesses was prepared by Scarlett Fondeur-Gil (UNCTAD) and the last chapter, Conclusions and way

forward, was prepared by Elsa Estevez and Tomasz Janowski (Center for Electronic Governance, UNU-IIST), with input from Vanessa Gray (ITU). In addition, Vanessa Gray, Susan Teltscher, Lisa Kreuzenbeck, Ivan Vallejo and Esperanza Magpantay from ITU provided substantive input and comments on the entire report.

The preparation of the report was coordinated by Vanessa Gray, ITU ICT Data and Statistics Division, under the supervision of Susan Teltscher, Head, ICT Data and Statistics Division. ITU’s contribution was carried out under the overall direction of Cosmas Zavazava, Chief, Project Support and Knowledge Management Department, Telecommunication Development Bureau.

The report was substantively edited by Sheridan Roberts, consultant to ITU.

The cover was designed by Aram Melikyan from ITU.

The report features data collected by the *Partnership* TG-WSIS in 2013 through its 2013 WSIS targets questionnaire. The following agencies participated in the data collection: Eurostat, OECD, UNCTAD, UNECA, UNECLAC, UNESCAP and UNESCWA. The *Partnership* also appreciates the cooperation of those countries that responded to the questionnaire: Australia, Azerbaijan, Bangladesh, Bhutan, Brazil, Bulgaria, Burundi, Cambodia, Canada, Chile, Colombia, Congo, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, El Salvador, Estonia, Fiji, Finland, Gambia, Georgia, Iran (I.R.), Israel, Japan, Jordan, Kazakhstan, Lao P.D.R., Latvia, Lebanon, Lesotho, Lithuania, Maldives, Mexico, Moldova, Nauru, Nepal, Niger, Nigeria, Norway, Oman, Peru, Philippines, Portugal, Romania, Senegal, Serbia, Singapore, Slovenia, Spain, Switzerland, Thailand, Turkey, United Arab Emirates, Uruguay, Venezuela, Viet Nam and Yemen.

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Introduction

The World Summit on the Information Society (WSIS) recognized information and communication Technologies (ICTs) as transformational technologies and as important enablers for social and economic development. Besides representing an important sector, ICTs enable economic growth and have strategic spillover effects on other sectors. They create jobs and foster innovation, empower people through new and faster communication channels, and help create greater access to education, healthcare and public services. While ICTs have grown tremendously and an increasing number of people are joining the global information society, major differences in ICT uptake and use persist – the digital divide therefore remains a key impediment to development.

To enhance the development of a global information society, increased attention has been given to the importance of tracking, monitoring and addressing the digital divide. The Partnership for Measuring ICT for Development (the *Partnership*) has been leading this task within the framework of the WSIS, since 2004. The *Partnership*'s efforts have improved the quality and quantity of ICT statistics worldwide, helped develop better tools to support countries to collect ICT data, and raised awareness about the importance of measurement. The *Partnership* has also contributed to the follow-up and implementation of the outcomes of the WSIS, and has taken on responsibility for tracking the WSIS targets.

The main objective of this report, *Final WSIS Targets Review. Achievements, Challenges and the Way Forward*, is to provide policy-makers with a comprehensive evaluation of the implementation of the WSIS commitments, and in particular the WSIS targets. It emphasizes the importance of ICTs for development, and the need to track these. The report is expected to highlight the lessons learnt from the WSIS monitoring process and to deliver an input to the debate on the post-2015 agenda, including discussion of possible targets and future indicators.

Background on the WSIS and the WSIS targets

The first two phases of the WSIS were held in 2003 in Geneva, Switzerland and in 2005 in Tunis, Tunisia. They brought together governments, private sector, civil society and international organizations from around the globe to set a common vision for building an inclusive information society. In accordance with the Millennium Development Goals (MDGs), the Geneva phase agreed on a *Declaration of Principles* and a *Plan of Action*, with ten targets and several action lines to be achieved by 2015. In Tunis, major stakeholders reaffirmed their support for the outcomes of the first phase of the WSIS and approved the Tunis *Commitment* and *Agenda*, along with the establishment of the Internet Governance Forum (IGF).

The Geneva *Plan of Action* promotes the use of ICTs for the achievement of internationally agreed development goals and targets. With special attention to developing countries, the ten targets of the *Plan of Action* had the following goals:

- encouraging connectivity – in villages, educational institutions, scientific and research centres, public libraries, cultural centres, museums, post offices, archives, health centres, hospitals and government departments;

- adapting primary and secondary school curricula to meet the challenges of the information society;
- ensuring access by the world's population to ICTs, including television and radio;
- supporting the development of content and facilitating the presence and use of all world languages on the Internet.

The ITU *World Telecommunication/ICT Development Report 2010: Monitoring the WSIS Targets, A mid-term review* (WTDR) (ITU, 2010) recommended that a new target "Connect all businesses with ICTs" should be added to the WSIS targets; three indicators were identified by the *Partnership* to track such a target (see *Measuring the WSIS Targets. A statistical framework, Partnership*, 2011). At the same time, the *Partnership* recommended some changes to the wording of the targets, mainly in order to improve their measurability (see Box 0.1).

The WSIS targets have served as global reference for improving global access and use of ICTs and have provided benchmark indicators for the evaluation of the overall objectives of the information society. In addition, the WSIS targets were intended to inspire particular targets at national level based on local characteristics, e-strategies and development policies.

Box 0.1: Amended WSIS targets[1]

Target 1. Connect all villages with ICTs and establish community access points;

Target 2. Connect all secondary schools and primary schools with ICTs;

Target 3. Connect all scientific and research centres with ICTs;

Target 4. Connect all public libraries, museums, post offices and national archives with ICTs;

Target 5. Connect all health centres and hospitals with ICTs;

Target 6. Connect all central government departments and establish websites;

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

Target 8. Ensure that all of the world's population has access to television and radio services;

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;

Target 10. Ensure that more than half the world's inhabitants have access to ICTs within their reach and make use of them;

Proposed Target 11: Connect all businesses with ICTs.

Source: Partnership on Measuring ICT for Development (2011).

WSIS monitoring and evaluation

WSIS highlighted the importance of internationally comparable ICT statistics to benchmark and monitor the progress made towards creating a global information society. It made specific reference to a follow-up mechanism and appropriate indicators to track global progress in the use of ICT (see Box 0.2).

Box 0.2: Call for follow-up process in WSIS documents

Geneva *Plan of Action* (2003), paragraph 28

"A realistic international performance evaluation and benchmarking (both qualitative and quantitative), through comparable statistical indicators and research results, should be developed to follow up the implementation of the objectives, goals and targets in the *Plan of Action*, taking into account different national circumstances."

Tunis *Agenda* (2005), Paragraph 113

"Appropriate indicators and benchmarking, including community connectivity indicators, should clarify the magnitude of the digital divide, in both its domestic and international dimensions, and keep it under regular assessment, and track global progress in the use of ICTs to achieve internationally agreed development goals and objectives, including the Millennium Development Goals."

Source: WSIS Geneva Plan of Action and WSIS Tunis Agenda for the Information Society (see ITU, 2005).

The Tunis Agenda requested the United Nations General Assembly to make an overall review of the implementation of the WSIS in 2015. In 2006, the United Nations General Assembly resolved (60/252) to conduct an overall review of the implementation of the WSIS outcomes in 2015. Consequently, in 2011, the United Nations Chief Executives Board (CEB) tasked the United Nations Group on the Information Society, under ITU leadership, to prepare, on the basis of an open consultation, a *Plan of Action* for the WSIS Overall Review (WSIS+10). In April 2012, during the CEB spring session, the plan was approved (ITU, 2013).

As a response to the request made by the WSIS to produce official statistics to monitor the information society, in 2004, the Partnership on Measuring ICT for Development was established at the UNCTAD XI in Brazil, as a multistakeholder initiative for the coordination of activities carried out by international and regional organizations involved in ICT measurement. Its current members are: International Telecommunication Union (ITU), Organisation for Economic Co-operation and Development (OECD), Statistical Office of the European Communities (Eurostat), United Nations Conference on Trade and Development (UNCTAD), United Nations Department of Economic and Social Affairs (UNDESA), United Nations Economic Commission for Africa (UNECA), United Nations Economic Commission for Latin America and the Caribbean (UNECLAC), United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), United Nations Economic and Social Commission for Western Asia (UNESCWA), UNESCO Institute for Statistics (UIS), United Nations Environment Programme/Secretariat of the Basel Convention (UNEP/SBC), United Nations University Institute for Sustainability and Peace (UNU-ISP) and the World Bank.

The *Partnership* has successfully defined a core list of ICT indicators to help developing countries produce official ICT statistics. The core list has been updated regularly since its first publication in 2005. It was endorsed by the United Nations Statistical Commission (UNSC) at its 38th session in 2007; two revised and extended core lists were endorsed by the UNSC in 2012 (43rd session) and 2014 (45th session). The core list has served as the basis for the collection of internationally comparable ICT statistics since about 2005. The latest core list of indicators includes 58 indicators and covers the following areas: ICT infrastructure and access; access and use of ICT by households and individuals; use of ICT by businesses; the ICT sector; trade in ICT goods; ICT in education; and e-government.[2]

Following the publication of the WTDR 2010, the *Partnership* also took the lead role in monitoring the WSIS targets. The WTDR 2010, which was produced in cooperation with several members of the *Partnership*, presented the first comprehensive quantitative assessment of the WSIS targets. The report highlighted the need for a formal monitoring progress towards measuring the WSIS targets and suggested a set of indicators to guide countries in their monitoring efforts of the WSIS targets.

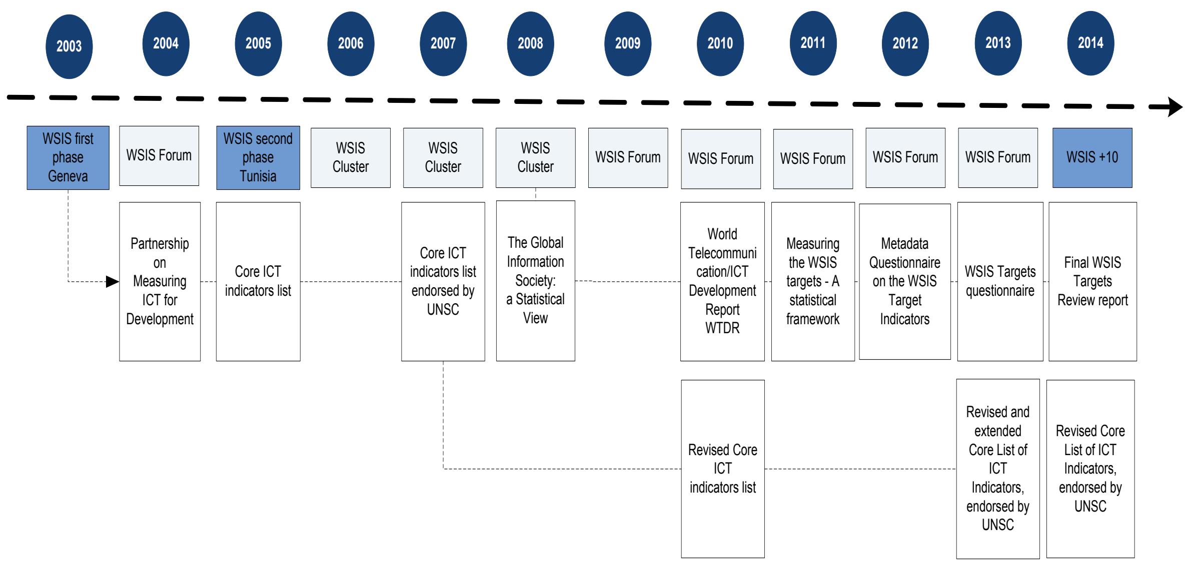
After the launch of the WTDR 2010, the *Partnership* established a Task Group on Measuring the WSIS Targets (TG-WSIS). This group presented its first results at the 8th World Telecommunication/ICT Indicators Meeting (WTIM) in November 2010. In 2011, the *Partnership* published *Measuring the WSIS Targets. A statistical framework*. This framework identified 52[3] measurable indicators to help monitor progress towards the WSIS targets. The framework further provided:

- definitions of each target indicator, including the terms used
- derivation of indicators (for example, use of appropriate denominators for proportions)
- classifications to be applied to measure the indicators
- scope of populations of units
- statistical units.

As recommended by the WTDR 2010, and based on the acknowledgment of the importance of businesses in the information society and the digital economy, the 2011 WSIS statistical framework suggested adding a target to measure business connectivity.

The WSIS monitoring process is shown in Figure 0.1.

Figure 0.1: WSIS monitoring process



About the final quantitative assessment report on the WSIS targets

In line with the Millennium Development Goals (MDGs), the year 2015 marks the endpoint for achieving the targets of the WSIS. The *Partnership* has prepared this report – through the Task Group on Measuring the WSIS Targets − with the purpose of elaborating a quantitative assessment of WSIS outcomes within the framework of the *Plan of Action* for the WSIS overall review (WSIS+10). It has been prepared specifically for the WSIS+10 High Level Event, which is "… designed to review the progress made in the implementation of the WSIS outcomes under the mandates of participating agencies, and to take stock of achievements in the last ten years … The event will review the WSIS

Outcomes (2003 and 2005) related to the WSIS action lines with the view of developing proposals on a new vision beyond 2015, potentially including new targets ..."[4]

It should be noted that the WSIS targets were not framed with measurement in mind and were developed without prior consultation with the statistical community. Therefore, the indicators that the *Partnership* identified in 2011 were developed based on the interpretation of each target and developed to 'best fit' their scope and to reflect their essence. This process included inputs and consultation with key international and regional players and experts on topics of the WSIS targets. The list of indicators that was identified to evaluate the WSIS targets was thus developed to capture developments and measure progress over time, and to ensure data quality and international comparability, taking into account international standards.

Several members and non-members of the *Partnership* have collaborated in drafting this report. These are ITU (targets 1, 3, 4, 8, 9 and 10), UIS (targets 2 and 7), WHO (Target 5), UNDESA (Target 6), UNCTAD (proposed Target 11), the Center for Electronic Governance at UNU-IIST (Conclusions and the way forward) and UNECLAC (Introduction). Other contributing authors have been the Universal Postal Union (UPU), the International Federation of Library Associations and Institutions (IFLA), the DEN Foundation and the OECD.

This report reviews progress made since 2003 on the 10+1 WSIS targets. The analysis of the achievements are based on internationally comparable data made available by partners and the non-members listed above, extensive research (including secondary sources), and responses to the *Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013*.

The 2013 WSIS targets questionnaire was sent to WSIS focal points in 195 member states, between November and December 2013. It requested quantitative information on each of the indicators. The questionnaire was prepared by the TG-WSIS and distributed by the four UN Regional Commissions (UNECLAC, UNESCWA, UNESCAP and UNECA), OECD, Eurostat and UNCTAD. The global response rate of the survey was 30 per cent, but not all countries that responded to the questionnaire completed it. The level of response draws attention to a lack of availability of official ICT statistics. While there are examples of the efforts made by the international community and countries to advance the implementation of ICT policies and their evaluation, countries have not been able to provide a complete assessment of their progress made towards the WSIS targets, based on the indicators identified by the *Partnership*.

The national coordination of the production and the collection of ICT statistics has also proven to be challenging, given the cross-cutting nature of ICTs. While some of the indicators are collected through national statistical offices (NSOs), usually through household surveys or population censuses, other indicators can be derived from administrative data sources, either by line ministries or other government agencies. A third set of indicators are collected, or derived by specialized (research or analysis) organisations. While at the international level a number of indicators for the WSIS targets (especially for targets 1, 2, 7, 8, 10 and the proposed target 11) are collected by different international agencies, through regular data collections, other indicators are not regularly collected. Data for these kinds of indicators are therefore less available and generally not internationally comparable.

This report is structured along 13 chapters (including this introduction) reviewing each one of the WSIS targets and the way forward post-2015. Each chapter on the WSIS targets includes:

- an introduction to the target
- a discussion on the indicators that were identified to track the targets and data availability
- a discussion on the achievement of the targets, with presentation of available data for the indicators; where possible, information is provided for different countries, regions and levels of development (classifications for the last two are based on the United Nations Statistics Division M49 classifications[5]); for some indicators, time series data are shown, thus highlighting progress made over time
- a set of conclusions and recommendations for each target, highlighting the key findings on the progress made. Recommendations are made on the relevance of the targets, and the availability of the indicators and their ability to track the target. Depending on the target and indicators, more appropriate targets and indicators, in particular in the context of the post-2015 development agenda and possible ICT monitoring framework, are proposed and discussed.

List of references

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Partnership on Measuring ICT for Development (2011), *Measuring the WSIS Targets: A statistical framework*, http://www.itu.int/en/ITU-D/Statistics/Pages/publications/wsistargets2011.aspx.

Endnotes

[1] The *Partnership* suggested changes in the wording of the WSIS targets (amended WSIS targets), mainly to improve the measurability to make them more feasible, and to add a target on ICTs in businesses. See *Partnership* (2011) for details.

[2] See http://www.itu.int/en/ITU-D/Statistics/Pages/coreindicators/default.aspx.

[3] This includes three indicators to track an additional target on ICTs in businesses.

[4] See http://www.itu.int/wsis/implementation/2014/forum/.

[5] See http://unstats.un.org/unsd/methods/m49/m49regin.htm.

CONNECT ALL VILLAGES WITH ICTs AND ESTABLISH COMMUNITY ACCESS POINTS

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

Executive summary

Despite the seeming ubiquity of ICTs, their benefits are not uniformly experienced by the 7.1 billion people in the world. According to recent estimates, over 4 billion people are not yet connected to the Internet (ITU, 2013a). The majority of those unconnected people are the main target group for the Millennium Development Goals (MDGs), and are also people for whom ICTs potentially have a great development impact. Communities living in rural and remote areas stand to benefit particularly from greater connectivity to telephones and the Internet, to be able to receive information and services that can improve their economic and social condition. In a broader context, the achievement of Target 1 would help developing countries make progress towards the MDGs.

Target 1 distinguishes rural and urban populations and is tracked using four indicators identified by the Partnership on Measuring ICT for Development. The indicators cover mobile cellular network coverage (Indicator 1.1), household access to telephones and the Internet (indicators 1.2 and 1.3), and use of the Internet by individuals (Indicator 1.4). Progress made towards Target 1 has been mixed. On the one hand, the last decade has shown much faster than anticipated growth in mobile-cellular telephony, with consequent changes in the provision of access to basic communication services. In particular, significant progress has been made in increasing mobile cellular coverage for rural populations. Currently available data suggest that in 2013, almost 90 per cent of the world's rural inhabitants were covered by a 2G mobile cellular signal. By 2015, all rural communities around the world are likely to be covered if the current rate is sustained. On the other hand, rural population coverage of a 3G mobile cellular signal was comparatively low in 2013. Household access to any type of phone service (fixed or mobile) has grown rapidly, largely fuelled by increased access to mobile phones due to falling prices and growing popularity of prepaid SIM cards.

In terms of Internet access and use, Target 1 is unlikely to be achieved by 2015 and currently available data suggest a pronounced rural-urban divide. Access to the Internet in any form (narrowband or broadband, fixed or wireless) is extremely low for rural households in developing countries, while in developed countries, rural households appear to enjoy comparable access to their urban counterparts, albeit with slight variations in type of access and (usually) a small lag in levels of penetration.

Nevertheless, currently available data on Internet access offer some cause for optimism. Access to the Internet using mobile networks appears to be a growing trend. In fact, there are indications that rural residents are now adopting mobile Internet, because fixed-line connection tends to be unavailable in rural areas. Broadband wireless networks are also growing in developing countries. These adoption patterns should offer telecommunication operators some assurance that rural households are a viable market, especially for wireless broadband. Another incentive for using wireless broadband to connect rural communities is that the installation of wireless broadband equipment generally requires less investment than wired infrastructure. To further facilitate the development of wireless broadband, policy-makers should provide incentives for rural deployment.

Based on the findings of this report, and given the limited achievements made on Target 1, the following recommendations are made should there be a post-WSIS target dealing with rural connectivity:

- Future tracking should focus on fewer indicators, in particular, changing subindicators of Indicator 1.2 (proportion of households with telephone, by type of network) and supplementing Indicator 1.3 with data from operators on the number of subscriptions according to types of access.
- Attention should shift towards measuring quality of access, which is partly covered by Indicator 1.3 (proportion of households with Internet access, by type of access). Data analyses for Target 1 suggest that while coverage was a primary goal for 2015, quality of access is likely to become the key distinction between rural and urban households. Quality of access entails a broader definition of ICT connectivity and further work on such indicators is recommended.
- The issue of rurally-relevant applications and content needs to be addressed alongside the issue of connectivity. For rural households to bridge the knowledge divide and access public services, they need to have access to relevant information and applications. This issue is further discussed in Chapter 9, which discusses WSIS Target 9 on content and language. Several cases presented in this chapter suggest that demand for content and communication could drive ICT adoption.
- Finally, in terms of connecting rural communities, more public-private partnerships should be formed. Governments play a critical role in setting the right regulatory framework to foster development of ICTs in rural areas. Lessons from countries that have made greater progress towards Target 1 can be adapted for countries that are lagging. Two specific strategies are offered: (1) market liberalization to introduce more competition in the mobile sector, and (2) introduce conditional licensing by setting targets in licence agreements for the percentage of the rural population covered by a mobile cellular network.

Introduction

At the end of 2013, there were an estimated 2.7 billion people using the Internet worldwide and approximately 6.8 billion mobile phones. Despite the apparent ubiquity of ICTs, their benefits are not uniformly experienced by the 7.1 billion people in the world. According to latest estimates, over 4 billion people are not yet online (ITU, 2013) and the majority of those are the main target groups of the Millennium Development Goals (MDGs) and any post-2015 development goals. ICTs potentially have a great development impact for this group – communities living in remote areas, in particular, stand to benefit greatly from connectivity because ICTs can deliver health, education and other services that may be otherwise unavailable.

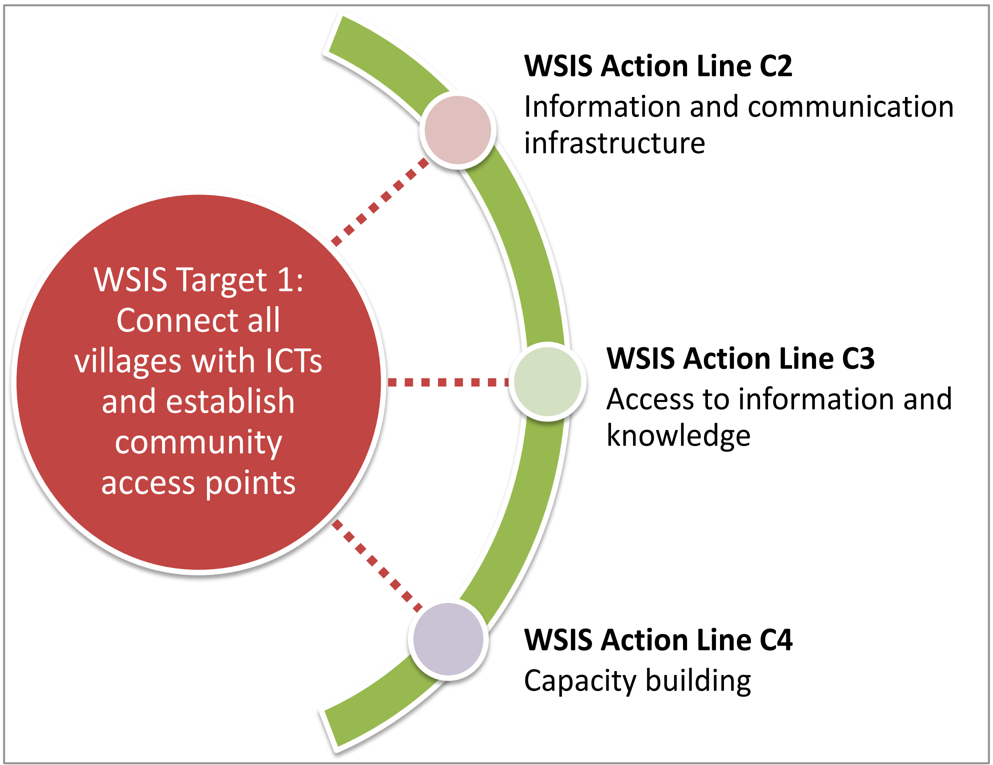
The guiding principles for rural access were embodied in the 2003 WSIS *Declaration of Principles* that declared a "… common desire and commitment to build a people-centred, inclusive and development-oriented Information Society, where everyone can create, access, utilize and share information and knowledge, enabling individuals, communities and peoples to achieve their full potential in promoting their sustainable development and improving their quality of life, premised on the purposes and principles of the *Charter of the United Nations* and respecting fully and upholding the *Universal Declaration of Human Rights*."[2] (ITU, 2005)

Target 1 focuses on connecting all villages with ICTs and establishing community access points. For rural residents, especially in developing countries, the costs of digital exclusion are profound. When urban residents in developing countries get Internet access, they also enjoy greater opportunities to improve their economic and social condition. With the Internet, they can access more information, economic opportunities, and essential health and public services. When rural residents are left unconnected, they remain trapped in a self-perpetuating cycle of existing conditions and are caught on the wrong side of the Matthew Effect[3] (those who have get more; and those who do not have get less). Target 1 is important in its recognition that connecting rural residents to ICTs will grant them access to opportunities that can better their lives and, at the broader level, help developing countries make progress towards the MDGs.

The challenge of connecting rural residents with ICT is non-trivial; even developed countries like the United Kingdom (Warman, 2013) and United States (NTIA, 2013) struggle to provide all their rural residents with Internet access that is comparable to that of their urban counterparts. The situation is understandably more dire in developing countries. Assessing the extent of access in rural communities is itself challenging because measuring the penetration and use of ICT is optimally conducted in a context of connectivity and basic infrastructure such as electricity – amenities that rural communities in developing countries often lack. Such communities are thus doubly disadvantaged because without robust assessment of connectivity, appropriate measures cannot be taken to address lack of access

Target 1 is related to all the WSIS action lines (ITU, 2010). In particular, there are direct linkages to action lines C2, C3 and C4 (see Figure 1.1).

Figure 1.1: Relevance of Target 1 to WSIS action lines



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." (ITU, 2005). 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. 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 those 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 ..." (ITU, 2005).

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, C4 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." (ITU, 2005).

Another important issue is to ensure that once villages are connected with ICTs, relevant applications and content are delivered to their inhabitants. The availability of relevant applications and content is addressed in action lines C7 (ICT applications), C8 (Cultural diversity and identity, linguistic diversity and local content) and C9 (Media) (ITU, 2005).

Data availability and scope

Target 1 comprises two objectives: 1) connecting all villages with ICTs and 2) establishing community access points.

Villages have been interpreted as referring to rural areas and reflect the focus on addressing the information gap between rural and urban areas (ITU, 2010). However, there is no internationally agreed geographic classification that defines rural areas and distinguishes them from urban areas. Nor is there a standard for defining villages (*Partnership*, 2011). This chapter uses the urban and rural splits provided by countries. The United Nations Statistics Division (UNSD, 2013) recognizes that definitions will vary between countries but states the importance of providing the urban and rural split:

> "Because of **national differences** in the characteristics that distinguish urban from rural areas, the distinction between the urban and the rural population is not yet amenable to a single definition that would be applicable to all countries or, for the most part, even to the countries within a region. Where there are no regional recommendations on the matter, countries must establish their own definitions in accordance with their own needs … traditional urban-rural dichotomy is still needed, classification by size of locality can usefully supplement the dichotomy or even replace it where the major concern is with characteristics related only to density along the continuum from the most sparsely settled areas to the most densely built-up localities."

Connectivity is focused on the Internet (narrowband and broadband) and both fixed and mobile phones. Connectivity by radio and television is covered in Target 8.

In ITU's first attempt to track the WSIS targets (*World Telecommunication/ICT Development Report 2010*, ITU, 2010), **Community access points** were interpreted as equivalent to Internet use locations community Internet access facilities and commercial Internet access facilities.[4] Tracking community access points was initially proposed as a WSIS target indictor, 'percentage of localities with public Internet access centres (PIACs)', broken down by size of locality, or by urban/rural. This indicator was removed from the list of WSIS target indicators for feasibility reasons and for lack of data (*Partnership*, 2011). Community access points are now tracked through the *Partnership* core indicator 'location of individual use of the Internet in the last 12 months' (*Partnership*, 2010).[5] The breakdown by location includes the two subcategories: 'Community Internet access facility' and 'Commercial Internet access facility'. Community access points play a vitally-important role in connecting people who lack access to ICTs. Box 1.1 presents a case study of rural public access centres in Bangladesh from the Global Impact Study of Public Access to ICTs (Sey *et al*., 2013). Findings from the study, which lasted from 2007 to 2012, provide cause for optimism about the impact that rural public access centres are making. One particularly interesting finding was that when computer experiences were taken into consideration, there was little difference between rural and urban users in their rate of use and perceived positive impact. This suggests that geography is not necessarily limiting for rural residents – with the right training and access to ICTs, they are also able to make use of the opportunities afforded by ICTs to improve their economic and social condition. This is also demonstrated by the *Infolady* programme in rural Bangladesh (Box 1.2).

Box 1.1: Users of rural public access centres – a case from Bangladesh

The Global Impact Study of Public Access to ICTs (Sey *et al*., 2013) was a five-year project (2007–2012) aimed at generating evidence about the character and impacts of public access to ICTs in eight countries: Bangladesh, Botswana, Brazil, Chile, Ghana, Lithuania, the Philippines and South Africa. Across all countries, the study found that overall, rural users had lower usage rates than urban users. However, controlling for level of computer experience, usage frequency and venue type, rural users mostly experienced positive impacts in similar proportions to urban users.

In the case of Bangladesh, the study estimated that about 46 per cent of users of public access facilities (telecentres, libraries, and cybercafés) live in rural areas. The study found several noteworthy differences between rural and urban users. Rural users most commonly accessed the Internet for communication and leisure, education, employment, and culture and language, although their use trails their urban counterparts in these areas. Another difference is type of access venue. Rural users largely visited telecentres, while urban users frequented cybercafés, presumably due to the respective availability of these facilities in their locality. In general, telecentre users tended to report lower usage, as well as lower levels of positive impacts, than cybercafé users.

One key finding from the study is that when computer experiences were taken into consideration, there was little difference between rural and urban users in their rate of use and perceived impact. Hence, it seems likely that the level of computer experience contributes to the observed rural/urban differences. Rural users, who are more likely to be inexperienced telecentre users, offer fewer reports of positive impacts compared with more experienced urban cybercafé users. This finding is consistent with the notion that access to ICTs is a necessary but not sufficient condition for inclusion in the information society. Other conditions, such as digital literacy, also need to be in place so that those who are least connected do not continue to be excluded.

Another finding from the Global Impact Study was that rural users consistently reported lower positive impacts in communication when compared to urban users, regardless of their computer experiences. These impacts relate to communication with family and friends, pursuing interests and hobbies, meeting new people and pursuing other leisure activities. These urban-rural differences can be attributed to different preferences for modes of communication and leisure activities. Urban residents appear to use ICTs for leisure and to maintain and expand their social networks.

In this regard, rural residents may be missing the opportunities afforded by ICTs to increase their social capital.[6] Rural residents with fewer social ties may thus be deprived of novel information and be confined to the provincial news of their close friends (Granovetter, 1983). Their smaller social networks can also limit their awareness of available employment and other economic opportunities.

Source: Global Impact Study, Technology & Social Change Group.

The *World Telecommunication/ICT Development Report 2010: Monitoring the WSIS Targets, A mid-term review* (WTDR) (ITU, 2010) concluded that community access points constitute one of the most practical methods of providing ICTs in rural areas in many developing countries. Reasons given were that incomes tend to be lower in rural locations compared to urban areas, and many rural households simply cannot afford ICTs; shared access is therefore a cost-effective means of providing rural connectivity. Box 1.1 suggests that community access points are still relevant for rural communities. However, in recent years, the price of handsets and mobile services has fallen to levels where basic services are more affordable in rural areas in the form of pre- or post-paid SIM cards. Given the trend in declining telecommunications costs, it is an opportune time to consider modes of providing access to rural communities in addition to community access points. Libraries and post offices (discussed in Target 4), schools (discussed in Target 2) and retail environments, such as coffee shops, can also serve as community access points. The challenge for policy-makers and other stakeholders is finding modalities that work best in rural areas.

As ITU's first exercise demonstrated (ITU, 2010), assessing the impact of community access points is a challenging task, particularly from the supply side. One way of capturing the uptake and importance of community access from the demand side is through the *Partnership*'s core indicator HH8 'Location of individual use of the Internet in the last 12 months'[5] (*Partnership*, 2010). The indicator is collected through household surveys and includes information on locations of Internet use, including community and commercial Internet access facilities.

Box 1.2: Infolady – a women-centred programme to deliver information services in rural Bangladesh

The *Infolady* programme[7] offers information, communication and ancillary services to rural disadvantaged dwellers, mostly women. In line with WSIS target 1, the programme provides rural communities with access points to the Internet and other communication services. In particular, it provides ICT access and locally relevant content to those members of the population who tend to be most digitally excluded, namely rural women of poor communities.

The services are provided by specifically trained women – the infoladies – who travel between villages on bicycles and are equipped with laptops, webcams, mobile phones, printers and Internet connectivity. Beneficiaries are met both in groups and at their homes, and are offered affordable services that would otherwise not be readily available. The services offered by infoladies include:

- communication services such as writing messages or VoiP telephone interactions between villagers and their spouses, or other relatives, who often have to migrate to find employment,
- basic health services, such as blood pressure measurement, blood testing for diabetes,
- reproductive health information and services such as pregnancy tests,
- advice on farming issues, using ICT to access and share relevant information,
- legal advice and assistance in interactions with administrations, for example, obtaining relevant information online or claiming benefits,
- buying and selling from villagers to enhance their access to markets and provide them with new opportunities.

An infolady typically listens to a villager's livelihood problems and assists them with Internet services or preloaded offline audio-visual livelihood content in the local Bangla language. The programme provides the infoladies with specific training, and a loan to purchase a bicycle and ICT equipment. They are able to generate a significant and steady income for themselves through the services they sell and the products they trade. The programme associates each infolady with an *Infolady HUB*, a local organization that provides security, training, logistical and technical support, and credibility. In return, infoladies buy products from the HUB and sell them to their beneficiaries. They can also buy products from their clients and sell them to the HUB, which the HUB then sells to retailers.

The model was launched in April 2010 by D.Net and is being scaled up nationwide in Bangladesh. D.Net is seeking to expand and increase the number of infoladies to 12 000 by the year 2017. Bangladesh Bank (the central bank of Bangladesh) recently allotted a facility of approximately USD 1.2 million to facilitate the availability of low-interest loans to infoladies. The fund is disbursed by the National Bank Limited (NBL), a private bank. This model has already created more than 50 women entrepreneurs in Bangladesh who earn approximately USD 150 per month. These entrepreneurs have reached over 300 000 rural citizens to date.

The model has had positive impact on the rural population's wellbeing by addressing issues such as family planning, hygiene, healthcare during pregnancy, agriculture, education and entertainment.

Over the years, the Infolady programme has received multiple awards for being a unique model of disseminating information. By providing relevant, useful and localised content to rural women, the programme contributes to the objectives of WSIS Target 1 in a least developed country context. It is a practical, low-cost and viable model for connecting rural people and facilitating the creation of knowledge networks in rural Bangladesh. At the same time, it offers new technology-based self-employment opportunities for educated rural women.

Source: UNESCAP, Infolady.

Re-thinking the 'build-it-and-they-will-come' assumption

Action lines C2 and C3 focus on the provision of services by governments and stakeholders, with the underlying assumption that once infrastructure and access is provided, rural residents will move into the digital society. This assumption is reminiscent of the telecentres era in the 1990s and early 2000s. Large investments were made to establish telecentres in rural villages in developing countries, with the hopes of bridging the digital divide for rural populations. The assumption then was that access to infrastructure and information would accelerate development in impoverished areas. Since then, most telecentres have been found to have limited effects in reducing poverty and tend to be financially unsustainable (Best and Kumar, 2008; Gurstein, 2011). As the WSIS targets and action lines are being reviewed, this is an appropriate time to consider the validity of the assumption of 'access equals development'. Would rural populations subscribe to Internet plans and use public access points if these were available? What other conditions need to be in place for the needs of rural populations to be addressed?

Another point of consideration arising from the relevant action lines is the implicit order in the delivery of connectivity and content. As the action lines are currently framed, connectivity precedes content. The pipelines must be present before content can be delivered. This logical linear order enables rollout of infrastructure installation in distinct phases, from a project management perspective. However, as the village of Talea (Box 1.3) demonstrates, there are alternatives to this modality. In the case of Talea in rural Mexico, the community created a mobile phone network of their own, and redefined traditional notions of community access. In this case, there was first the need for information exchange between the villagers and other people in their networks, and then came the construction of home-grown infrastructure that addressed those communication needs.

Box 1.3: The Mexican village that got itself talking

In the tiny coffee-producing village of Talea de Castro in Mexico, residents are unserved by any of the main telecommunications operators. For years, the locals have asked the main networks in Mexico to install a mobile phone antenna in the village. They kept getting the same answer: it was not worth sending an engineer into the remote mountains of Oaxaca for fewer than 10 000 customers. Villagers said that the phone companies wanted other infrastructure built before they would provide coverage. According to the community leaders, the phone companies wanted electricity lines and a new road built to the site where the antenna would be erected, involving significant cost and red tape for the local people.

Faced with intransigence from big business, the 2 500 villagers of Talea decided to do something for themselves. They launched a mobile phone network of their own. Using technology from a US-based company and expertise from a non-profit organisation, Rhizomatica, the villagers installed an antenna on the roof of a strategically-placed private residence to provide maximum coverage to Talea. Experts from Rhizomatica worked with the community using local structures and local capacity in order to provide equipment and services at costs that the community could afford.

Calls and texts within the village are free and calls to areas outside are significantly cheaper than they would be using the big telecom companies. Residents report that a five-minute call to the United States only cost 30 cents, which is about ten times cheaper than using a landline. Other residents have boosted their income by carrying a phone. Taxi drivers could get work through their mobile phones rather than driving around the streets looking for work. The impact is not just economic in nature. When newcomers arrive in the village, they automatically receive a message telling them to go to the local radio station to register their phone. Their phones can then be used to get help in a medical emergency or when flooding occurs.

Since its initial launch, calls had been restricted to five minutes to avoid saturating the system's capacity. Residents have now installed a more permanent antenna on top of a specially built phone mast to provide more lines and wider coverage.

Source: BBC Latin American news, 14 October 2013.[8]

The rest of this chapter reviews the indicators for Target 1, data availability to track the indicators and reports the progress towards the achievement of this target since the 2010 review. It further discusses the importance of staying committed to the target, while taking a more integrated approach to connecting rural populations to ICTs.

Indicators to track WSIS Target 1

The following four indicators were identified to track Target 1:

> Indicator 1.1: Proportion of rural population covered by a mobile cellular telephone network, by type of mobile cellular telephone technology
>
> Indicator 1.2: Proportion of households with telephone, by type of network, by urban/rural
>
> Indicator 1.3: Proportion of households with Internet access, by type of access, by urban/rural
>
> Indicator 1.4: Proportion of individuals using the Internet, by location, by urban/rural.

Indicator 1.1 refers to the percentage of a country's inhabitants that live within rural areas and are served by a mobile telephone signal, irrespective of whether they use the service – either as a subscriber or a user who is not a subscriber. The indicator measures the theoretical ability to use mobile cellular services, not the actual use or level of subscription.

Indicator 1.2 refers to phone access at home by in-scope urban and rural households. The indicator is further split into four parts based on the type of phone access. This indicator measures phone access at home and reflects the shared nature of the phone use at home regardless of who the subscriber is.

Indicator 1.3 refers to Internet access at home by in-scope urban and rural households and by type of Internet access services they have. As with Indicator 1.2, this indicator assumes that once a household has an Internet subscription, family members will be able to use online services regardless of who the subscriber is. The indicator does not measure actual use.

Indicator 1.4 refers to the use of the Internet by in-scope[9] urban and rural individuals and the location of their Internet use. This indicator focuses on Internet use rather than access, which is covered by Indicator 1.3. Locations of use include community and commercial Internet access facilities.

Table 1.1 presents the data sources used in this report for measuring Target 1. For Indicator 1.1, the original data sources are telecommunications operators. In almost all countries, data are aggregated at the national level by telecommunication/ICT regulators and ministries, which provide information annually to ITU. The indicator is a further disaggregation of the *Partnership* core ICT indicator, A7. The split of the indicator into urban and rural is not collected by most countries and was estimated from urban and rural classifications in population censuses. For indicators 1.2 to 1.4, the data are collected by ICT household surveys, usually conducted by national statistical offices (NSOs).

Table 1.1: Data sources for indicators for measuring Target 1

Indicators		*Partnership* core indicator	Data availability (2012 or 2011)
1.1	Proportion of rural population covered by a mobile cellular telephone network, by type of mobile cellular telephone technology	A7	High – based on country data for mobile-population coverage and rural population data; estimated from ITU data covering 177 countries.
1.2	Proportion of households with telephone, by type of network, by urban/rural	HH3	Low – Fewer than 19 countries had data by urban/rural and type of network.
1.3	Proportion of households with Internet access, by type of access, by urban/rural	HH6, HH11	Low – 21 countries had data by urban/rural; data availability is lower when disaggregated by type of access.
1.4	Proportion of individuals using the Internet, by location, by urban/rural	HH7, HH8	Low – 19 countries had data by urban/rural split and 16 countries had data by locations of use.

Source: ITU.

The indicators used for the current review are from *Partnership* (2010). Changes to the household indicators were finalized in 2013, with some changes to HH3, HH11 and HH8. Changes to the indicators on ICT infrastructure and access were also finalized in 2013, with A7 becoming A6 and being limited to 3G mobile networks. See ITU (2014) for more information.

Achievements against Target 1

Rural population covered by a mobile phone network

This is measured by Indicator 1.1 and is *Partnership* core indicator A7. It refers to the proportions of rural populations covered by a mobile cellular telephone network. Indicator 1.1 is disaggregated by mobile phone technology, as follow:

- 2G mobile communication network (providing download speeds of below 256 kbit/s)
- mobile broadband signal (providing download speeds of at least 256 kbit/s).[10]

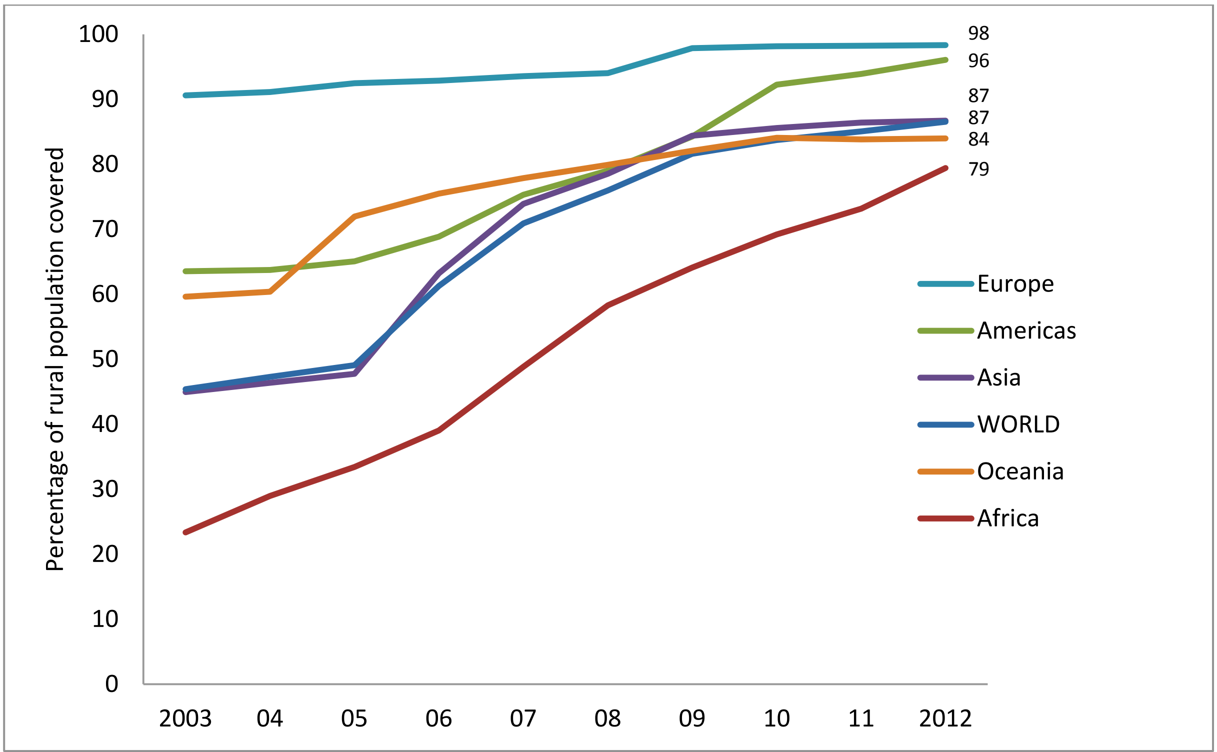
Considerable progress has been made in Indicator 1.1 in terms of mobile-cellular coverage for rural populations since 2003. Based on the latest statistics, only about one in eight rural residents is out of range of a mobile signal (see Table 1.2); this compares to one in four in 2008 and about one in two in 2003. By the end of 2012, 87 per cent of the world's rural population, or 2.9 billion people, were covered by a mobile cellular signal. In 2008, it was 76 per cent (2.5 billion people) and in 2003, 45 per cent (1.5 billion people). The number of rural residents not covered decreased from 800 million in 2008 to 451 million by the end of 2012. Progress made by regions from 2003 to 2012 is shown in Chart 1.1.

Table 1.2: Rural population covered by a mobile cellular signal,[11] 2012

Region	Overall mobile cellular coverage	Rural population covered	Rural population covered	Rural population not covered
	%	%	millions	millions
Africa	88	79	498	129
Americas	99	96	171	9
Asia	92	87	2 017	309
Europe	100	98	196	3
Oceania	98	84	3	0.6
World	93	87	2 886	451

Source: ITU estimate.

Chart 1.1: Rural population covered by a mobile cellular signal, by region, 2003–2012



Source: ITU estimate.

In 2003, only 23 per cent of rural populations in Africa were covered by a mobile cellular signal; this coverage had improved to 79 per cent by the end of 2012. Mobile cellular coverage in Asia nearly doubled from 45 per cent in 2003 to 87 per cent by the end of 2012. Even in Oceania where some of the most remote countries in the world are located, 84 per cent of rural populations were covered by a mobile cellular signal by the end of 2012, up from 60 per cent in 2003.[12] While this is still below the 87 per cent global coverage, the increase in connectivity has helped many rural citizens in small island states of Oceania to connect to information and services previously lacking in their locality (Box 1.4 describes the information-communication revolution in the Pacific). European countries connected a further 7 per cent of their rural populations between 2003 and 2012, with many countries in Europe now reporting 100 per cent mobile cellular coverage for their rural populations. At the end of 2012, the Americas had rural connectivity comparable to Europe (96 per cent of rural population).

Box 1.4: An Information-communication revolution in the Pacific

Oceania is a region comprised of some 9 000 islands spread across a vast ocean, making them among the most remote in the world (with the exception of Australia and New Zealand). This is also a region where ICT outreach is rapidly developing. More than two million people in Papua New Guinea and the Pacific Islands gained access to mobile phones over the last six years. Access to mobile networks and devices has reduced isolation, made it easier and cheaper to do business, and increased government options for service delivery.

In Papua New Guinea and the Pacific Islands, villagers who for years had made three-hour long boat trips to make a simple phone call to the capital, are now calling and texting family in other provinces and even other countries. Government and business transaction costs are also decreasing as connectivity improves. The benefits have been felt right across Papua New Guinea, Samoa, Solomon Islands, Tonga and Vanuatu, and are now stretching into the North Pacific. The telecommunications revolution is also creating jobs where they are needed most: directly creating livelihoods for at least 30 000 people in Papua New Guinea alone.

Mobile phones are just the beginning. High-speed broadband is the next step to help overcome the challenges related to remoteness. Currently, most Pacific Island countries still depend on costly satellite links with limited bandwidth, and Internet connectivity costs are among the highest in the world. A 256 kbit/s broadband Internet connection costs around USD 650 per month in Palau. In Kiribati, one of the poorest countries in the region, it would cost USD 430. Such high rates are common across the Pacific. As a result, less than 1 per cent of the region's population typically has access to a reliable Internet connection. Where the Internet exists, access speeds are often slow and connectivity sporadic. Outside the main towns, people are still more likely to communicate with letters transported by ship than by e-mail.

The situation is expected to improve in 2014 with the arrival of broadband. Through a project funded by the World Bank and Asian Development Bank, an 830 km fibre-optic cable will be installed underwater to connect Tonga, a country made up of 176 islands spread across 700 000 square kilometres of ocean, to the Southern Cross Landing Station in Fiji, and onwards to global broadband networks.

Source: adapted from World Bank (2013).

This optimistic evaluation and outlook for rural mobile cellular availability has two caveats. First, indicator 1.1 focuses on the proportion of inhabitants that are within range of a mobile cellular signal, irrespective of whether or not they are subscribers. The numbers presented above are not equivalent to mobile subscription density or mobile usage. Second, data were not available for many developing countries that presumably have lower cellular signal availability. In Oceania, nine out of the nineteen countries in the region had no data about mobile coverage.

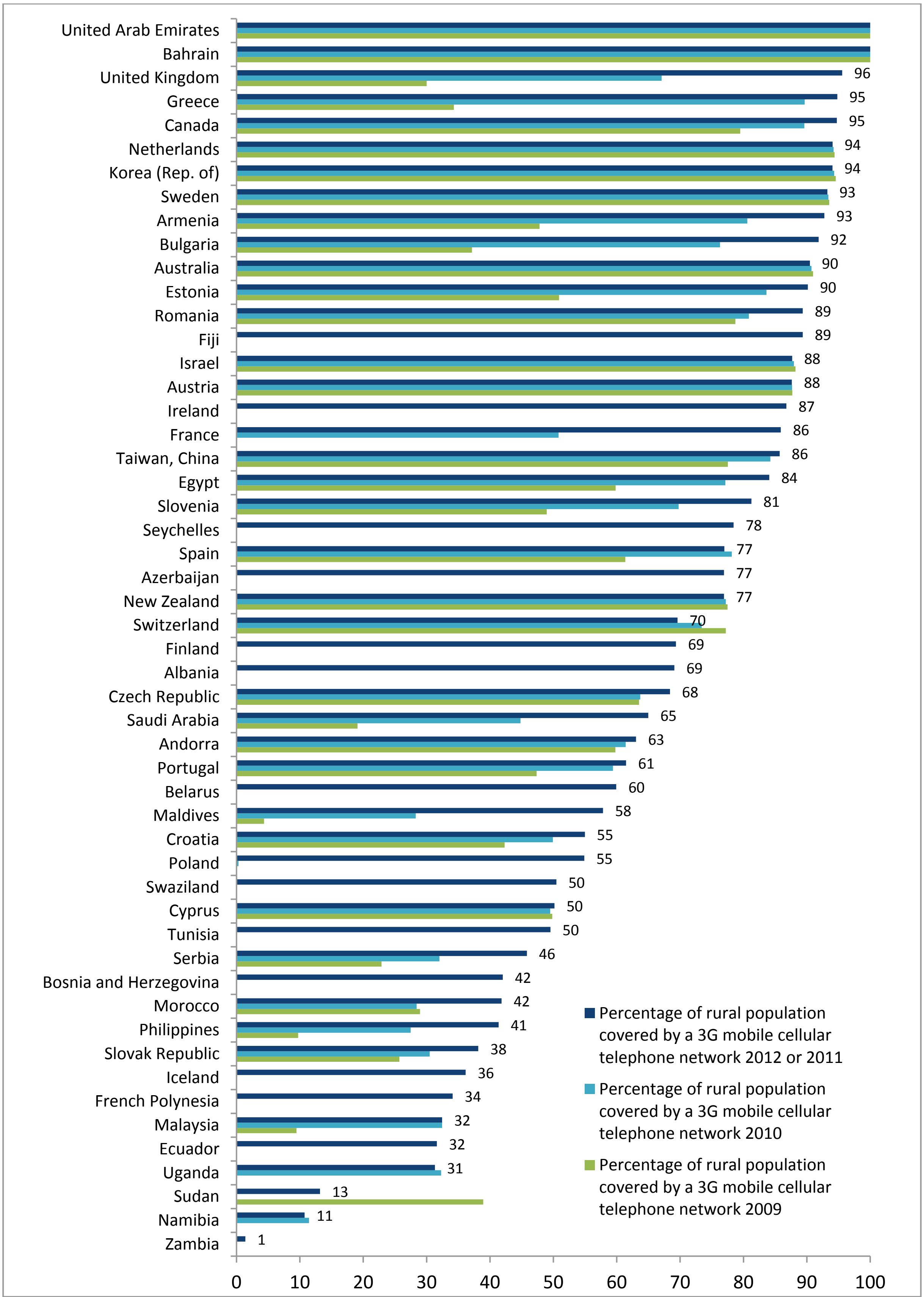
Turning to the indicator on rural populations covered by a 3G mobile cellular network, data availability was considerably lower. Chart 1.2 shows the proportion of rural populations covered by a 3G mobile cellular signal for countries that reported non-zero data for 2012.[13] A 3G mobile cellular signal is least available in African countries, with many sub-Saharan countries reporting no 3G mobile cellular coverage for their rural populations. While Chart 1.1 demonstrates tremendous progress in closing the digital divide in terms of mobile cellular signal availability to rural populations, Chart 1.2 demonstrates that there is still a considerable gap between developed and developing countries in terms of 3G cellular coverage. However, this gap is expected to close rapidly in the next few years – especially if current growth in mobile ownership is sustained. To provide better signal coverage to their subscribers, operators are likely to upgrade existing infrastructure to 3G or better, or install new infrastructure that would be faster than 2G.

3G mobile cellular coverage of rural populations ranged from highs of over 90 per cent in several developed countries to 100 per cent in the United Arab Emirates and Bahrain. Among developing countries, Fiji has done noticeably well in making 3G mobile cellular coverage available to rural residents. This progress was recognized in ITU's *Measuring the Information Society 2012* (ITU, 2012).

Fiji tied for the third largest improvement of any country, moving up five places to 88th from 2010 to 2011. In the 2012 report, ITU attributed Fiji's high ranking to strong growth in mobile-broadband penetration, extension of 3G coverage, and the development of Fiji's, and the Pacific's, first national broadband plan. The country is ranked 82nd in the 2013 report (ITU, 2013).

The rural populations of a number of African countries do not have 3G mobile cellular coverage. This lack of access means that mobile services are mainly limited to basic telephony like phone calls and text messages. Public services that require a 3G connection are still unable to reach the populations who are likely to benefit most from using such services.

Chart 1.2: Rural population covered by a 3G mobile cellular signal,[14] 2009–2012



Source: ITU estimate.

Note: The country of Sudan split in 2011.

Indicator 1.1 provides contrasting results on progress made towards connecting rural populations to ICT and these have implications for how the digital divide is defined post-2015. As shown above, progress in 2G mobile cellular coverage has been impressive, while progress in 3G mobile cellular coverage has been modest – at least for most developing countries. However, 3G is a fairly new technology and many countries are just starting to deploy 3G or LTE Advanced technology.[15] Global coverage patterns could therefore change rapidly in the coming years, with 3G perhaps taking a shorter time than 2G to achieve near global coverage. As countries move to deploy 3G or LTE Advanced infrastructure, the issue of spectrum allocation could also become more salient. To meet the increase in demand for radio spectrum, it is important to have agreement on uniform and coordinated strategies both within countries and between neighbouring countries.[16] If the current growth trends continue, the mobile digital divide may soon be less about a dichotomy of haves and have-nots for a basic mobile signal, and more about the quality of connectivity. The scarcity of 3G mobile cellular coverage for rural populations, especially in developing countries, suggests that quality of access will be a key dimension of the digital divide post-2015. The amount of information and services that can be accessed on a smartphone with a 3G or 4G connection is significantly greater than that available on a basic mobile phone on a 2G network.

The issue of the quality of access is relevant, even in developed countries. A recent study released by the Pew Research Center's Internet Project[17] found that 63 per cent of American adult mobile phone owners in the United States now use their phones to go online, a figure that has doubled since the Pew Research Center first started tracking Internet usage on mobile phones in 2009. For many, such as younger adults or lower-income Americans, mobile phones are often a primary device for accessing online content; 21 per cent of all adult mobile phone owners now do most of their online browsing using their mobile phone rather than a computer. However, screens are considerably smaller on mobile devices and the data connection is usually of a lower speed and often more expensive than a fixed-line connection. In addition, fixed-broadband packages often provide unlimited data allowances, while mobile-broadband packages are capped. Finally, the quality of mobile broadband networks depends on the number of people using the network at the same time. While mobile devices appear to be the future of Internet access, these factors relating to quality of access need to be considered.

If trends for growing 3G mobile Internet occur in developing countries, the availability of basic 2G mobile networks would not be able to meet the communication needs of their populations – and even more so for rural residents. One way of meeting this challenge is to look for cost-effective ways of ensuring coverage that will give telecom operators an incentive to serve rural populations. Box 1.5 highlights emerging technologies that provide mobile coverage for remote parts of Congo without the installation of costly cell towers.

Box 1.5: Emerging technologies provide mobile coverage in rural Congo

Emerging technologies in the form of picocells may soon provide mobile coverage to the remote parts of Congo. In 2012, the Pan-African telecom provider RascomStar-QAF, Viasat and UK-based ip.access announced plans to use small access nodes called picocells to provide coverage even in Congo's rainforests. Picocells have a range of hundreds of metres compared to the tens of metres range of femtocells that are typically used to deliver a private signal to homes outside of the coverage area.

The RASCOM-QAF satellite is the first satellite entirely dedicated to the African continent. When it was launched in 2010, one of the goals was to provide the African continent with mobile network coverage. However, in many remote and rural parts, people are still unable to use mobile phones simply because of the lack of necessary infrastructure, particularly telecommunications towers.

To address the lack of cell towers, the partnership will install 50 picocells mini base stations around Congo to provide mobile coverage to remote rural communities. UK-based company ip.access will supply picocells around Congo, with one gateway in the capital, Brazzaville. Each cell will then create a private wireless network in a particular area. A picocell is easy to use and the company says that it could be put up by someone with basic technical knowledge. Therefore, the picocell solution would be much simpler and cheaper than building new towers and expensive base stations. The partnership believes that this solution will provide affordable universal telephony access to previously unconnected parts of the world at an affordable price.

Source: ITU research based on BBC News (5 June 2012).

Proportion of households with telephone

This is measured by Indicator 1.2 and is *Partnership* core indicator HH3. It refers to phone access at home by in-scope urban and rural households.[18] The indicator is split into four parts, as follows:

Proportion of households with <u>any</u> telephone access

Proportion of households with fixed telephone only

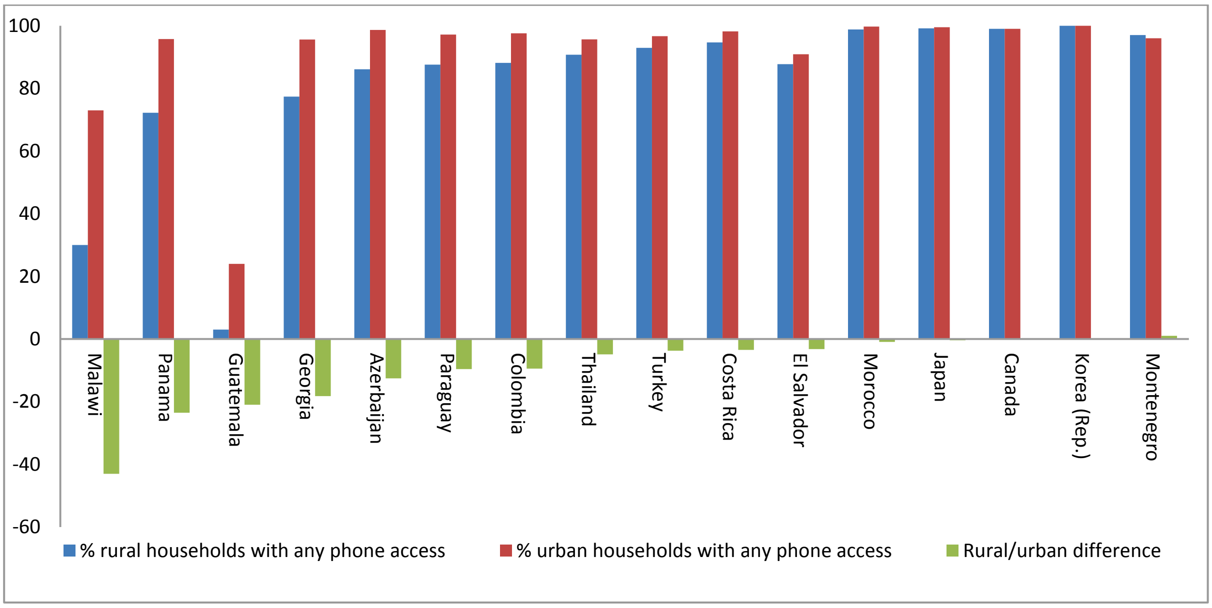
Proportion of households with mobile cellular telephone only

Proportion of households with both fixed and mobile cellular telephone.

The data for Indicator 1.2 are collected by ICT household surveys, usually conducted by NSOs. Data for the indicator split by rural/urban breakdown were very limited and only a handful of countries (17–20) reported data for the years 2011 or 2012. One reason for the scarcity is that many developed countries have stopped tracking fixed-line phone subscriptions at the household level; data were also very limited for the least developed countries.

Chart 1.3 uses available data to show the proportions of households with <u>any</u> phone access, disaggregated by urban and rural populations, and showing the differences between levels of urban and rural access. Overall, access to phone services was high for rural households in countries for which data were available, except for Malawi (30 per cent) and Guatemala (3 per cent). For the other countries, penetration of phone access for rural households was high, ranging from 72 to 100 per cent for 2012. Not surprisingly, for most countries, urban households had greater access to phone than rural households. Rural/urban differences were largest in Malawi (43 percentage points), Panama (24 percentage points), and Guatemala (21 percentage points).

Chart 1.3: Households with any telephone access, by rural/urban difference, 2012/2011



Source: ITU.

Table 1.3 presents multi-year data for rural/urban differences for households with any phone access, for selected countries. Only nine countries had multi-year data for the time period 2009 to 2012. In Japan and the Republic of Korea, rural and urban access was consistently high (99–100 per cent). The other countries have been making steady progress at narrowing the gap between rural and urban populations. Georgia for instance, had a rural/urban gap of 55 percentage points in 2010 and this narrowed to 18 percentage points in 2012; rural penetration improved from 18 to 77 per cent in the same period.

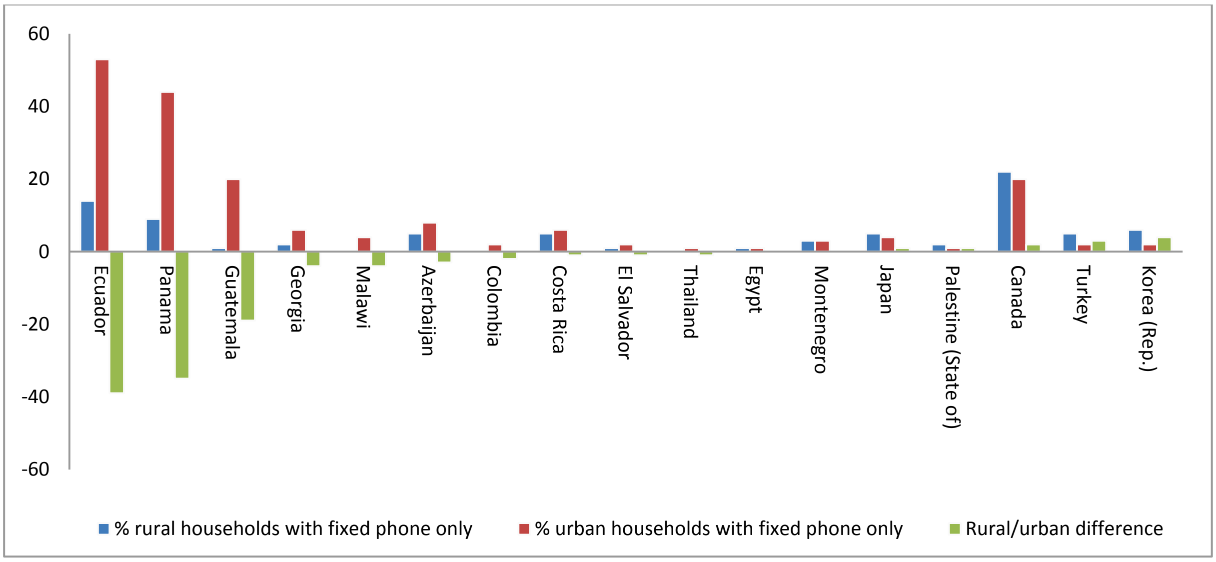
Table 1.3: Households with any phone access, by rural/urban difference, 2009–2012, percentage

Country		2009			2010			2011			2012	
	Rural	Urban	Diff.	Rural	Urban	Diff.	Rural	Urban	Diff.	Rural	Urban	Diff.
Georgia	..	..	..	18	73	-55	..	..	..	77	96	-18
Azerbaijan	47	85	-38	82	91	-9	..	..	..	86	99	-13
Paraguay	79	92	-13	76	93	-17	84	95	-12	88	97	-10
Thailand	87	95	-8	..	..	..	91	96	-5	91	96	-5
Turkey	94	96	-2	94	97	-3	93	97	-4	93	97	-4
Costa Rica	79	92	-13	81	93	-12	91	97	-6	95	98	-3
El Salvador	77	90	-13	84	92	-9	86	93	-7	88	91	-3
Japan	100	100	0	99	99	0	100	100	0	99	100	0
Korea, Rep.	100	100	0	..	..	..	100	100	0	100	100	0

Source: ITU.
Note: .. not available.

Turning to proportions of households with fixed phone only, the statistics suggest the decreased importance of the fixed phone line (Chart 1.4). In almost all 17 countries with data available, with the exceptions of Canada and Ecuador, the proportion of rural households with fixed phone only was less than 10 per cent in 2012. These figures are consistent with dipping global trends in fixed phone subscription rates (ITU, 2013a). Fixed-telephone networks are often limited to urban areas, particularly in developing countries. In rural areas, many people are getting connected with mobile phones instead of fixed phone because mobile cellular prices have been dropping rapidly to the extent that low-income groups can afford connectivity.

Chart 1.4: Households with fixed phone only, by rural/urban difference, 2012/2011



Source: ITU.

In terms of the rural/urban differences, rural households lag urban households in most countries for which data are available. The largest differences were in Ecuador (39 percentage points) and Panama (35 percentage points). Several countries reported higher access figures for rural households, though the differences were small in all cases. In those cases, the difference is likely due to rural households retaining their fixed-line subscriptions and not adopting mobile phones. This observation is consistent with demographically older rural populations who tend to be later adopters of mobile technology (Bond *et al*., 2007).

Table 1.4 shows multi-year data for the proportion of households with fixed phone only, by rural/urban differences, from 2009 to 2012. Only nine countries had multi-year data for this time period. In most of these countries, the proportion of both rural and urban households with fixed phone only decreased over the time period.

Table 1.4: Households with fixed phone only, by rural/urban difference, 2009–2012, percentage

Country	2009			2010			2011			2012		
	Rural	Urban	Diff.	Rural	Urban	Diff.	Rural	Urban	Diff.	Rural	Urban	Diff.
Georgia	..	..	..	18	73	-55	..	..	..	2	6	-3
Azerbaijan	6	9	-2	6	9	-3	..	..	..	5	8	-3
El Salvador	2	7	-4	2	3	-2	1	3	-2	1	2	-2
Thailand	1	3	-1	1	2	-1	1	2	-1	0	1	-1
Costa Rica	20	16	4	19	13	6	10	8	2	5	6	0
Egypt	6	9	-3	..	..	..	2	3	-1	1	1	0
Japan	3	4	0	7	5	2	6	4	1	5	4	1
Turkey	11	6	5	4	2	2	6	3	3	5	2	4
Korea, Rep.	9	3	6	..	..	..	6	2	4	6	2	4

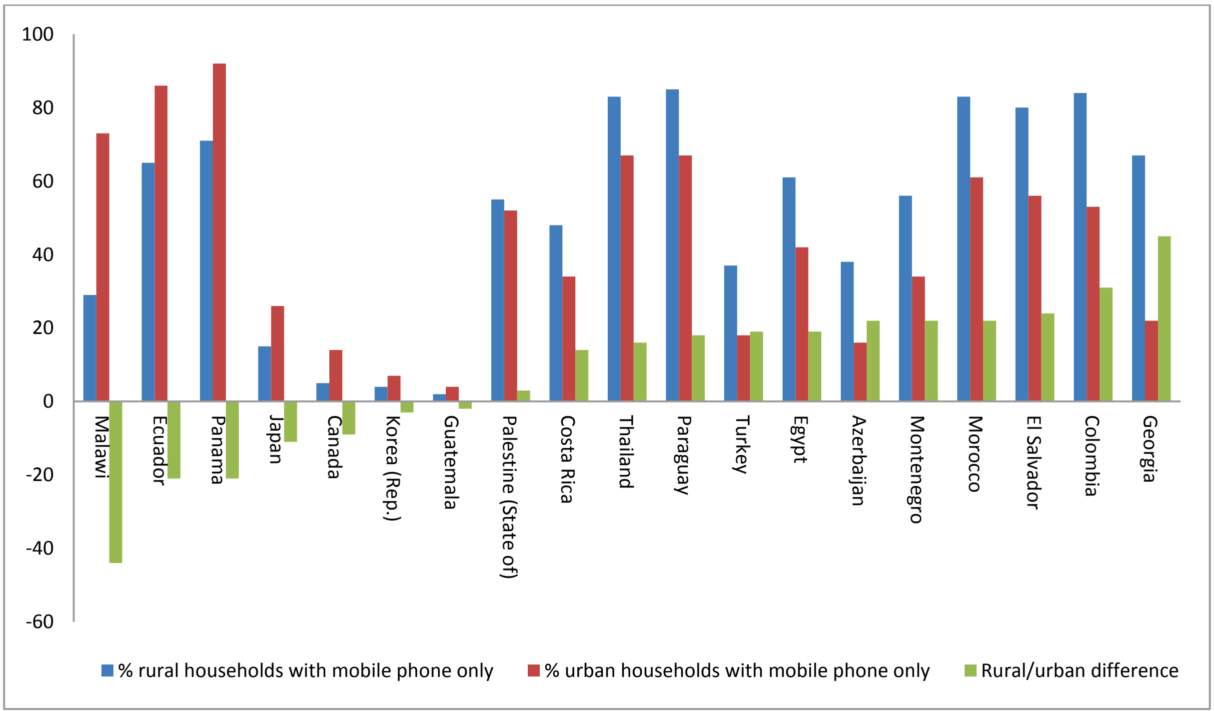
Source: ITU.

Note: .. not available.

The third component of Indicator 1.2 is proportions of households with mobile phone only. Overall, mobile phones appear to be playing an increasingly significant role in connecting rural households. Proportions of rural households with mobile phone only ranged from 2 per cent in Guatemala to 85 per cent in Paraguay. In 11 of the 19 countries with available data, this proportion was over 50 per cent. This is significantly higher than the corresponding figures for fixed phone only.

For access by mobile phone only, there was a higher proportion of rural households than urban households in 12 countries out of 19 countries with available data. This is likely to be a function of rural households having limited access to fixed phone services.

Chart 1.5: Households with mobile telephone only, by rural/urban difference, 2012/2011



Source: ITU.

Table 1.5 shows multi-year data for the proportion of households with mobile phone only, by rural/urban differences, from 2009 to 2012. In seven of the nine countries with data available, the proportion of rural households with mobile phone only increased significantly. For instance, in Azerbaijan, the proportion of rural households with mobile phone only more than doubled from 14 per cent in 2009 to 38 per cent by 2012. In Costa Rica, the proportion nearly doubled, from 25 per cent in 2009 to 48 per cent by 2012.

Table 1.5: Households with mobile phone only, by rural/urban difference, 2009–2012, percentage

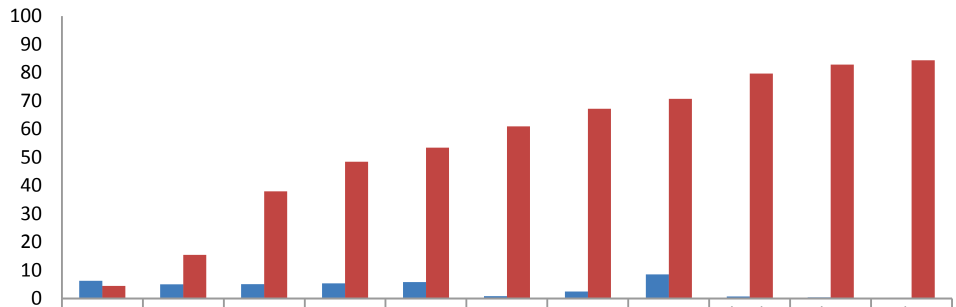
Country			2009			2010			2011			2012
	Rural	Urban	Diff.	Rural	Urban	Diff.	Rural	Urban	Diff.	Rural	Urban	Diff.
Japan	9	7	2	10	19	-8	13	20	-8	15	26	-11
Korea, Rep.	14	21	-6	..	..	..	5	6	-1	4	7	-2
Costa Rica	25	18	7	28	23	5	41	29	12	48	34	15
Thailand	75	54	21	78	56	22	82	60	21	83	67	16
Paraguay	76	61	15	76	63	13	81	62	19	85	67	19
Turkey	35	33	2	45	38	7	51	42	9	37	18	19
Egypt	49	34	15	..	..	..	58	40	18	61	42	19
Azerbaijan	14	18	-4	40	18	22	..	..	..	38	16	22
El Salvador	65	45	21	74	54	20	78	59	19	80	56	24

Source: ITU.

Note: .. not available.

Chart 1.6 shows a comparison of rural households by the two modes of access. In Colombia, Egypt, El Salvador and Thailand, less than 1 per cent of rural households have fixed phone only, while values for mobile phones only range from 61 per cent (Egypt) to 84 per cent for Colombia. The chart underscores the earlier point made about the phenomenal role that mobile phones have played in recent years to connect rural residents in developing countries.

Chart 1.6: Rural households by fixed phone only and mobile phone only, 2012/2011

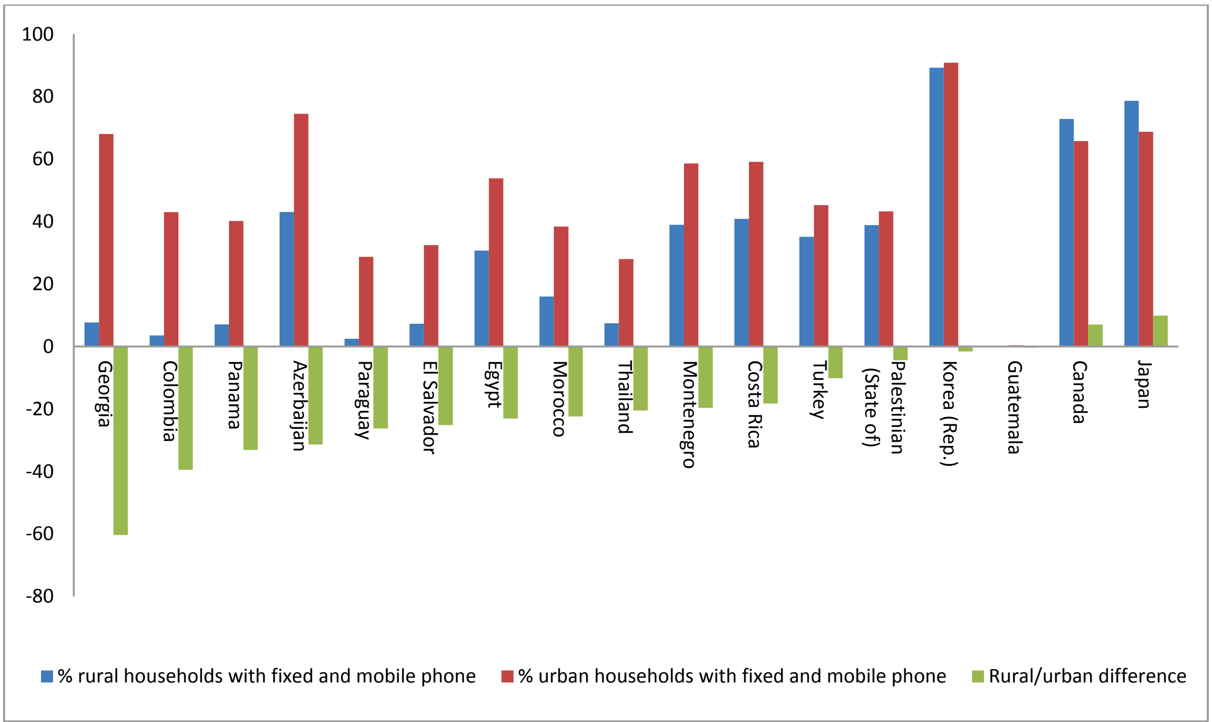


	Korea (Rep.)	Japan	Azer-baijan	Costa Rica	Turkey	Egypt	Georgia	Panama	El Salv-ador	Thai-land	Colom-bia
% rural households with fixed phone only	6	5	5	5	6	1	2	9	1	0	0
% rural households with mobile phone only	4	15	38	48	53	61	67	71	80	83	84

Source: ITU.

With regard to proportions of households with both fixed and mobile phone, the data are consistent with the trends discussed earlier (Chart 1.7). In seven of the 17 countries for which data are available, the proportion of rural households with both fixed and mobile phone was below ten per cent. Given that fixed phones are less likely to be available to rural households, there would naturally be a lower proportion of rural households that have access to both fixed and mobile phone. The Republic of Korea, Canada and Japan have some of the smallest rural/urban differences in terms of connectivity to both fixed and mobile phone. Rural and urban residents in these three countries were as likely to have high access to both types of telephony. In Guatemala, less than 1 per cent of both urban and rural households had fixed and mobile phone. In the State of Palestine, about two in five households (both urban and rural) had fixed and mobile phone. The largest rural/urban differences were in Georgia, Columbia and Panama (60, 39 and 33 percentage points respectively).

Chart 1.7: Households with both fixed and mobile telephone by rural/urban difference, 2012/2011



Source: ITU.

Overall, Target 1 has not been achieved in respect of telephone connectivity, although significant progress has been made. For most of the countries for which data are available, over 70 per cent of rural households have phone access of some type. The proportion is likely to be lower for least developed countries, most of which do not collect data on ICT access.

Although data availability was generally low for Indicator 1.2, three trends are evident:

- Mobile telephony is providing connectivity to rural populations who had been largely excluded from the diffusion of fixed-line telephony.
- Rural populations are tending to connect via mobile telephony only – whether from lack of choice and/or because mobile phones offer other advantages.
- Although telephone signal coverage is widespread, there are still rural populations who are unconnected. When they are connected, the next digital divide is likely to be one of quality of access, as evident from the low availability of 3G signals for rural populations in Indicator 1.1.

Proportion of households with Internet access

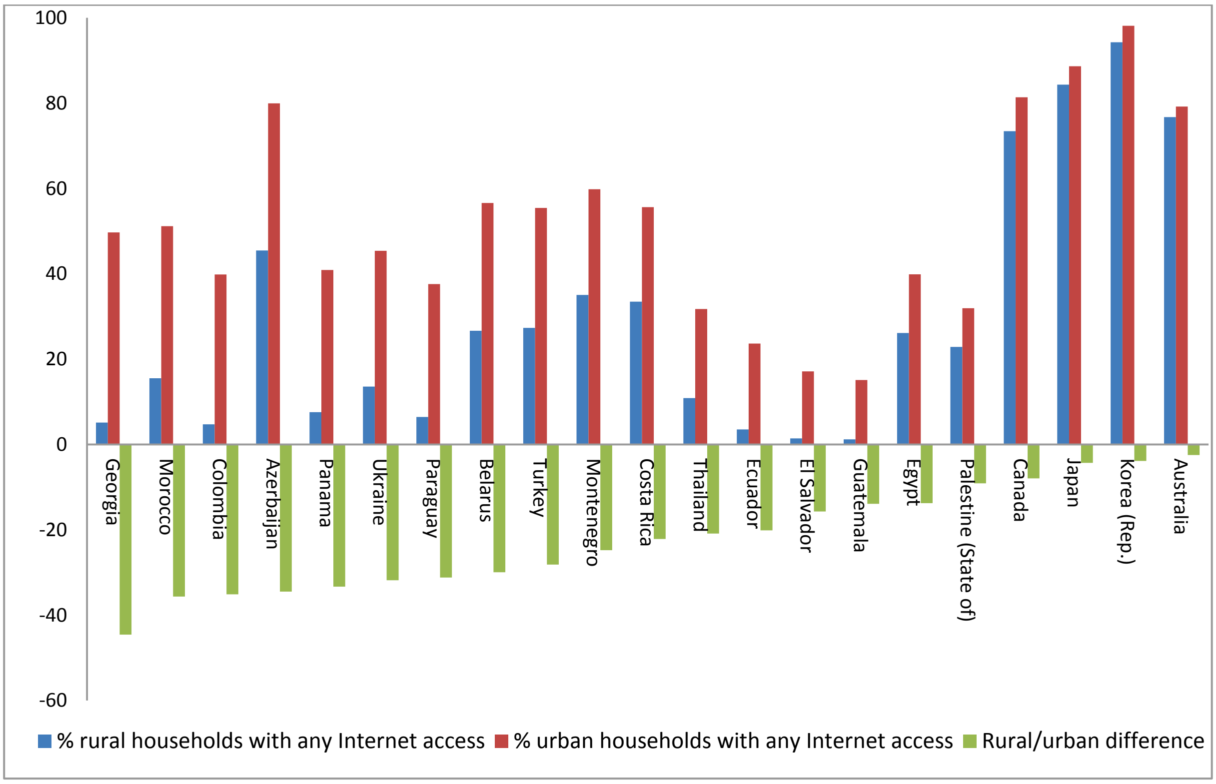
This is measured by Indicator 1.3 and uses the *Partnership* core indicators HH6 and HH11. It refers to the proportion of households with Internet access, by type of access, by urban/rural. Indicator 1.3 is split into two parts, as follows:

- Proportion of households with any Internet access, by urban/rural
- Proportion of households with Internet access, by type of access, by urban/rural.

Indicator 1.3 deals with Internet access for rural households. Measuring rural household access to the Internet, and especially broadband Internet, is important for understanding how well connected rural households are. ICTs in the home represent a fundamental measure of accessibility, as residents can access the Internet within the privacy of their home and have more control on the duration and purpose of use. Household access also monitors shared access to ICTs. Residents in rural communities in many developing countries cannot afford personal ICTs – unlike their counterparts in developed countries. Therefore, shared access in the home may be their only means of being connected. The measurement of household access enables policy-makers to make evidence-based policy decisions, especially where access is low. From a measurement perspective, household access is an unambiguous measurement, as a household is a well-defined statistical concept and the maximum penetration level is 100 per cent (ITU, 2010). The limitation to measurement of household Internet access is that access outside the home is not captured. Indicator 1.4 provides information on use of the Internet at locations other than home.

Chart 1.8 shows the proportion of households with any Internet access by rural/urban differences, in 2012 and 2011. Only 21 countries had data on household Internet access dissected by rural/urban. As with other household indicators, very little data are available from least developed countries. Rural household penetration ranged from 1 per cent in Guatemala and El Salvador to 94 per cent in the Republic of Korea. Of the 21 countries, seven had rural household penetration of less than 10 per cent and ten had penetration between 10 per cent and 50 per cent. Only four countries had rural household penetration rates of above 50 per cent.

Chart 1.8: Households with any Internet access by rural/urban difference, 2012/2011



Source: ITU World Telecommunication/ICT Indicators Database.

Rural/urban differences, especially in developing countries, show clearly that rural households are being left behind. In Guatemala, urban households are 12 times more likely to be connected to the Internet than rural households. In Georgia, the ratio is ten times. Even for several countries with relatively high GNI per capita, rural/urban differences are noticeably large. In Morocco, the difference in rural and urban household connectivity was 36 percentage points, in Ukraine 32 percentage points and in Turkey 28 percentage points.

Table 1.6 shows the proportion of households with Internet access, by rural/urban differences, from 2009 to 2012. In respect of the 12 countries that had data for this indicator, rural household penetration of the Internet is growing, but generally at a slow rate. Nevertheless, several countries have done very well in ensuring that rural households are connected to the Internet. In Azerbaijan, rural household penetration more than doubled from 21 per cent in 2009 to 45 per cent in 2012. In Costa Rica, penetration quadrupled, from 8 per cent in 2009 to 33 per cent in 2012.

Table 1.6: Households with any Internet access, by rural/urban difference, 2009–2012, percentage

Country	2009			2010			2011			2012		
	Rural	Urban	Diff.	Rural	Urban	Diff.	Rural	Urban	Diff.	Rural	Urban	Diff.
Colombia	1	19	-18	2	24	-23	2	29	-27	5	40	-35
Azerbaijan	21	42	-21	29	58	-29	..	..	..	45	80	-34
Ukraine	..	..	..	6	30	-24	10	38	-28	14	45	-32
Paraguay	3	17	-14	2	21	-19	6	32	-26	6	38	-31
Belarus	10	31	-21	13	38	-25	21	47	-26	27	57	-30
Turkey	16	36	-20	24	49	-25	23	51	-28	27	55	-28
Costa Rica	8	26	-19	11	32	-21	18	43	-25	33	56	-22
Thailand	4	21	-17	5	24	-18	6	26	-19	11	32	-21
El Salvador	0	9	-9	1	12	-11	2	17	-15	1	17	-16
Egypt	19	33	-15	..	..	..	..	..	..	26	40	-14
Japan	81	84	-3	79	85	-6	84	89	-6	84	89	-4
Korea, Rep.	91	97	-6	..	..	..	94	98	-4	94	98	-4

Source: ITU World Telecommunication/ICT Indicators Database.

Note: .. not available.

Despite the progress made in some countries, the overall trend of a widening gap between rural and urban households is clear. In Colombia, the rural/urban difference doubled from 18 to 35 percentage points between 2009 and 2012. In Azerbaijan, the difference increased from 21 to 34 percentage points. Given that Internet infrastructure is typically rolled out first in urban areas, the trend observed is unsurprising. Nevertheless, the growing gaps deserve attention so that rural households do not fall too far behind. For areas where access is limited, efforts should be made to improve connectivity so that rural households can start to experience the benefits of the Internet as many of their urban counterparts are already doing.

Box 1.6 highlights ways in which the Internet and mobile phones are improving the reach and effectiveness of health, economic and agricultural programmes in Africa.

Box 1.6: Internet-based applications for rural populations in Africa

A recent report by the McKinsey Global Institute identified several opportunities for Internet-driven growth and productivity in several sectors including health, financial services and agriculture. Three opportunities in these sectors that are specific to rural populations are highlighted below:

Health

Remote diagnostics and telemedicine could address 80 per cent of the health issues of patients in rural clinics, thereby revolutionising health care for large portions of the population, while reducing costs and travel time. Internet access could enable widespread automation and centralisation of patient admissions, health records and supply chains in public health systems and private hospitals. It also paves the way for advances in practitioner education and training.

Telemedicine can also be used to promote health education and ensure that patients follow through on treatment regimes. Uganda's *Text to Change* project aims to increase public knowledge of HIV/AIDS prevention through text messaging, using a multiple-choice quiz for Celtel mobile subscribers in the rural region of Mbarara. At the end of the quiz, a final text message is sent to encourage participants to go for voluntary testing and counselling at the local health centre. This project led to an increase of nearly 40 per cent in the number of people coming in for free HIV/AIDS screening. In a scheme in Mozambique, tuberculosis patients receive daily SMS reminders to remind them to take their medication; this has raised compliance rates considerably.

Financial Services

The Ethiopia Commodity Exchange (ECX) provides a virtual marketplace and is accessible online, by phone and SMS. It improves transparency on supply, demand and prices, and increases farmers' share of revenue. The ECX receives more than one million requests per month for market information, with 80 per cent coming from rural areas. As the Internet brings greater transparency, producers are able to see price differences between different grades and commodities. They are therefore able to make more informed decisions on what to plant and can see the quality premium and discount associated with post-harvest production. Likewise, the Agricultural Commodity Exchange in Malawi allows farmers to submit bids and offers online. The East Africa Exchange goes one step further, providing a virtual trading platform, building a regional market and improving price transparency for farmers across six countries. It also provides support services such as warehousing, logistics and market intelligence on stockpiles and expected yields of key crops.

Agriculture

Internet-based agriculture platforms also have the potential to drive up demand for web access, and thus support infrastructure rollout in rural areas. This is exactly the effect that the Senegal-based Manobi had on mobile networks. The initiative, which provides weather and pricing information to fishermen via SMS and WAP, has directly assisted with extending network coverage to remote areas. Technology-driven agricultural services have already shown their ability to improve crop yield, expand access to markets and boost revenue for farmers – thus improving livelihoods and boosting the broader economy. Such services could also create a valuable market in and of themselves, growing to some USD 3 billion a year across Africa by 2025.

Source: adapted from McKinsey Global Institute (2013).

More than just showcasing Internet-based applications for rural populations, Box 1.6 advances the notion that emphasis on Internet connectivity for rural populations can enhance the ways in which development programmes reach the populations that can benefit the most. Furthermore, uptake of the applications could lend strength to infrastructure rollout in rural areas by driving up demand for web services, as in the case of the Senegalese Internet-based agricultural platforms.

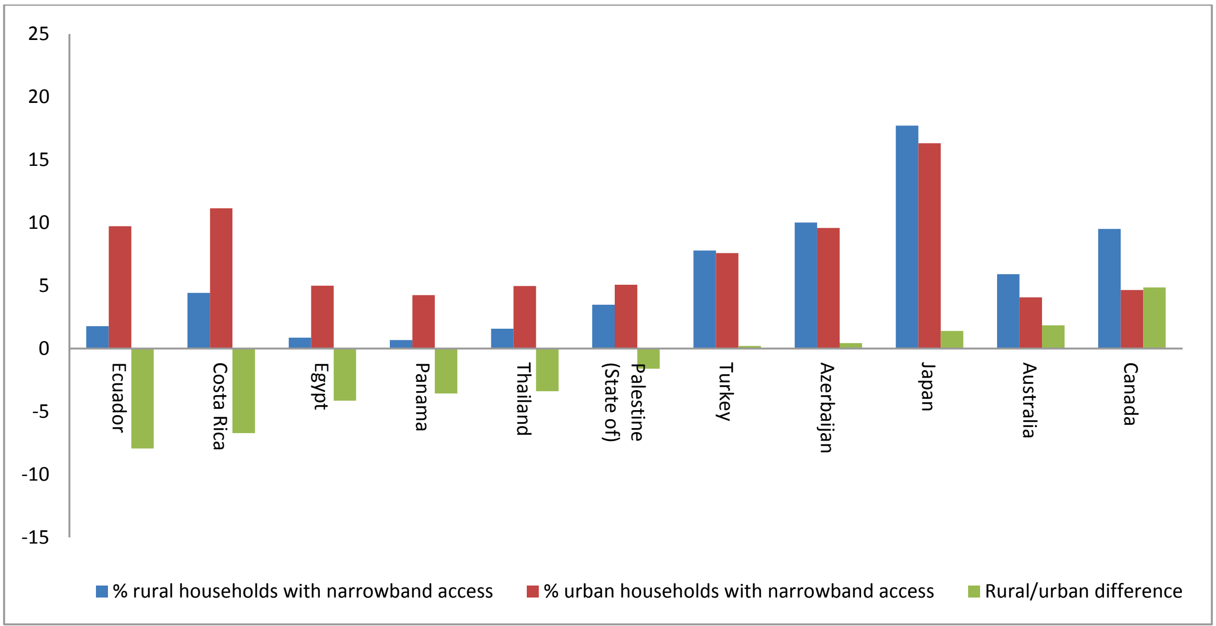
Charts 1.9 to 1.11 present the proportion of households with Internet, by type of access and by rural/urban differences. The different types of access shown are narrowband, fixed (wired) broadband and wireless broadband.

Chart 1.9 shows the proportion of households with narrowband access by rural/urban differences in 2012 or 2011. Narrowband includes analogue modem (dial-up via standard phone line), ISDN

(Integrated Services Digital Network), DSL at advertised download speeds below 256 kbit/s, and mobile phone and other forms of access with an advertised download speed of less than 256 kbit/s. Narrowband mobile phone access services include CDMA 1x (Release 0), GPRS, WAP and i-mode (*Partnership*, 2011).

Only 12 countries had data on narrowband access split by rural/urban. For most countries shown, the proportion of rural households with narrowband access is low (below 10 per cent), with the exception of Japan, where the proportion was 18 per cent in 2012. Even for urban households, the proportions are low, with Japan showing the highest penetration at 16 per cent. Because household penetration rates were generally low, the differences between rural and urban household penetration were also small (less than 10 percentage points in all cases).

Chart 1.9: Households with narrowband access by rural/urban difference, 2012/2011

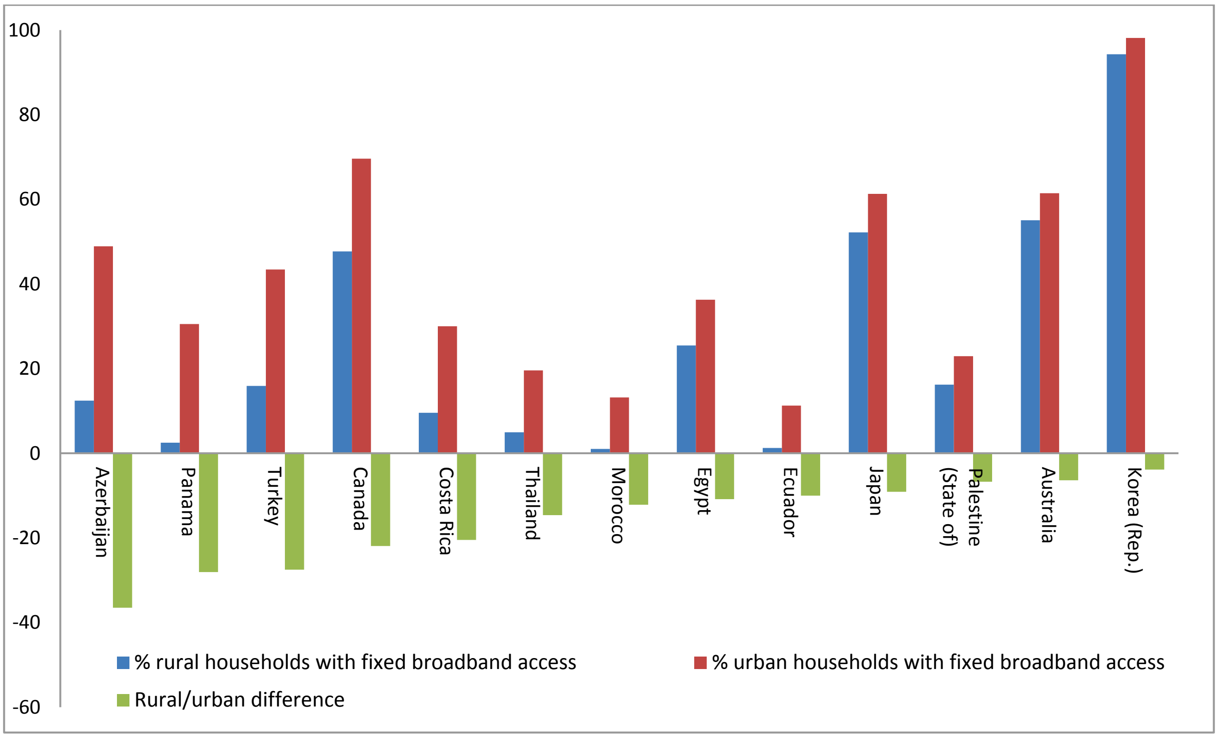


Source: ITU.

Chart 1.10 shows the proportion of households with fixed broadband access by rural/urban differences in 2012 or 2011. Fixed broadband refers to fixed (wired) high-speed access to the public Internet (a TCP/IP connection) at downstream speeds of at least 256 kbit/s. This can include cable modem, DSL and fibre-to-the-home/building (*Partnership*, 2011).

Thirteen countries had data available for this part of Indicator 1.3. Rural household penetration varied considerably across countries and ranged from a low of 1 per cent in Morocco and Ecuador to a high of 94 per cent in the Republic of Korea. Rural household penetration of fixed broadband was generally higher than narrowband but five developing countries had penetration rates of less than or equal to 10 per cent of households. For developed countries with data available, rural household penetration was about 50 per cent or more. The rural/urban gap was highest in Azerbaijan where urban households were four times more likely to have fixed broadband access than rural households. The gap was smallest in the Republic of Korea where rural households enjoy a level of connectivity similar to their urban counterparts (94 and 98 per cent respectively in 2012).

Chart 1.10: Households with fixed broadband access by rural/urban difference, 2012/2011



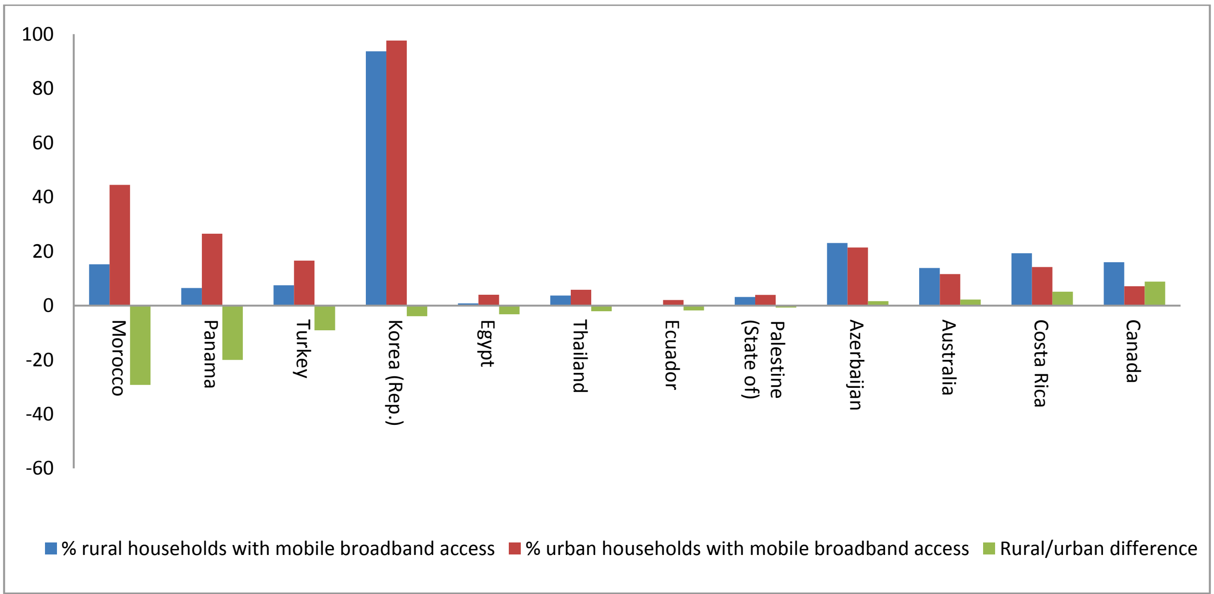
Source: ITU.

The third part of Indicator 1.3 focuses on the proportion of rural households with wireless broadband access. Wireless broadband refers to wireless high-speed access to the public Internet (a TCP/IP connection) at downstream speeds of at least 256 kbit/s. This can include satellite Internet, terrestrial fixed wireless and fixed WiMax. It also includes broadband terrestrial mobile wireless access, which includes the following two types of subscriptions:

- standard mobile subscriptions with active use only, which include mobile subscriptions with advertised data speeds of at least 256 kbit/s and which have been used to make an Internet data connection via IP in the previous three months;
- subscriptions to dedicated data services over a mobile network that are purchased separately from voice services either as a stand-alone service (modem/dongle) or as an add-on data package to voice services, which requires an additional subscription.

Chart 1.11 shows the proportion of households with mobile broadband[19] access by rural/urban differences in 2012 or 2011. Twelve countries had data available for this part of Indicator 1.3. Rural household penetration of mobile broadband access ranged from less than 1 per cent in Ecuador and Egypt to 94 per cent in the Republic of Korea.

Chart 1.11: Households with mobile broadband access by rural/urban difference, 2012/2011



Source: ITU.

The figures from Azerbaijan and Costa Rica reflect the opportunity of mobile broadband for connecting rural households. For both countries, the proportion of rural households with mobile access was higher than fixed broadband access. It is possible that rural households in these countries could be skipping the wait for rural broadband connections and adopting mobile broadband. For this adoption trend to gain traction, cost is a key barrier to be overcome. Even in developed countries, the cost of mobile broadband can still be prohibitively high for the average household. In rural areas of least developed countries, the cost is likely to be out of reach for most residents.

In 2012, rural households connected to the Internet were most likely to have broadband access. At least for countries with available data, narrowband Internet does not seem to be playing a large role in connecting rural households. Mobile broadband has the potential to connect rural households, as mobile infrastructure requires a lower investment by operators. Mobile broadband is a fairly new technology and as it develops in the next few years, subscription costs could be lowered to a level where low income households can afford it. However, to formulate the appropriate policies to connect rural households, policy-makers need to know the extent of connectedness and, as the preceding sections show, this information is scarce for the countries and regions that are the least connected.

In terms of progress made towards Target 1, Indicator 1.3 is still far from being achieved. In 2010, the WTDR reported that Internet access in rural households was very limited in developing countries and broadband access did not exceed 10 per cent of rural households in any developing country for which data were available. Current data indicate that little progress has been made with regard to connecting rural households to the Internet. Even if substantial efforts are made in the time remaining, it is highly unlikely that all rural populations could be connected to the Internet by 2015. For full access to the possible economic and social benefits afforded by ICTs, the Internet needs to be made available to rural residents who are already struggling with difficult geographic and demographic conditions.

The failure to adequately connect rural households calls to attention the need to rejuvenate efforts to this endeavour in the time remaining and also post-2015. This is not to say that Internet access should take precedence over other development goals like poverty reduction and improvement of health. However, there is a growing awareness that ICTs can greatly accelerate the speed at which innovations are diffused and applied.

Proportion of individuals using the Internet

This is measured by Indicator 1.4 and uses *Partnership* core indicators HH7 and HH8. It refers to the proportion of individuals using the Internet, by location and by rural/urban. This indicator is split into two parts, as follows:

- Proportion of all individuals using the Internet at any location in the previous 12 months
- Proportion of Internet users using the Internet at each location (namely home, work, place of education, another person's home, community Internet access facility, commercial Internet access facility, any place via a mobile cellular telephone, and any place via other mobile access devices) (*Partnership*, 2011).

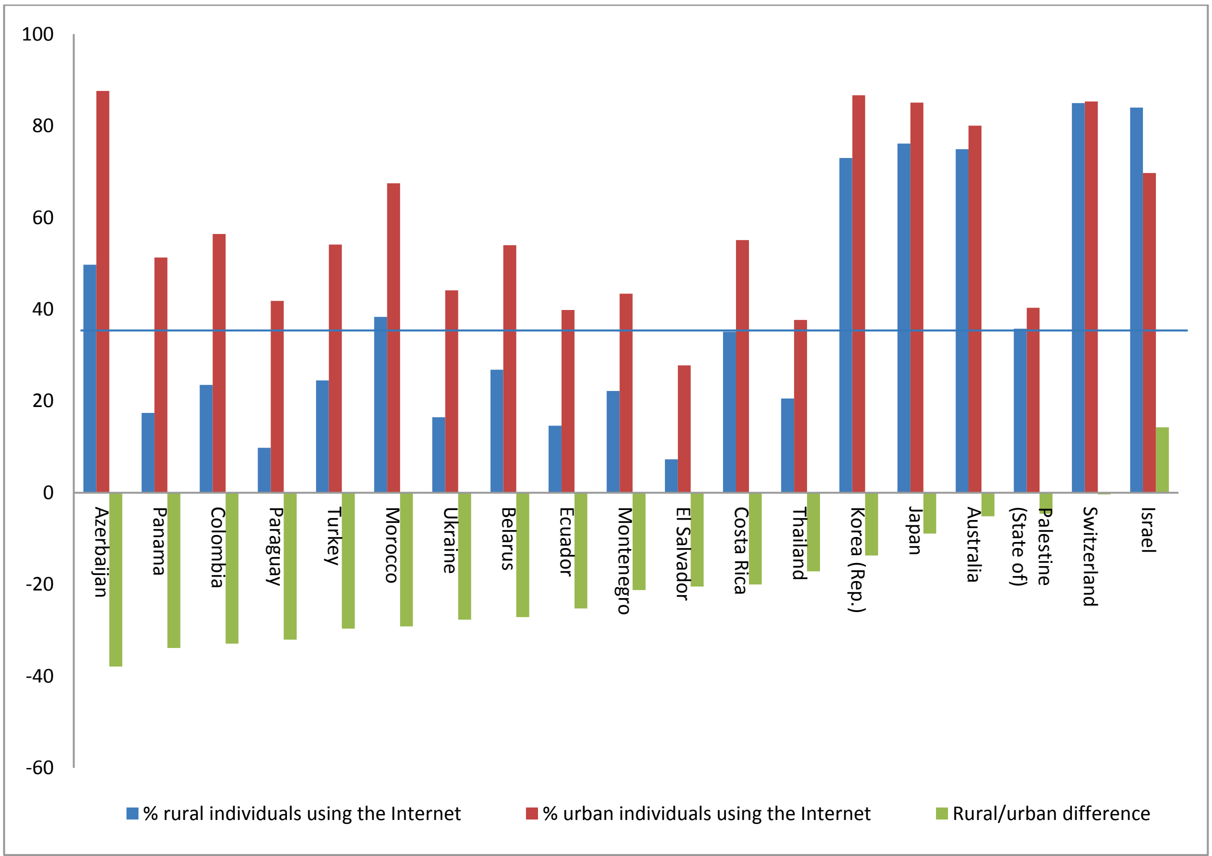
This indicator focuses on use rather than access, which is covered by Indicator 1.3.

Globally, about two in every five persons (39 per cent of the world's population) were estimated to have used the Internet in 2013. The global estimate of Internet users has increased at the rate of about 3 percentage points per annum since 2006. The percentages of Internet users in Africa and Asia have been below global averages since 2006. Only one in five persons living in Africa (21 per cent) and one in three in Asia (32 per cent) accessed the Internet in 2013. These global estimates do not differentiate between rural and urban areas; in cases where data by rural/urban splits are available, the rural residents in Africa, and to a large extent Asia, are far below global averages in terms of Internet use.

Chart 1.12 shows the proportion of Internet users by rural/urban differences in 2012 or 2011. Nineteen countries had data available and country data for rural individuals ranged from 7 per cent in El Salvador to 85 per cent in Israel and Switzerland.

Given that the estimated global average proportion of individuals using the Internet was 36 per cent in 2012, Chart 1.12 depicts a scenario of relatively low connectedness for rural populations in developing countries. While the percentages of urban Internet users in developing countries generally exceed the global average, the percentages of rural Internet users in most developing countries are well below 36 per cent. In countries like El Salvador and Paraguay, fewer than 10 per cent of rural residents used the Internet.

Chart 1.12: Individuals using the Internet by rural/urban difference, 2012/2011



Source: ITU World Telecommunication/ICT Indicators Database.

For all but one of the countries (Israel) shown in Chart 1.12, rural residents trailed urban residents in terms of Internet use. Developed countries generally had much smaller rural/urban differences than developing countries. Israel was the only country where the proportion of rural users outnumbered urban users (by 14 percentage points).[20] Switzerland had the smallest gap of (less than 1 percentage point). At the other end of the spectrum, Azerbaijan had the largest gap, with 38 percentage points. In 2012, 88 per cent of urban residents in Azerbaijan accessed the Internet compared to only 50 per cent of rural residents. Among developing countries, the State of Palestine has a relatively small rural/urban gap but the country also has low overall proportions of residents using the Internet.

Table 1.7 shows the proportion of individuals using the Internet, by rural/urban differences, from 2009 to 2012, for the 15 countries with multi-year data. Similar to the proportions of households with Internet access shown in Table 1.6, the rural/urban gap appears to be widening in developing countries, while most developed countries have a small or reducing gap.

Table 1.7: Individuals using the Internet, by rural/urban difference, 2009–2012, percentage

Country	2009			2010			2011			2012		
	Rural	Urban	Diff.	Rural	Urban	Diff.	Rural	Urban	Diff.	Rural	Urban	Diff.
Colombia	10	36	-26	..	..	..	17	48	-31	23	56	-33
Azerbaijan	14	39	-25	32	58	-26	..	..	..	50	88	-38
Turkey	19	44	-24	22	47	-25	24	51	-27	24	54	-30
Ecuador	9	32	-23	12	38	-26	15	40	-25	..	..	..
Paraguay	5	28	-22	5	30	-25	7	36	-29	10	42	-32
Belarus	12	33	-21	15	38	-23	23	46	-23	27	54	-27
Thailand	15	33	-18	17	35	-19	17	36	-19	21	38	-17
Ukraine	5	21	-15	8	29	-21	..	..	..	16	44	-28
Korea, Rep.	69	84	-15	..	..	..	72	86	-14	73	87	-14
El Salvador	3	17	-14	3	19	-15	5	24	-19	7	28	-20
Australia	69	77	-8	..	..	..	75	80	-5	..	..	..
Palestine	28	34	-6	..	..	..	36	40	-5	..	..	..
Japan	76	81	-5	76	83	-7	75	87	-12	76	85	-9
Switzerland	79	82	-3	82	84	-2	..	..	..	85	85	0
Israel	76	62	14	83	66	16	..	..	..	84	70	14

Source: ITU World Telecommunication/ICT Indicators Database.

Note: .. not available.

Comparing the proportion of Internet users (Table 1.7) with the proportion of households with Internet access (Table 1.6) demonstrates the value of collecting both types of data. In some countries, actual use exceeds household access. For instance, in El Salvador, in 2012, only 1 per cent of rural households had Internet access but 7 per cent of rural individuals are using the Internet, indicating that the Internet is being accessed outside the home. This suggests that in countries where access lags use, efforts should be made towards improving infrastructure and increasing the availability of the Internet in the home. Policy-makers and other stakeholders would need to tailor a mix of actions that suit the contexts in which they operate.

Indicator 1.4 also tracks the proportion of Internet users by locations of use (Table 1.8).

Table 1.8: Internet use by rural/urban and location of use, 2012/2011, percentage of Internet users

Country	Home		Work		Place of education		Another person's home		Community Internet facility		Commercial Internet facility		Any place via mobile phone		Any place via other mobile devices	
	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.
Australia	**93**	**95**	**40**	**50**	16	21	31	37	13	13	14	18	..	..	..	..
Belarus	**89**	**90**	**4**	**5**	0	0	1	1	..	..	0	0	4	3	2	1
Colombia	16	**57**	4	21	**51**	21	6	7	1	2	**41**	**29**	..	..	..	..
Costa Rica	**40**	**53**	9	**17**	**11**	8	3	2	0	0	8	7	..	..	27	11
Ecuador	14	**43**	7	10	**42**	18	1	1	..	..	**35**	**27**	..	..	..	..
El Salvador	12	**46**	3	7	9	5	4	3	0	0	**50**	**23**	3	2	**19**	14
Israel	**98**	**98**	**65**	**62**	..	..	..	..	..	..	..	..			29	36
Japan	**84**	**86**	34	39	8	8	..	..	6	6	3	4	**68**	**71**	..	..
Korea, Rep.	**96**	**98**	36	43	21	22	4	4	3	3	10	11	**50**	**55**	3	4
Morocco	**72**	**75**	11	19	5	5	**37**	20	9	6	**62**	21	14	13	11	11
Panama	**25**	**59**	15	**32**	**39**	21	8	7	8	7	12	4	7	9	0	0
Paraguay	**39**	**61**	5	11		2	..	3	..	..	9	7	**37**	**16**	..	..
Switzerland	**96**	**96**	**42**	45	8	8	16	21	6	7	..	..	..	..	40	**48**
Thailand	**38**	**64**	24	**37**	**57**	37	14	14	4	3	31	21	3	4	10	17
Turkey	**50**	**69**	24	**34**	6	7	16	17	0	0	**28**	18	18	23	0	1
Ukraine	**66**	**91**	12	**11**	17	5	**25**	8	2	0	6	1	9	3	0	0

Source: ITU World Telecommunication/ICT Indicators Database.

Notes:

1. Rur.=Rural; Urb.=Urban.
2. .. not available.
3. As many individuals use the Internet at more than one location, at country level, the split by location of use will add up to more than 100 per cent.
4. The two most common locations of access (for urban and rural Internet users) are shown in bold.
5. Country age scope varies, therefore data comparability between countries may be affected to the extent that different subpopulations are included in the data.

In 2012, urban Internet users in all countries most commonly accessed the Internet at home. Rural Internet users also most commonly accessed the Internet at home except in Colombia, Ecuador and El Salvador, where the most common locations of access were instead places of education and commercial Internet facilities. In fact, outside of the home, workplace and place of education, commercial Internet facilities appear to be an important location of access for rural Internet users for six of the 16 countries with available data. In contrast, community Internet facilities were not commonly accessed by either rural or urban Internet users. In this context, it should be noted that of course the popularity of community access centres – where access is typically free – depends on their availability. If there are no public or private initiatives to provide such community access, people will be not able to use them. This, and the limited data availability, do not allow for generalization to other countries but highlights the importance of places of education and commercial Internet facilities in providing access for rural Internet users. This is an important consideration as Internet use at these locations can be a stepping stone for the adoption of Internet at home (Coward *et al.*, 2013; Larose *et al.*, 2012). In the case of commercial Internet facilities, the fact that rural Internet users are willing to pay for their services is an indication of the value that they attach to these resources (Coward *et al.*, 2013). Policy-makers could partner with the private sector in this regard to look for viable modalities that can improve rural connectivity for areas that are unserved or underserved.

Conclusions and recommendations

Progress made towards Target 1 has been considerable according to some indicators but modest for others. The last decade has shown much faster than anticipated growth in mobile-cellular telephony. Significant progress has been made in terms of increasing mobile cellular coverage and access to phones for rural populations. Current data suggest that by 2013, almost 90 per cent of the world's rural inhabitants were covered by a 2G mobile cellular signal. By 2015, all rural communities around the world are likely to be covered. In this regard, Target 1 has been achieved. However, coverage of the 3G mobile cellular signal was comparatively low in rural communities in 2012 – although this could change rapidly as 3G is a fairly recent technology.

With respect to telephone access for rural households, Target 1 has not been achieved, although significant progress has been made in those countries for which data are available. For most of those countries, over 75 per cent of rural households have phone access of some type. The proportion is likely to be lower for the least developed countries, most of which do not collect data on ICT access.

In terms of Internet access and use, Target 1 is unlikely to be achieved by 2015 and there is pronounced rural-urban divide in terms of Internet access. Available data indicate that access to the Internet in any form (narrowband or broadband, fixed or wireless) was extremely low for rural households in developing countries in 2012. On the other hand, in developed countries, rural households are more likely to have comparable access to their urban counterparts, with slight variations in modes of access and (usually) a small lag in levels of penetration. Available data also indicate that use of the Internet by individuals in developing countries was low, especially in rural areas.

Three conclusions can be drawn from examination of currently available data:

1. Despite the progress that has been made in expanding mobile network coverage to rural areas, Target 1 will not be achieved by the end of 2015 in terms of Internet access and use for rural areas.
2. The widest rural/urban digital divide is in broadband access; mobile broadband offers one modality for connecting rural communities.
3. Measurement and tracking rural access to, and use of, ICTs is vitally important but data availability is low, reflecting the high cost of collecting data using household surveys.

Rural households in developing countries seem to be twice disadvantaged – first, by their remote geography and secondly, by the developmental status of their nations. *Measuring the Information Society 2013* (ITU, 2013) estimated that for the world's least developed countries (LDCs), fewer than one in ten people would be using the Internet by the end of 2013. On the basis of the target set by the Broadband Commission for Digital Development, at least 60 per cent of the world's population should be online by 2015, including 50 per cent in developing countries and 15 per cent in LDCs. This target is also unlikely to be achieved at the current growth rates. Given that Internet access will offer greater functionality and more public services for rural communities compared to basic telephony, policy-makers and other stakeholders need to continue to strive to make Internet services available and affordable to rural residents.

Currently available data do offer some cause for reasoned optimism. Access to the Internet using mobile phones appears to be a growing trend. In fact, there are indications that rural residents are adopting mobile broadband Internet rather than fixed-line connections (because the fixed line tends to be unavailable in rural areas). Other types of broadband wireless networks are also growing in developing countries. These adoption patterns should offer telecommunication operators some assurance that rural households can be a viable market, especially for mobile broadband.

The availability of household survey data for rural households was very low, as is evident from the data presented. Data availability for the least developed countries was particularly limited. Although the original intent of the full set of Target 1 indicators was to provide an in-depth assessment of ICT access and use, few countries have been able to provide relevant data, especially time-series data and data split by urban and rural areas. Should there be a post-WSIS target on rural connectivity, it is recommended that future tracking be focused on fewer indicators that would provide concise insights into the information lives of rural households.

Household-level data relating to Indicator 1.2 may become more difficult to interpret as fixed lines decrease in importance globally. A useful modification post-2015 would be to measure the proportion of households with any mobile phone (regardless of whether they also have a fixed phone) and possibly the proportion of households with any fixed phone (regardless of whether they also have a mobile phone). Those two indicators, together with the existing indicator on the proportion of households with any telephone access, should provide a more meaningful picture of rural connectivity. All these indicators are included in the ITU household questionnaire and are collected by a few countries.

Indicator 1.3 could be supplemented with data from operators on the number of subscriptions according to types of access. This is contingent on the ability of operators to break down residential subscriptions by rural/urban.

Data collection on locations of use for Indicator 1.4 has yielded very limited information but when available, the data can provide useful insights.

In terms of definitions, a challenge remains on how to identify rural populations (and distinguish them from urban populations) in a manner that is both meaningful and comparable across countries.

It is suggested that attention should shift towards quality of access data post-2015. Analyses for Target 1 suggest that while coverage was the primary goal for 2015, quality of access is becoming the key digital divide between rural and urban households. The current indicators address quality of access through the type of mobile telephone coverage and the type of Internet access. However, quality of access can be more broadly defined. Other measurables include speed and reliability of networks (data that are available from telecommunications companies) and the accompanying skills to use ICTs (perhaps as a component of WSIS Action Line C4). Quality of access to ICT and ICT capabilities cannot be decoupled because the benefits that rural households can garner from good quality access may be limited by poor ICT skills. Governments working on improving the quality of ICT access should monitor some of the quality of service (QoS) indicators that ITU collects and introduce policies to improve ICT skills in order for rural households to realize the full potential of ICTs.

Measures of actual usage and QoS entail a broader definition of ICT connectivity that goes beyond the 'haves and have-nots' type of analysis. Such measures could better capture the digital divide in the post-2015 information society (ITU, 2012). The ITU Expert Group on Telecommunication/ICT

Indicators (EGTI[21]) discussed the topic of QoS indicators from 2009 to 2012, and concluded that it was not possible to collect a comprehensive set of QoS indicators for mobile- and fixed-broadband services at the international level. However, given the importance of these data, further work should be carried out on such indicators. The main issues identified by the EGTI were lack of country-level data and differing methodological approaches that did not enable international comparison.

It is suggested that any future indicators on rural connectivity address the issue of rurally relevant applications and content. Demand for, and use of, ICTs, such as applications on commodity prices or transport schedules delivered via text messaging, can help to drive demand for better phone and Internet connectivity. It may seem logical to deliver connectivity first and then content but development outcomes are realized only when the content is put to use. For rural households to bridge the knowledge divide and access public services, they need to be connected to the relevant information services and applications (action lines C7 and C8). In fact, several cases presented in this chapter suggest that demand for content and communication can drive ICT adoption. Just as the introduction of this chapter suggested rethinking the 'build-it-and-they-will-come' paradigm, the conclusion suggests the parallel approach of identifying the information needs of rural households so that efforts at increasing the availability of ICT can meet those needs.

The underachievement of Target 1, especially in Internet access, highlights the magnitude of the challenges to be overcome in order to connect people living in rural areas with ICTs. The challenges include remote geography, perceived low demand and high costs of service delivery. Affordability and availability of telecommunications services generally work against people living outside major urban centres. Vast distances between rural villages can make the rollout of ICT infrastructure prohibitively costly for private investors as multiple cell towers have to be set up to reach relatively small numbers of clients. Understandably, telecommunication companies have pursued the 'low-hanging fruit' of urban populations, where incomes are higher and potential clients are concentrated in a relatively small geographic area. There is also a perception that rural residents spend less on their telecommunication needs because, on average, they generally have lower discretionary income.

It is recommended that more public-private partnerships be created in order to accelerate progress towards the achievement of Target 1. The past decade has shown that it is overly-optimistic to leave the task of connecting rural residents to the private sector. Private investors are not in the business of bridging the digital divide – they are ultimately accountable to their shareholders and have to remain financially viable. In this context, governments play a critical role in setting the right regulatory framework to foster development of ICTs in rural areas. The task of connecting rural residents should therefore be undertaken by a specialized team of stakeholders, from both the private and public sectors, possibly also including international agencies, national coordinating agencies and experts. This team should formulate and implement national ICT plans to ensure that rural residents will not continue to be excluded from the information society.

There are two specific strategies that governments can implement with respect to the telecommunications sector. These were recommended in the WTDR 2010 and are still relevant:

- **Market liberalization.** 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 order to make services more affordable and increase the spread of the Internet and broadband, governments need to encourage greater liberalization in the

Internet market. For example, 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 miss out on Internet connectivity because of a lack of options and high prices.

- **Conditional licensing.** Set targets in licences for the percentage of the rural population to be covered by mobile cellular networks. Some countries have not exploited the regulatory tool of imposing licence conditions on operators in order 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.

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Endnotes

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[1] The original WSIS indicator was worded slightly differently "Connect villages with ICTs and establish community access points". In this report, villages are also referred to as "rural areas".

[2] These Principles have also been institutionalized in several countries either as part of a National ICT/Broadband Plan or some form of a universal access policy. These plans are discussed in greater detail in Chapter 10.

[3] Also commonly known as "the rich get richer and the poor get poorer" phenomenon.

[4] As defined by the *Partnership* (2010).

[5] Note the change in the reference period in ITU (2014) to three months.

[6] Social capital is a set of associations between people, consisting of social networks and associated norms that have an effect on community productivity and well-being. Social capital facilitates coordination and cooperation (World Bank, 2011).

[7] See: https://www.youtube.com/watch?v=zhAUeIfGwA8&list=PL95853B5AE338A359, official website: http://infolady.com.bd.

[8] See http://www.bbc.co.uk/news/world-latin-america-24450542.

[9] Country age scope varies, therefore data comparability between countries may be affected to the extent that different subpopulations are included.

[10] Mobile broadband coverage is defined as at least 3G for the purposes of this report.

[11] Mobile phone coverage is defined as at least 2G for the purposes of this report.

[12] Though note that in Oceania, nine out of the 19 countries in the region had no data about mobile coverage.

[13] A small number of developing countries in Africa and the Americas reported zero coverage for 2012.

[14] Defined as at least 3G for the purposes of this report.

[15] LTE refers to Long Term Evolution, a high-speed cellular data transmission network that provides download speeds of at least 100 Mbit/s and upload speeds of at least 50 Mbit/s. LTE Advanced is one on the technology families recognized as IMT-Advanced, as defined in ITU Standards. For more information, see, for example: http://www.3gpp.org/technologies/keywords-acronyms.

[16] The ITU Radiocommunication Report for Mobile, Radiodetermination, Amateur and Related Satellite Services 2078 (ITU-R M. 2078) establishes recommendations for the allocation of sufficient radio spectrum to allow for the proper development of advanced networks. See http://www.itu.int/pub/R-REP-M.2078/en.

[17] See http://pewinternet.org/Reports/2013/Cell-Internet.aspx.

[18] Countries apply different concepts in measuring ICT household access. Some countries consider a household to have access to ICTs if any (individual) member has access to ICTs. Other countries apply the traditional concept established in household surveys about household goods availability and would only consider a household as having access to ICTs if they are generally available for use by all members of the household at any time. The latter is the concept recommended by the ITU Manual for Measuring ICT Access and Use by Households and Individuals (ITU, 2014). Because two different approaches are applied in measuring ICT household access, data are not always comparable between countries.

[19] Mobile broadband is a sub-category of wireless broadband, which is the sum of: mobile-broadband plus satellite plus fixed wireless (Wimax).

[20] Israel has a relatively small rural population, with only around 8 per cent of the population living in rural areas.

[21] See work of the ITU Expert Group on Telecommunication/ICT Indicators, http://www.itu.int/en/ITU-D/Statistics/Pages/definitions/default.aspx.

CONNECT ALL SECONDARY SCHOOLS AND PRIMARY SCHOOLS WITH ICTs

Target 2: Connect all secondary schools and primary schools with ICTs[1]

Executive summary

Target 2 reflects the importance of connecting all schools with ICTs. ICT connectivity in schools provides pupils 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.

Target 2 is tracked using four indicators, which address both newer and older types of ICT. Radio and television, including both broadcast and ad hoc modes of delivery, represent traditional forms of ICT that nevertheless remain key for connecting schools in both developed and developing countries. This is particularly so in rural and remote areas, where financial resources and/or human resources are often lacking. In areas where electrical infrastructure is absent, radio has the added advantage that it only requires batteries.

The first two indicators – 'proportion of schools with a radio used for educational purposes' and 'proportion of schools with a television used for educational purposes' – show varying levels of achievement amongst countries. Penetration of radio and television for educational purposes has been universally achieved in a number of developed and developing countries, while they lag in a number of others. More importantly, the availability of radio and television frequently remains very low in a number of developing countries despite the fact they can play an important role in connecting schools, especially where more advanced forms of ICT are absent. While radio and television are known to be increasing in some countries to fill connectivity gaps, they are decreasing in others, particularly where the emphasis is shifting towards more advanced forms of ICT including computers and the Internet.

Despite such challenges and consistent with the evolving information society, schools in a large proportion of countries (both developed and developing) are progressing towards increased use of computers – albeit at very different speeds. The third indicator, the 'learners-to-computer ratio' (LCR), tracks general access to computers. Tracking the LCR is important since its value is inversely proportional to time on task. In other words, the greater the number of learners sharing a single computer device, the less time overall that pupils can use computers during class time. LCRs vary substantially between regions and countries. They are lowest in Europe and other OECD countries, typically below 10:1, while they are relatively high in developing countries. LCRs are highest in a number of least developed countries (LDCs) in Asia and Africa, where computers are unevenly distributed across the education system, resulting in a lack of availability for the majority of students. While progress has been difficult to measure conclusively in most regions and countries, data show that LCRs are falling in a number of countries. This is particularly so in developing countries that have implemented strong policy initiatives and programmes with high-level governmental support and a sector-wide approach. The adoption of low cost laptops and tablets has been relatively effective to rapidly decrease LCRs in a number of countries.

The fourth indicator, the 'proportion of schools with Internet access, by type of access', shows that while Internet access has been universally achieved in the majority of European and other OCED countries, Internet connectivity is lagging behind in most developing countries. It remains under 10 per cent in some countries from all developing regions, including Latin America and the Caribbean, Asia and Africa. Data on Internet access are the most frequently available for all the indicators used to track Target 2. However, collecting data on schools with broadband Internet access is more challenging. Where available, data show that the availability of broadband Internet varies. In many European and other OECD countries, broadband Internet is universally available, while this is also true for some developing countries with strong ICT in education initiatives. In some developing countries, all schools with Internet are connected using broadband – suggesting that a leapfrogging phenomenon may be occurring, with schools bypassing the use of older forms of Internet access such as narrowband.

Significant progress has been achieved connecting schools with ICTs during the ten years since the Geneva phase of the WSIS. However, progress has not been uniform across countries and regions. As universal connectivity remains elusive for many countries, a post-2015 ICT monitoring framework should continue to track ICT connectivity in schools. Based on current analysis, and considering the rapidly evolving ICT landscape, some additional indicators for monitoring ICT in education during the post-2015 agenda could include an additional version of the 'learner-to-computer ratio' that includes only schools with computer-assisted instruction (CAI). This indicator would shed light on the actual level of computer access available in schools, particularly in developing countries where access is unevenly distributed. Additionally, the 'learner-to-computer connected to the Internet ratio' (LCCIR), would provide information on the technological capacity of computers and other digital devices. Analysis has shown that while countries may have some success in building a computer infrastructure, connecting these devices to the Internet may lag behind. While data on LCCIR have been somewhat more challenging to obtain, particularly in developing countries, they would shed additional light on the relative connectivity of schools, as indicators 2.3 (LCR) and 2.4 (proportion of schools with Internet access) do not capture the full extent to which all computers in schools are connected.

The UIS regularly collects the relevant data to calculate both these indicators. While data will not be universally available in the post-2015 environment, increased capacity building in countries will contribute to improvements of ICT in education statistics over time.

Finally, this report offers some policy recommendations for connecting all schools with ICTs:

- Strengthen existing electrical infrastructure.
- Recognise the potential of fixed broadband, WiMax, and mobile broadband (3G and 4G) Internet for equipping schools with high-speed Internet.
- In countries with difficult terrain, consider building a combination of wireless and satellite-based telecommunications with low-cost Very Small Aperture Terminal (VSAT) apparatus for downlink of data and images.
- Consider the use of both radios and televisions to connect schools in situations where more advanced forms of ICT are not feasible or available.
- Low cost computers are an effective strategy to rapidly increase the computer resources in a country, but this policy option should be weighed against other educational priorities.

- Recognise the role of community media centres to play a role in extending the reach of ICT to pupils when ICTs are not available in schools.
- Establish partnerships with multiple levels of government and the private sector, particularly with telecommunications companies, to negotiate low cost access to Internet services.
- In countries where universal Internet service is not feasible, governments should promote the installation of public Internet facilities in rural areas.

Introduction

The advent of the knowledge economy and global economic competition compel governments to prioritise educational quality, lifelong learning, and the provision of educational opportunities for all. Policy-makers widely accept that access to information and communication technology (ICT) in education can help individuals to compete in a global economy by creating a skilled work force and facilitating social mobility. They emphasise that ICT in education has a multiplier effect throughout the education system, by:

- enhancing learning and providing students with new sets of skills
- reaching students with poor or no access (especially in rural and remote regions)
- facilitating and improving the training of teachers
- minimising costs associated with the delivery of traditional instruction
- improving the administration of schools in order to enhance the quality and efficiency of service delivery.

Outside official school hours, schools with ICT may also be used to provide learning opportunities for the community, including marginalized groups, such as the elderly, minorities, the unemployed and people with disabilities.[2]

However, beyond the rhetoric, and of equal importance to policy-makers, are basic questions related to the measurement of ICT in education, such as connectivity, participation, usage and outcomes, including retention and learning achievement. While some of these dimensions are difficult to measure, Target 2 indicators measure basic components of ICT connectivity in primary and secondary schools.

As illustrated in Figure 2.1, WSIS Target 2 is closely related to three WSIS action lines. For example, Action Line C2 (Information and communication infrastructure) states that:

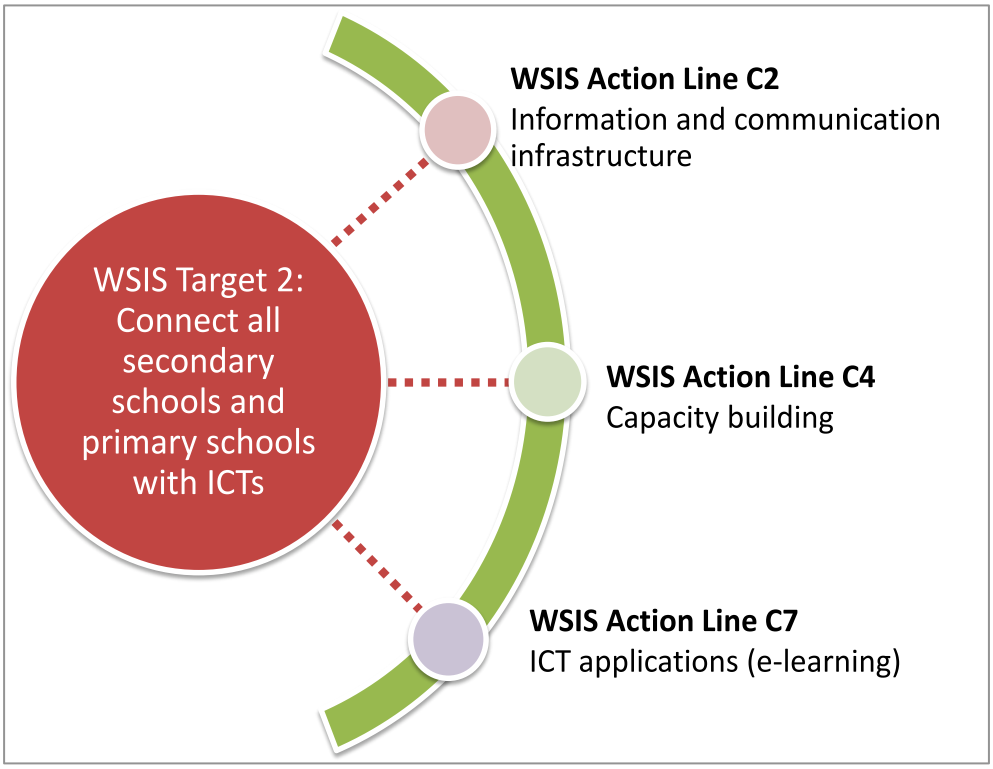
> "In the context of national e-strategies, provide and improve ICT connectivity for all schools, universities, health institutions, libraries, post offices, community centres, museums and other institutions accessible to the public, in line with the indicative targets." (ITU, 2005)

Target 2 is also significant in the context of Action Line C7, in respect of promoting e-learning, and Action Line C4 (Capacity building), which enumerates a number of policies such as integrating ICT in education and promoting e-literacy skills for all:

> "Everyone should have the necessary skills to benefit fully from the information society. Therefore capacity building and ICT literacy are essential. ICT 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."
(ITU, 2005

Figure 2.1: Relevance of Target 2 to WSIS action lines



Data availability and scope

Despite the growing demand for ICT in education statistics, there have been few global initiatives to identify indicators or to provide data on ICT in education. Periodic surveys on schools have been carried out in Europe, usually under a project of the European Commission (European Schoolnet, 2013) as well as in a number of regions, including Latin America and the Caribbean (Hinostroza and Labbé, 2011), and Asia (World Bank, 2010; ADB, 2012). However, data on ICT in education are generally not comparable across countries and are based on different sets of indicators and definitions. Despite its limitations in terms of geographical coverage, the OECD's Programme for International Student Assessment (PISA) dataset has been a relatively reliable source of information on access, use and outcomes regarding ICT in education (OECD, 2011; Scheuermann *et al*., 2009).

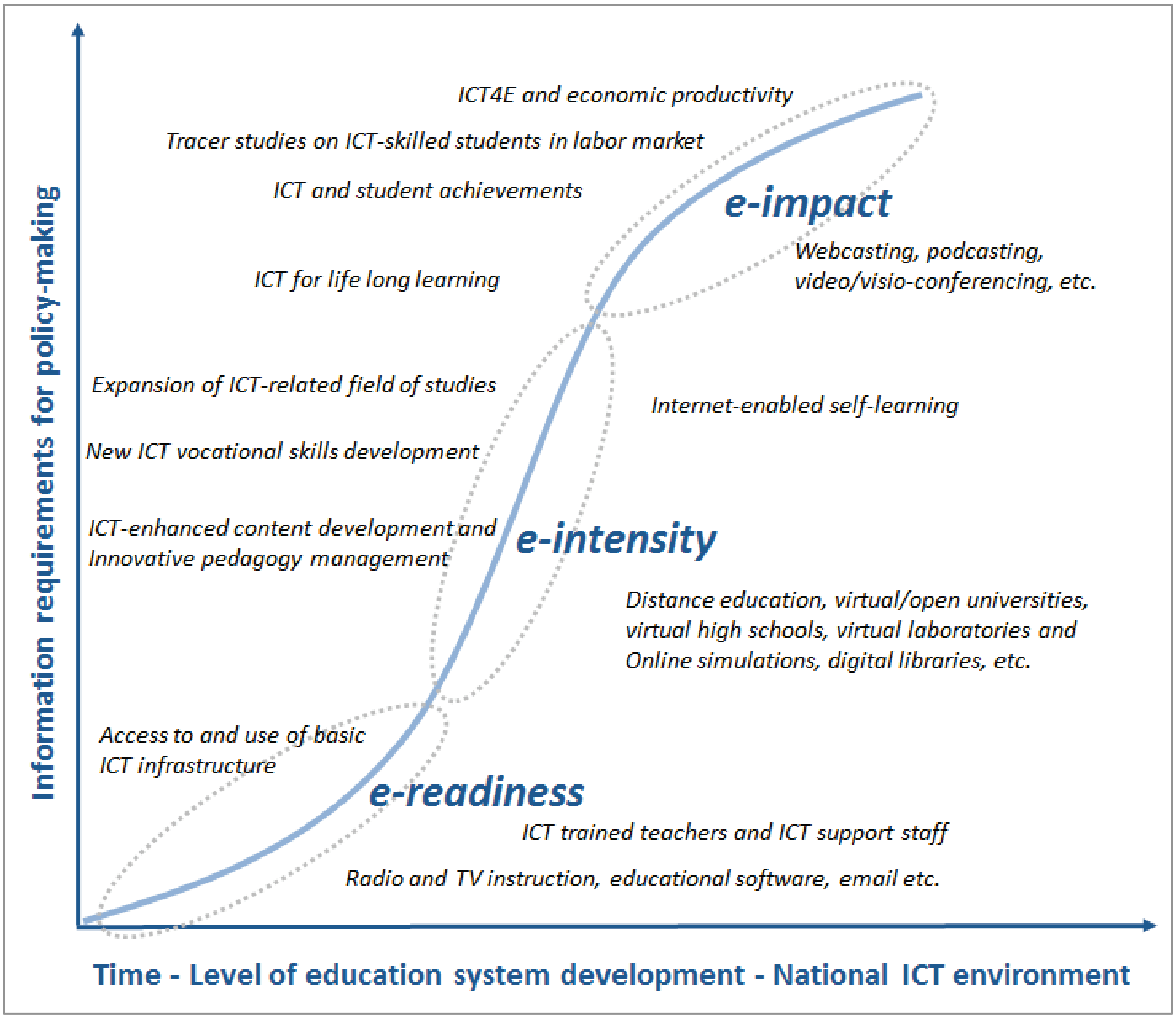
The Partnership on Measuring ICT for Development is mandated to establish internationally comparable statistical indicators and associated standards for monitoring of the information society. However, in order to monitor ICT in education from an international perspective, it is necessary to build consensus on a conceptual framework. Under the auspices of the *Partnership*, the UNESCO Institute for Statistics (UIS), in 2009, led a process for the development and pilot testing of internationally comparable core indicators of ICT for education (ICT4E). These were a subset of the indicators described in the UIS *Guide to Measuring Information and Communication Technologies (ICT) in Education* (UNESCO-UIS, 2009a). Since the release of the UIS *Guide* in 2009, the approach has emphasized that schools are the main units of data collection, with aggregation at the country level.

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 established the international *Working Group for ICT Statistics in Education* (WISE). The purpose of the working group was to bring together statisticians (as national focal points) from ministries of education (or national statistical offices) from 25 countries to pilot the international *Questionnaire on Statistics of ICT in Education* (UNESCO-UIS, 2009b). The four indicators identified to monitor Target 2 in the following sections result from this initiative.

While the results of the UIS surveys presented in this chapter provide important insights into the status of ICT in education in both developed and developing countries, the survey has not yet been disseminated globally and this chapter is therefore limited to 118[3] countries from various data collections. Initially, data were collected from 25 countries using the pilot questionnaire (UNESCO-UIS, 2009b); those data were analysed and included in the *World Telecommunication/ICT Development Report 2010: Monitoring the WSIS Targets, A mid-term review* (WTDR) (ITU, 2010). Since then, UIS has conducted regional data collections and released reports for Latin America and the Caribbean (UNESCO-UIS, 2012), Arab States (UNESCO-UIS, 2013) and Asia (UNESCO-UIS, 2014). UIS began collecting ICT in education statistics in sub-Saharan Africa in late 2013. Since several countries have yet to complete the UIS survey, data in this chapter are complemented with indicators collected using the *Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013* (*Partnership*, 2013) as well as from other regional or national sources.

At an individual country level, the most appropriate indicators to measure Target 2 depend on a country's development status and the penetration of ICT in education. Thus, the concerns of policy-makers and their information needs will shift over time. Countries that are in the early stages of introducing ICTs (*e-readiness* stage) have different information needs than countries that have longer experience with technology. For instance, in the initial stages, countries require information on underlying infrastructure to support ICT, including electricity and Internet connections; on access to different types of ICT-assisted instruction; and, on training for teachers to give them basic ICT skills. During the second stage (*e-intensity* stage), the underlying infrastructure has been established, thus facilitating the rapid uptake of ICT in education. This results in changing information needs, including those related to the management of pedagogical innovation, adaptive and inclusive curricula, organizational change, sustainable technical support and continued staff development. Finally, countries in the most advanced stage of ICT use in education (*e-impact* stage) require information on enhancing student outcomes and the effects on economic productivity (see Figure 2.2).

Figure 2.2: Information needs at different levels of ICT penetration in educational systems



Source: UIS, adapted from (UNTAD, 2007).

Indicators to track WSIS Target 2

While Target 2 promotes connection of all primary and secondary schools with ICTs, it does not specifically state which ICTs should be used (*Partnership*, 2011). Clearly 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 traditional ICTs, such as radio and television broadcasts (live and off-air), as well as more recent digital technologies, such as broadband Internet, cloud (distributed) computing, computer e-learning software and mobile learning models.

The following four indicators were defined in the 2011 WSIS statistical framework (*Partnership*, 2011) to track Target 2:[4]

Indicator 2.1: Proportion of schools with a radio used for educational purposes

Indicator 2.2: Proportion of schools with a television used for educational purposes

Indicator 2.3: Learners-to-computer ratio

Indicator 2.4. Proportion of schools with Internet access, by type of access (broadband, narrowband).

Indicator 2.1 refers to the proportion of a country's primary and secondary schools that have at least one radio that is used for educational purposes. The indicator measures the potential use of radio(s) by teachers and pupils in education, but not the quality nor actual use. The indicator is the *Partnership* core ICT indicator, ED1 (*Partnership*, 2010).

Indicator 2.2 refers to the proportion of a country's primary and secondary schools that have at least one television that is used for educational purposes. The indicator measures the potential use of television(s) by teachers and pupils in education, but not the quality nor actual use. The indicator is the *Partnership* core ICT indicator, ED2 (*Partnership*, 2010).

Indicator 2.3 refers to the number of pupils on average sharing a computer. The indicator measures the potential access to computers by pupils and teachers, but not the quality nor actual use. It can be calculated in two different ways:

1. the average number of all pupils nationally sharing a single computer
2. the average number of pupils in schools that have computers for educational purposes, sharing a single computer (*Partnership* core ICT indicator, ED4 (*Partnership*, 2010)).

While Indicator 2.3 in the 2011 WSIS statistical framework is defined per the first form of the indicator, the second form is a useful complementary indicator and is therefore included in this chapter.

Indicator 2.4 refers to the proportion of a country's primary and secondary schools that have Internet access, as well as the proportion with various types of access, in particular fixed broadband. The indicator measures the extent of Internet access among schools, but does not measure the degree to which it is used for educational purposes, as many schools in developing countries reserve Internet for administration. Moreover, the indicators do not measure the quality or speed of Internet connectivity, which is known to vary significantly between countries. The indicator is the *Partnership* core ICT indicator, ED5 (*Partnership*, 2010).

All of the Target 2 indicators are in the *Partnership*'s core list of ICT indicators and, at the international level, are collected and published by UIS. While relatively few have done so, a number of countries and regions have set specific targets on ICT in education (see Box 2.1) that can be monitored by the *Partnership*'s indicators.

Box 2.1: Setting targets for integrating ICT in education – regional and national level examples

While Target 2 does not specify the proportion of schools that should be connected to ICT, some regions and countries have set their own targets:

In Latin America and the Caribbean, eLAC 2015 set the goal of connecting all educational establishments to broadband and increasing computer density, while promoting the use of convergent educational resources such as mobile phones, video games and open interactive digital television (UNECLAC, 2010).

In Georgia, the Deer Leap Programme was established to facilitate the modernization of the education system by creating a country-wide, school-based ICT infrastructure and building capacity in modern information technology. One of its goals was to provide access to computers and the Internet in all schools by 2008 (Ministry of Education and Science, 2007). While this was not achieved, the government programme 2008–2012, 'Georgia without Poverty', reaffirmed its pledge to modernize all public schools and implement the Deer Leap Programme successfully, equipping schools with computers and connecting them to the Internet.[5]

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 (LCR) for secondary schools by 2011. Schools connected will have access to broadband speeds of up to 100 Mbit/s (Department of Broadband, Communications and the Digital Economy, 2009).

In South Africa, the Department of Communications developed a draft national broadband policy, which restated its vision for broadband for all South Africans by 2030. From baseline data, which states that there were 25 per cent of schools connected to the Internet via broadband in 2013, 50 per cent of schools will be connected by 10 Mbit/s in 2016, and all schools will be connected by broadband in 2020 (Department of Communications, 2013).

Achievements against Target 2

Proportion of schools with a radio/a television used for educational purposes

Considered 'older' more traditional forms of ICT, radio and television have been used in education since the 1920s and 1950s, respectively. Experience has shown that radio and television represent effective solutions for delivering educational content, by expanding access on a large scale and at a low cost. Strategies include: targeting of young adults who have left primary or secondary schools before graduation, allowing them to follow curricula from a distance; and providing otherwise unavailable instruction in sparsely settled rural and remote areas (Haddad *et al.*, 2007; Trucano, 2010; World Bank, 2010).

While there are numerous benefits to be gained from connecting schools using computers and the Internet, many developing countries continue to see broadcast technologies as a viable alternative. Live radio broadcasts and off-air audio-assisted technologies as well as television broadcasts and off-air video-assisted technologies are still considered valid modes of education delivery. Radio-assisted instruction (RAI), in particular, has an added advantage in rural and remote areas where there may be little or no access to electricity and devices can be operated using batteries. Addressing the perceived lack of interactivity of radio broadcast technologies in delivering educational content, interactive radio instruction (IRI) requires that pupils react to questions and exercises through verbal responses to programme contributors during broadcast. This technology might alleviate some of the concerns of educators and learners alike (Trucano, 2010).

For the purposes 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 also be an audio lecture or lesson, with printed material for learners to follow. Any teacher who is not qualified in the subject matter, can use the radio broadcast 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.

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

Chart 2.1 shows indicators 2.1 and 2.2: the proportion of schools that have a radio for educational purposes and the proportion of schools that have a television for educational purposes. Of the Target 2 indicators, 2.1 and 2.2 are more difficult to assess due to lack of available data. The data show that there are countries in each region that do, and do not, use radio- and television-assisted instruction. In fact, a number of developing countries that do not provide televisions and radios universally for educational purposes may benefit significantly, especially where computers and Internet connectivity are absent (see Box 2.2).

Box 2.2: Connecting schools through interactive TV-assisted instruction in a remote state in Brazil

Faced with a significant deficit of qualified teachers, especially in remote regions and in subjects like mathematics, science and foreign languages, several countries are engaged in long-term efforts to recruit and train additional teachers, as well as upgrade the knowledge and skills of those already in their education systems. Where there are pressing needs for teachers that cannot be met through conventional approaches or according to the traditional timelines dictated by the capacity and effectiveness of teacher training institutes, educational authorities are looking to see how ICT can be leveraged to help reach students in schools without qualified teachers – or in some cases, without any teachers at all (Trucano, 2014).

In Amazonas, which is Brazil's largest state by area, significant logistical challenges exist in the deployment of quality education. For example, there are 6 100 rural/riverside communities outside the capital city of Manaus, which is home to about half of the state's 3.8 million residents. The main forms of transportation are by air or river. Suffering from remoteness, pupils have lower completion rates compared to the national average, and a high number of overage students in a total student population of 864 000. To extend educational opportunity and enhance the quality of teaching, educational authorities in the state are promoting the widespread use of interactive educational television through public media centres (Centro de Mídias do Amazonas) (IDB, 2014).

This programme utilizes satellite television in the service of what is essentially multi-point videoconferencing (and thus interactive). Classes are taught remotely by teachers in Manaus and lessons are broadcast to students in schools in rural communities, who are supported by a professional face-to-face tutor in their classrooms. One lesson is typically shared by multiple municipal schools simultaneously. These municipal schools serve as primary schools in the morning, and then older students come to school in the afternoon for the educational TV offerings. Each class is mediated by an onsite tutor, who coordinates the questions and answers, provides further explanations and directions, and helps support the equipment to ensure that the experience is as interactive as possible. Students have access to textbooks and other educational resources (both paper-based and via the Internet). Students in these settings follow the same curriculum as other schools across the state, but on a block schedule, whereby (for example) students have three consecutive weeks of mathematics, then four weeks of biology, followed by three weeks of English, instead of studying multiple subjects simultaneously as in a typical school (Trucano, 2014).

The initiative grew substantially between 2007 and 2013, quadrupling the number of pupils exposed, doubling the number of schools, and serving seven times more communities (Box Table 2.2). While there are plans to expand coverage substantially (for example, increase the number of schools covered to 960), it is not easy to deploy satellite antennas in these rural, remote communities. A rigorous evaluation agenda has been proposed, looking at project impact, for example, on academic performance, dropout and repetition rates (IDB, 2013).

Box Table 2.2: Measuring interactive educational television in amazonas

	2007	2013	Future Goals
Pupils	10,000	38,000	53,000
Classrooms	260	1,809	not available
Schools	200	400	960
Communities	334	2,400	3,900

Source: Trucano, 2014.

In Latin America and the Caribbean, radio(s) and television(s) are universally available for educational purposes in a number of small island countries including Anguilla, Bahamas, Barbados, Saint Lucia, Saint Kitts and Nevis, Saint Vincent and the Grenadines, and Trinidad and Tobago. In contrast, in 2010 just 1 per cent of private schools in the Dominican Republic provided radio for educational purposes through the private sector rural community education and development programme, *Escuelas radiofónicas*, while televisions were available in 15 per cent of all schools. Radio and television were also poorly integrated in a number of other Latin American and Caribbean countries including

Antigua and Barbuda, British Virgin Islands, Costa Rica, Ecuador, Guatemala, Sint Maarten, Venezuela and Mexico.

Mexico, where 14 per cent of schools had televisions used for educational purposes in 2009,[6] represents one of the best known television-assisted initiatives in the region. Commonly known as *Telesecundaria*, this initiative was launched in 1968 as a means of using television to extend lower secondary education to remote and small communities, at a lower cost than establishing conventional schools. The early model included lessons transmitted live through open public channels to television sets placed in remote classrooms, where students listened and took notes in the presence of a teacher. Each hour of class was made up of the television broadcast itself, followed by a discussion with the teacher of what had been seen. More recent versions of the programme include additional interactivity. The system was inexpensive because public networks donated airtime to the Ministry of Education and because it required fewer teachers than traditional schooling (Hinostroza and Labbé, 2011; UNESCO, 2012).

Asia demonstrates a similar pattern where radios and televisions are not evenly available. Radio and television are universally available in China, Hong Kong; Bahrain; and the Republic of Korea, but were only available in a minority of schools in Myanmar[7] (13 per cent and 5 per cent) in 2012, Yemen (37 per cent and 11 per cent) in 2013, and Azerbaijan (5 per cent and 36 per cent) in 2012. In Palestine, where Internet access was available in less than a third of schools, radios were universally available and televisions were present in 77 per cent of schools in 2012 (UIS, 2013).

In Jordan, the integration of radio and television for educational purposes (94 and 59 per cent, respectively) is decreasing given the discontinuation of radio broadcasts in 2009 and television broadcasts in 2002. Broadcasts have been replaced by an ad hoc approach using existing hardware in schools for instruction. For example, radios/recorders are used for English language and Islamic education, while televisions continue to be used to view educational video tapes (Ministry of Education, 2013a). Similarly, policies shifting away from the use of conventional radio in Oman resulted in a decrease in the proportion of schools with a radio from about 100 per cent in 2008 to 55 per cent in 2013, while the use of televisions decreased from 100 per cent to 80 per cent.

Similar patterns are evident in Eastern Asia. For instance, radio(s) and television(s) for educational purposes are decreasing in Thailand, having been available in 72 per cent and 100 per cent (respectively) of schools in 2008 compared to 29 and 30 per cent (respectively) in 2012. Radio access also decreased in Malaysian schools from 100 per cent in 2008 to 27 per cent in 2011, while television access remained universal (100 per cent).

In Africa, basic electrical infrastructure lags behind most other regions, strengthening the rationale for extending the use of conventional ICTs, particularly radio. However, while few data are available in Africa, evidence suggests that significant disparities exist. For example, as far back as 2008/2009, schools in Botswana and Mauritius had high proportions of radio(s) – 77 per cent and 93 per cent, respectively – while most schools also had television(s) – 100 per cent and 97 per cent. In contrast, just 58 per cent and 23 per cent of schools in Lesotho had radio(s) and television(s) for educational purposes, respectively, in 2009. Moreover, despite its role in filling gaps in connecting schools to ICTs, only one third of schools (35 per cent) in Ethiopia had television(s) for educational purposes in 2008.

Similarly, radio and television are also not prioritised in schools in Egypt, even though large populations live in rural areas, where radios could serve a useful function. Radios were available in 46 per cent of schools in 2010, while televisions were available in 64 per cent of schools. Television connection is often through the use of mobile technology equipped with transmission receivers to the Egyptian Satellite (Nile Sat) television broadcasts, which air educational programmes for children and general literacy programmes (UIS, 2013).

Finally, many countries in Europe no longer collect data on radios and televisions in school. However, for countries with available data, radios and televisions for educational purposes are generally provided in schools. They are available in all schools in Croatia, Finland, Sweden and the United Kingdom. In contrast, they are least available in Bosnia and Herzegovina, where 9 per cent and 75 per cent of schools had radio(s) and/or television(s) for educational purposes, respectively in 2008.

Chart 2.1: Schools with radio/television used for educational purposes, 2012 or LYA[8]

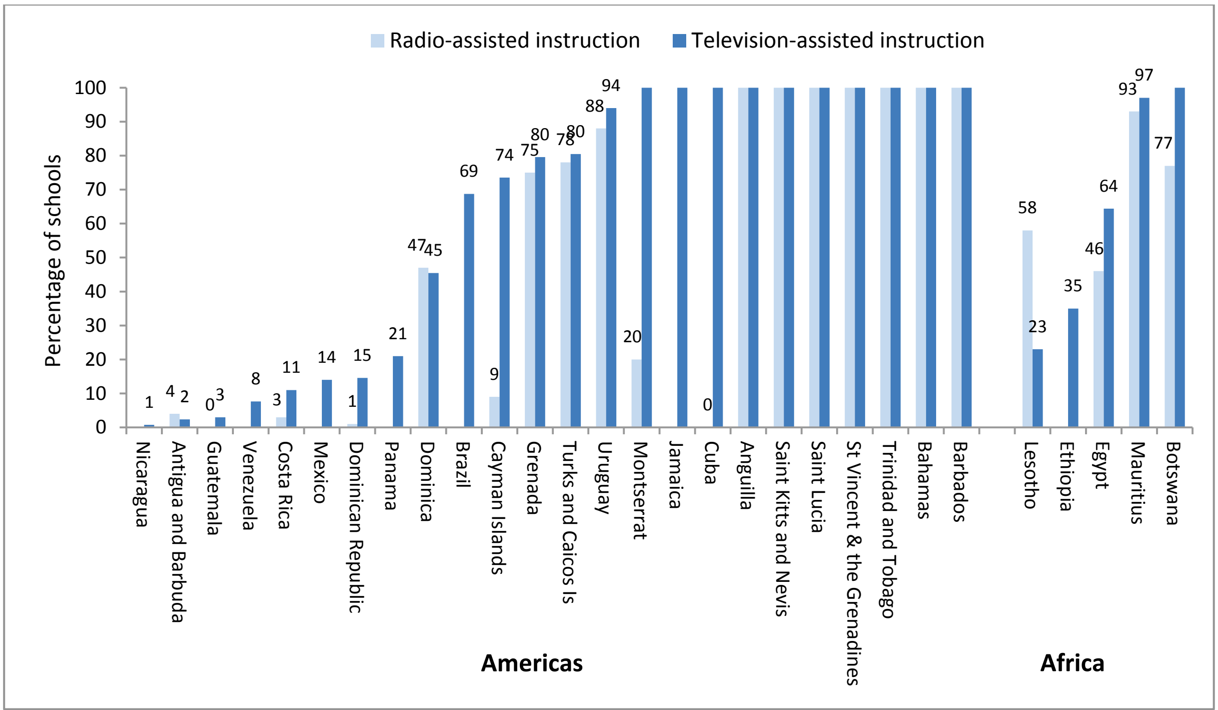
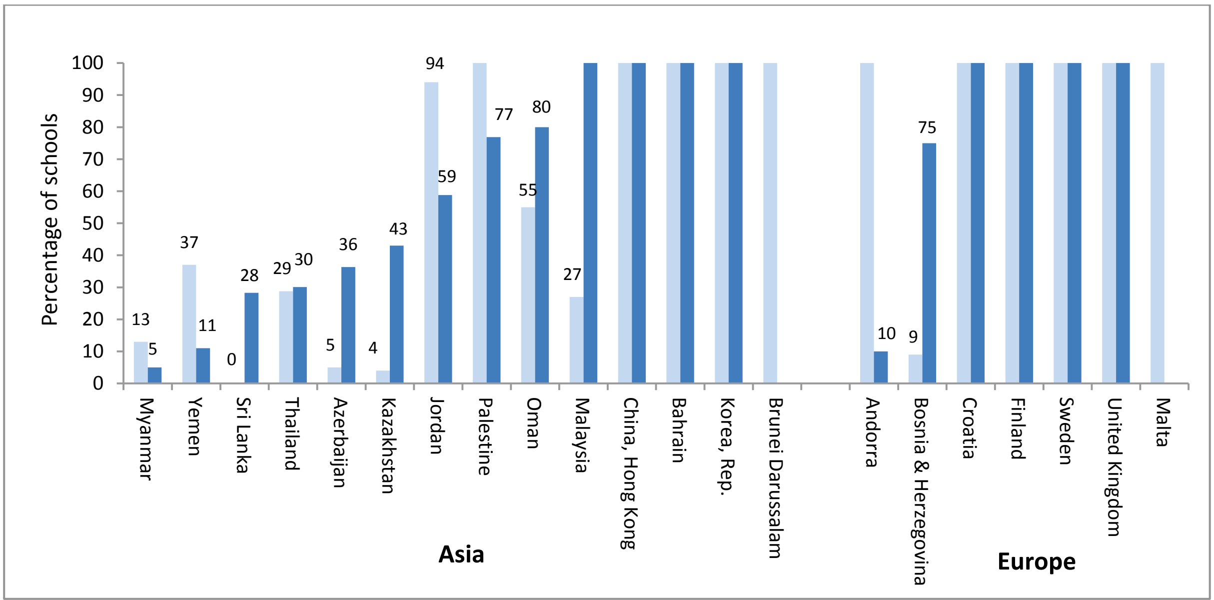


Chart 2.1: Schools with radio/television used for educational purposes, 2012 or LYA (cont.)



Source: UIS database, Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013 (*Partnership*, 2013).

Notes:

1. Reference years range from 2008 to 2013 (2008 to 2012 for the Americas, 2008 to 2010 for Africa, 2008 to 2013 for Asia and 2008 to 2009 for Europe). Full details can be found on the UIS website, http://www.uis.unesco.org/Communication/Documents/wsis-tables-2014.pdf.
2. Data on televisions in Mexico refer to primary and lower secondary education, in Panama to lower secondary education, and in Dominican Republic and Jamaica to upper secondary. Data on radios for Myanmar refer to secondary only. Data for Nicaragua refer to primary and lower secondary only. Data for Uruguay refer to primary education only. Data on televisions for Antigua and Barbuda, Barbados, Costa Rica, Dominican Republic, Mexico, Uruguay and Venezuela, reflect public schools only. Data on radios for Thailand and China, Hong Kong refer to public schools. Data for Azerbaijan, Bahamas, Jamaica, Malaysia and Nicaragua refer to public schools only. Data on radios for Dominican Republic refer to private schools only. Data for Palestine refer to West Bank schools only.

Learners-to-computer ratio

In order to provide advanced forms of ICT-assisted instruction, including computer-assisted instruction (CAI) and Internet-assisted instruction (IAI)[9] (see Target 7), ICT resources must be available and able to keep pace with demand and technological evolution.

Depending on the measurement objective, Indicator 2.3, 'learners-to-computer ratio' (LCR), measures access in two different ways. The most basic method refers to the mean number of learners sharing a single computer available for educational use. It is calculated by dividing the total number of learners in a country by the total number of computers available for educational purposes in all primary and secondary schools. A high value for this ratio depicts a situation where, on average, there are many learners nationally for each available computer. However, the national aggregate level LCR is rather a gross measure of computer use for educational purposes, as CAI might not be available in all schools in a given country. In order to shed light on access for pupils enrolled in schools that actually offer CAI, UIS also calculates the complementary indicator, 'learners-to-computer ratio in schools with CAI'. A high value for this indicator suggests that not only is there strain on computer resources across the entire education system, but more specifically that this strain also exists in schools equipped with computers. In many developing countries, such as India, where computers may be shared with the general community, available resources are even more strained, unless scheduling is established to prioritise pupils (Department of School Education and Literacy Ministry of Human Resource Development, 2012).

In the absence of an international target or national norms, a ratio of one learner to one computer may seem to suggest that computer provision is adequate. However, since countries vary in their curricula and levels of financial resources, the sharing of school-owned computers might reflect pedagogical as well as cost-efficiency decisions (see Box 2.3). It is noteworthy that in many countries not all educational levels nor curricular subjects require the support of computers in all classes. Additionally, this indicator should be analysed in the context of parallel use of other, non-computer ICTs in schools – especially radio and television.

Where national standards exist, an aggregate LCR 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 learners across the country. In contrast, a LCR lower than the norm suggests that additional resources might be reallocated to schools where resources are scarce. By frequently updating this indicator, countries can monitor the LCR and ensure that all schools meet the required standard.

The LCR is an aggregate measure of the digital divide, irrespective of the type of school. Chart 2.2 shows the highly variable LCR values across regions and countries. In countries where the basic LCR is greater than 100:1, computer resources are greatly overstretched. This is the case for a number of countries from all regions except Europe. In Latin America and the Caribbean, 122 pupils on average shared a computer in the Dominican Republic in 2010, while in Asia, there has been a considerable lack of computers in Yemen, Indonesia and Philippines, where national level LCRs were 376:1, 136:1 and 128:1, respectively, in 2012. The lack of computers is even greater in Nepal and Cambodia, where nationally at least 500 primary and secondary pupils share a computer.[10] Computer resources are also greatly overstretched in Africa. For example, approximately 500 pupils or more shared a computer in Niger and Principe and Zambia in 2013, while in Ghana and Morocco, national LCRs were 117:1 in 2009 and 174:1 in 2008, respectively. In Sao Tome and Principe, computers at the primary level are only used for administrative purposes, resulting in a secondary level LCR of 158:1 in 2013.

Where enrolment data in programmes offering CAI are available, the calculation of the 'learner-to-computer ratio in schools with computer-assisted instruction' (LCR in schools with CAI) sheds light on how computer resources are distributed amongst schools that have computers for educational purposes. Generally, the larger the difference between the LCR and the LCR in schools with CAI, the smaller the proportion of pupils nationally that have access to computers for learning. Chart 2.2 shows that while computer resources may be strained at the national level in many countries, the LCRs in schools with CAI in the same countries reveal a distribution pattern that is more conducive to learning. For example, while 33 pupils shared one computer on average in Iran (Islamic Republic of) in 2012, there were just 11 pupils on average sharing a computer in schools with CAI. Similarly, in Latin America and the Caribbean, there were 75 pupils, on average, sharing a single computer in Paraguay in 2010, compared to 22 in the schools with CAI.

In some countries, not only are computers strained nationally, but they are also strained in the schools where they are available. In Asia, 128 and 98 pupils shared a computer at the national level in the Philippines in 2012 and in Sri Lanka in 2011, respectively, compared to 69 and 55 in schools with CAI.

Box 2.3. Implementing 1:1 computing through low cost laptops and tablets – costs versus benefits

Few, if any, national ICT in education policies provide a rationale for specified learners-to-computer ratios (LCRs), nor do they suggest how these ratios relate to achievement in curriculum outcomes, student performance, skills development, classroom methodologies or levels of usage. Given the apparent lack of any informed policy rationale, there is indeed a strong feeling that a clearer vision is required (Camfield *et al*., 2007).

Nonetheless, one-to-one computing, which is being introduced in several countries has demonstrated itself as an effective ICT model to decrease LCRs. The two most common initiatives include *One Laptop Per Child* (OLPC), which manufactures the XO laptop computer specifically designed for children in developing countries, and the similar INTEL Classmate PC laptop computer. The advantage of these laptops is their low cost, durability and low energy requirements – they use significantly less electricity than standard laptops.

One-to-one computing has been most prevalent in Latin America and the Caribbean, with some of the largest deployments of XO computers in Uruguay (510 000 laptops) and Peru (860 000 laptops) (OLPC, 2014), and Classmate computers in Argentina (projected 3 million laptops) and Venezuela (almost 2 million laptops since 2009) (Reardon, 2010; Robertson, 2012).

One-to-one computing is also seen in Asia. For example, Thailand adopted the *One Tablet per Child* (OTPC) scheme, distributing one device per child in grade 1, beginning in 2012. Given that each year, every new grade 1 cohort is given a tablet, all primary pupils will have their own tablet by approximately 2018. In 2014, this scheme will also be extended to cover secondary grade 7 pupils to achieve one-to-one computing in secondary education (Ministry of Education, 2013b). Turkey, under its Fatih national programme, is introducing tablets across its educational system (Fatih, 2014). Meanwhile, smaller OLPC deployments are also occurring in Nepal (6 000 laptops) and Mongolia (14 500 laptops) (OLPC, 2014). In Africa, Rwanda has deployed 110 000 laptops nationally.

The financial implications of one-to-one computing are potentially significant, particularly for many developing countries. In some cases, the cost could have a considerable impact on other areas of education provision, especially in countries where more classrooms and teachers are urgently needed. For example, India opted not to expand their one-to-one computing project beyond a pilot phase because of such considerations (Kraemer *et al*., 2009).

In addition to financial barriers, operational challenges also exist. Teachers need to be trained to use computers and servicing and maintenance facilities for the laptops need to be made available. In the programme conducted in Uruguay (El Ceibal), repairs have been the responsibility of the family, which has led to complaints that poorer families are at a disadvantage, thus contradicting the notion that the laptops help to eliminate the domestic digital divide (OLPC News, 2010).

The impacts of one-to-one computing in developed countries are mixed. In the United States, one-to-one laptop projects in primary schools did not lead to measurable improvements in reading or writing skills – but nor did they harm them (Camfield, 2007). Results such as this can be interpreted in two ways – either technology does not improve learning, or standardized tests failed to measure the skills learned using technology. The study did find that laptop programmes improved students' abilities to deal with information and to collaborate. More recently, a report on one-to-one learning initiatives in 19 countries in Europe carried out by European Schoolnet (EUN), on behalf of the Institute for Prospective Technological Studies (JRC-IPTS), provided preliminary evidence of a variety of impacts that ICT may have in education. In addition to enhancing learning outcomes, ICT might beneficially affect students' motivation, foster student-centred learning behaviours, diversify teaching and learning practices, and improve parents' attitudes (Balanskat *et al*., 2013).

However, less is known about the effects of the OLPC and other similar initiatives in developing countries. In Peru, which has the largest deployment of XO computers globally, the expansion in access translated into substantial increases in computer use both at school and at home. While there was no evidence of positive impacts on enrolment or test scores in mathematics and languages, some positive effects were found in general cognitive skills (Cristia *et al*., 2012).

Source: UIS research.

LCRs are relatively low in most developed countries for which data are available. In Europe, for example, most countries have a LCR of 10:1 or less. LCRs are lowest in Sweden (2:1), with Denmark, Estonia, Norway and Spain at 3:1. In contrast, LCRs were relatively high in some Eastern European countries, including Albania, and Bosnia and Herzegovina where the LCRs were 32:1 in 2009 and 30:1 in 2008, respectively.

A number of developing countries have been very effective in reducing LCRs across their educational systems. For instance Uruguay's *El Ceibal* initiative, which partners with the *One Laptop per Child* (OLPC) project, has acquired low cost highly durable XO computers and is a pioneering country in achieving one-to-one computing (a LCR of 1:1). In Asia, Thailand is also in the process of implementing its *One Tablet per Child initiative* (OTPC), and as a result the LCR decreased from 25:1 in 2008 to 14:1 in 2012 (Thailand, 2013).

Even though not participating in one of the well-known one-to-one computing initiatives, Colombia and Georgia have made substantial progress in building their educational computer resources by obtaining financial support from different levels of government, local communities and businesses. For example, between 2002 and 2013, the LCR in Colombia decreased from 142:1 to 13:1 (see Box 2.4), while in Georgia it decreased from more than 200:1 in 2004 to 7:1 in 2012 (see Box 2.5). Finally, while the Dominican Republic also reduced its LCR in primary and secondary schools from 179:1 in 2008 to 122:1 by 2010, the average number of pupils sharing a single device remained high (UIS, 2012).

Chart 2.2: Learner-to-computer ratios, national aggregate/schools with CAI, 2012 or LYA[8]

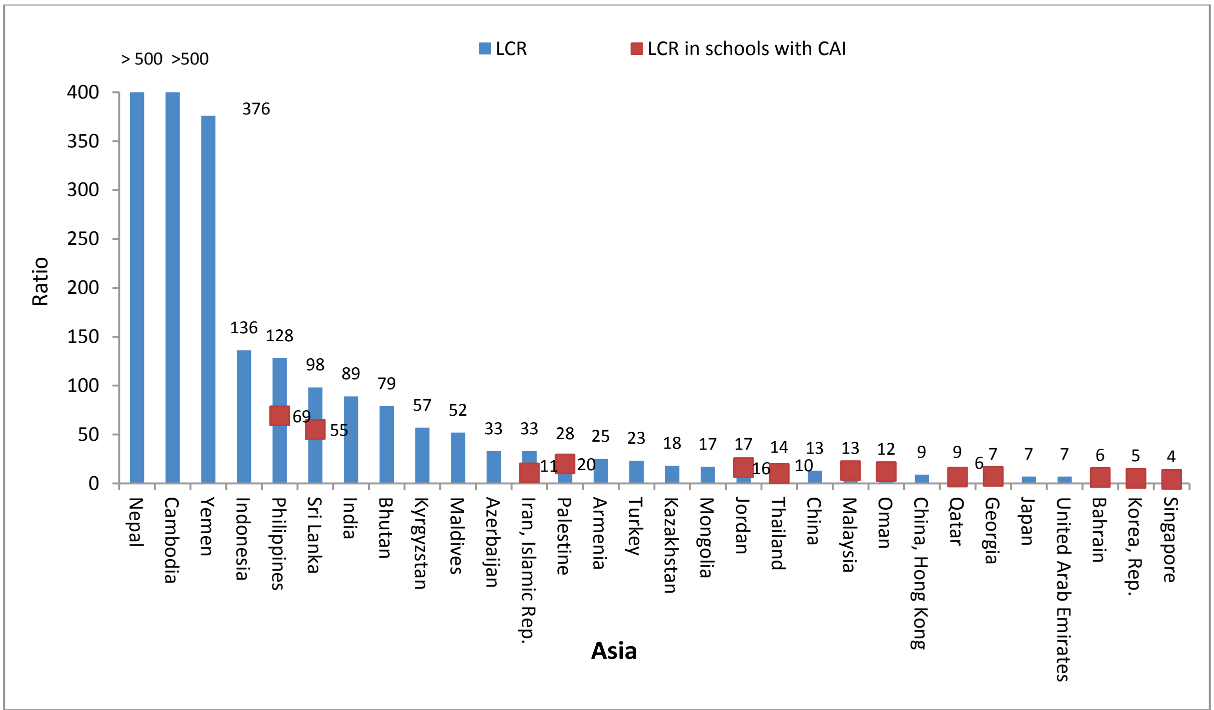
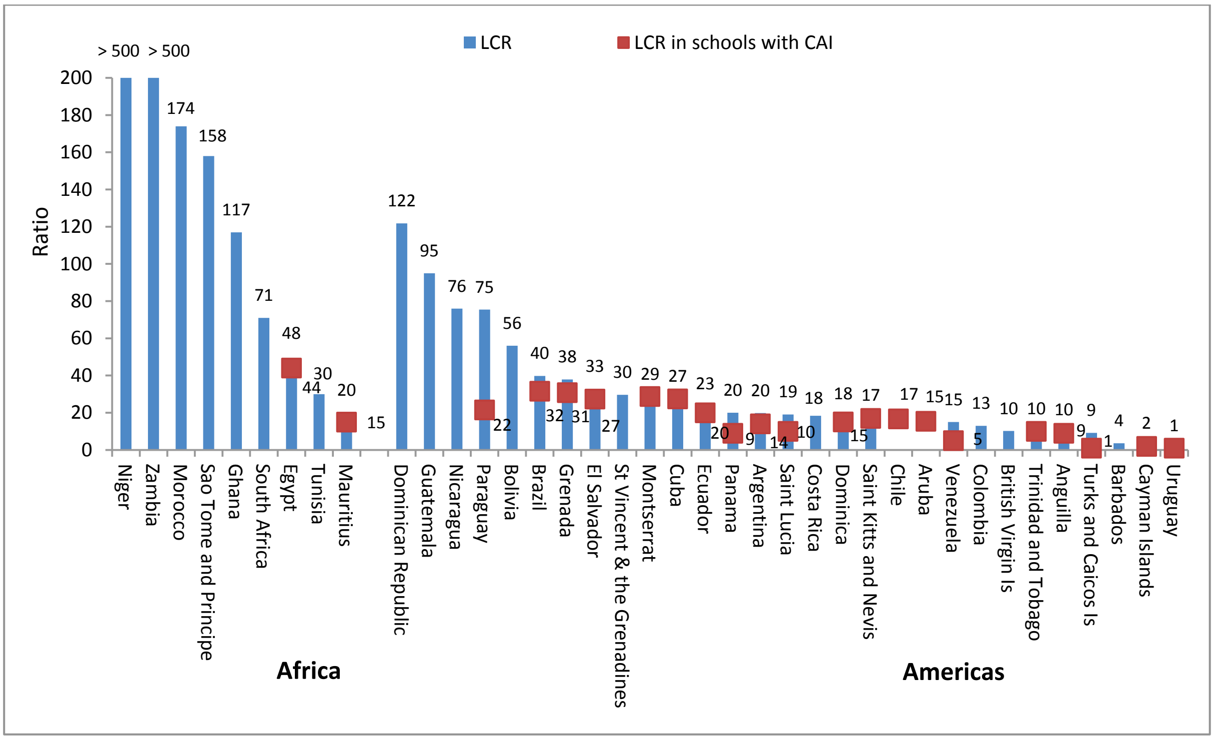
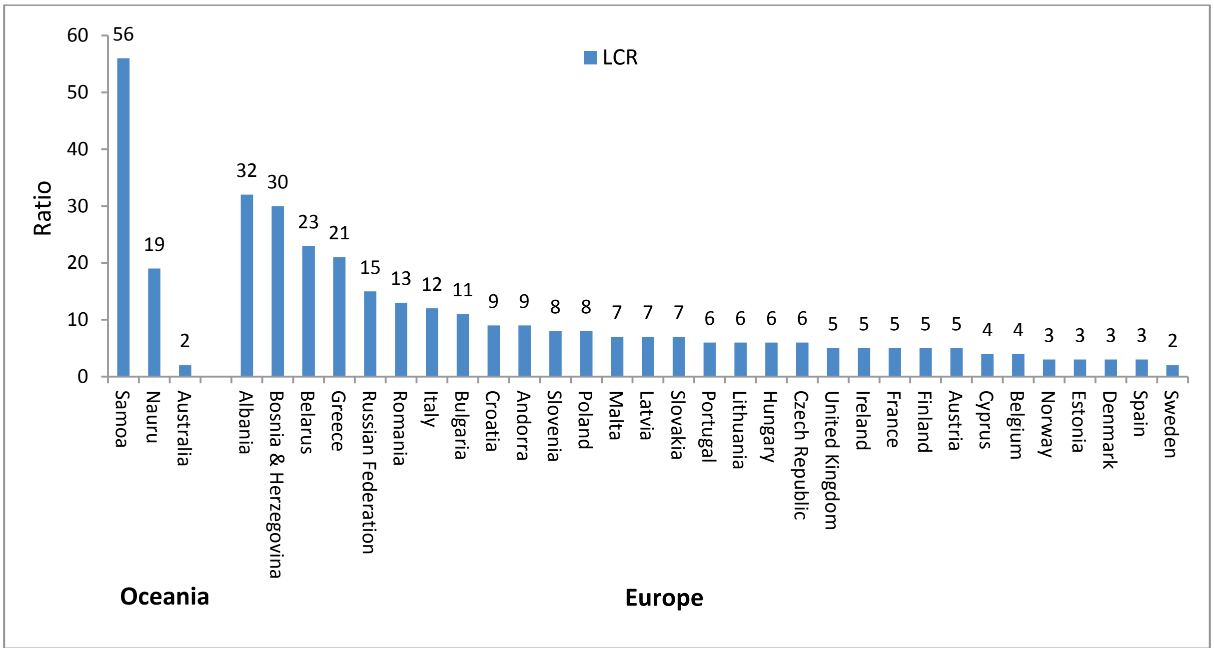


Chart 2.2: Learner-to-computer ratios, national aggregate/schools with CAI, or LYA (cont.)





Source: UIS database, Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Notes:

1. Reference years range from 2007 to 2013 (2009 to 2013 for the Americas; 2008 to 2013 for Africa, Asia and Europe; and 2007 to 2012 for Oceania). Full details can be found on the UIS website, http://www.uis.unesco.org/Communication/Documents/wsis-tables-2014.pdf.
2. Data for Cambodia refer to secondary schools only. Secondary data for Nicaragua, China and Philippines do not include upper secondary. Data for Saint Lucia and Uruguay refer to primary schools only. Data for European countries refer to lower secondary. Data for India do not include independent secondary schools. Data for Morocco, Tunisia, Dominican Republic, Guatemala, Nicaragua, Montserrat, Saint Lucia, Trinidad and Tobago, Anguilla, Philippines, Sri Lanka, Kazakhstan, Malaysia, Qatar, Japan, Singapore, Belarus and Russian Federation refer to public schools. Data for Palestine refer to West Bank schools only.

Box 2.4: Progress towards increasing access to ICT in Colombia

In Colombia, ICT has amplified educational opportunities by:

- engendering new approaches to teaching and learning (Piscitelli, 2012)
- contributing to increasing student retention
- improving learning outcomes and the pursuit of higher education (Rodriguez *et al*., 2011)
- allowing the acquisition of technological skills needed in the information society (Ananiadou and Claro, 2009)
- facilitating the inclusion of ethnic minority groups, people with disabilities and students of low academic achievement (Castellanos, 2012)
- opening doors to tertiary education, free of charge, to anyone connected to the Internet.

Acknowledging current challenges, the ICT Ministry of Colombia since 2000 has endorsed the *Computers for Education*, or *Computadores para Educar* programme (CPE), which comprises an association of public entities that helps realise development opportunities for children and youth by improving the quality of education through ICT. As the main state mechanism for bringing technology to educational institutions, CPE contributes to lowering the national LCR. In 2002, the programme supplied schools with approximately 11 000 units of computer equipment resulting in a ratio of 142:1. Having secured a supply of 70 000 computers for educational institutions four years later, the ratio decreased to 46:1 in 2006. Most recently, with total computer assets totalling 760 000 in 2013, a ratio of 13:1 has been achieved.

CPE is innovative in its approach to computer provision, taking into account trends towards mobility and versatility, the needs of students and school budgets. For example, desktop computers provided in 2002 were upgraded in 2006, while more recent computer deployments introduced laptops in 2009 and tablets in 2012.

Nevertheless, the implementation of CPE has met a number of challenges, including lacks in adequate financial resources to safely store equipment, poor electricity supply, and minimal teacher training on how to use ICT in the classroom. In order to deal with these challenges and ensure successful implementation of CPE, Colombia has:

- involved local communities, businesses and government to increase funding
- negotiated greater electrical supply from power plants and sought donations for solar panels
- negotiated flexible teaching schedules with educational administrators to allow teachers to meet the 150 hours of required training.

While results are preliminary, an internal impact assessment of the programme showed that dropout rates decreased by 4 per cent. There was also a 2 per cent improvement in the national examination, and a 5 per cent increased probability of pursuing higher education.

Source: Ministry of Information Technologies and Communications, 2014.

Box 2.5: Georgia improves access to digital technology – the Deer Leap programme

To counter a lack of ICT resources and Internet connectivity in schools, Georgia's Ministry of Education and Science launched an ambitious national programme in 2005, known as *Deer Leap*, for integrating ICT into teaching and learning in schools. The project had several aims including:

- providing every school with computers, Internet access, educational software and ICT support services
- upgrading the ICT skills of teachers and students
- integrating ICT into the curriculum through computer-assisted instruction in a wide range of subjects
- computerization of the Education Management Information System (EMIS) at school, local and national levels.

With Estonia's assistance, the programme was provided with a total budget of just over USD 14 million (GRID, 2014).

The four-year program (2005–2009) was modelled on the Estonian *Tiger Leap* programme and was managed by a board consisting of representatives of government, Parliament, civil society, business associations, university academics and teachers. The task of the programme was especially challenging, given that in 2004 before the program started, the LCR in schools was over 200:1 and Internet connections in schools were rare (as well as slow and costly). While Internet Informatics was a compulsory subject in all secondary schools, the content of this subject – which was programming – was frequently taught without computers. Moreover, ICT was rarely used in other subjects or in school management.

By the end of 2008, the Deer Leap programme had resulted in increased ICT infrastructure in schools, including more than 26 520 new computers. The LCR had decreased from 250:1 in 2004 to 22:1. All computers were equipped with the Linux operating system and a set of open-source software applications. Internet connectivity was provided to more than 300 schools, so that 60 per cent of all primary and secondary pupils could have access to Internet at school. A web-based collaboration environment for educational projects was also developed and integrated with a portal to support authoring and sharing learning objects, including participation in international projects and collaborative learning between Georgian and Estonian schools. Finally, administrative support in the form of IT managers hired in most schools and the training of teachers, helped to support the ongoing modernization and computerization of the Georgian education system.

The goal of integrating at least one computer in each school by 2008 was not achieved. However, Georgia reaffirmed its commitment through the *Georgia without Poverty Programme* (2008–2012) and pledged to modernize all public schools and implement the *Deer Leap* programme successfully. By 2012, Georgia had met its target of having at least one computer in all schools, with a LCR for combined primary and secondary schools of 7:1. Internet connectivity was also installed in all Georgian schools, one third (29 per cent) of which had a fixed broadband connection by 2012.

Source: UIS research.

Proportion of schools with Internet access

The proportion of schools with Internet access is measured by Indicator 2.4. It is central to understanding connectivity at the primary and secondary level – and hence to assessing Target 2. The indicator measures the overall level of access to Internet in schools, not the intensity of use nor the actual amount of time that learners spend on the Internet for educational purposes. Access may be through any wired or wireless device (PCs, laptops, PDAs, tablets, smartphones etc.) using fixed broadband, fixed narrowband or mobile broadband connections. Private Internet connectivity within schools via mobile phone networks is excluded.

At the most basic level, electrification is a key concern for countries where many schools may not be connected to a reliable source. However, even where there is an electricity supply, ministries of education in some countries often have little or no control over Internet connectivity in schools, which depends on the national telecommunications infrastructure (World Bank, 2010). In some countries, Internet service providers (ISPs) are unwilling to operate in difficult geographic terrain or in rural areas with low population density (ADB, 2012).

Given the vital importance of broadband access, connectivity is also measured according to the type of Internet connection. 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 educational purposes.[11]

Fixed broadband Internet refers to high-speed connectivity for public use of at least 256 Kbit/s in one or both directions (downloading and uploading). It includes cable modem Internet connections, DSL Internet connections of at least 256 Kbit/s, fibre and other fixed broadband technology connections (such as satellite broadband Internet, Ethernet LANs, fixed-wireless access, Wireless Local Area Network and WiMAX).[12]

Recognizing the importance of broadband Internet to effectively access online resources, the Broadband Commission for Digital Development, whose membership includes UNESCO, ITU and private industry, recently adopted the goal of *Broadband for All*, particularly for women, girls and marginalized groups. By defining practical ways in which countries, at all stages of development, can achieve broadband connectivity in cooperation with the private sector, the Broadband Commission for Digital Development promotes the importance of universal broadband on the international policy agenda to accelerate progress towards achieving the MDGs by 2015 (Broadband Commission for Digital Development, 2013).

Information on the type of Internet access can inform policies and decisions to expand and/or upgrade Internet connections in schools. Data to monitor the availability of general Internet and fixed broadband access in schools exist for a reasonable number of developed and developing countries. Chart 2.3 shows that, by 2012, the vast majority of schools in developed countries were connected to the Internet. In fact, many developed countries had stopped tracking some aspects of ICT infrastructure in schools, because connectivity (usually fixed broadband) was approaching 100 per cent. For instance, according to a report released by the European Union in 2006, the vast majority of schools in Europe already had Internet access. Similarly, all public schools in the United States were connected to the Internet as of 2006 and 97 per cent had a broadband connection, while in Canada, 97 per cent of schools were connected to the Internet as early as 2004.

Chart 2.3 demonstrates that in the majority of European countries with data (that is, in 20 out of 23 countries), more than 95 per cent of schools have an Internet connection. In contrast, 81 per cent of schools in Poland had Internet in 2012, while the Russian Federation and Belarus had 80 per cent and 61 per cent of schools, respectively, with Internet connectivity in 2008. According to Chart 2.3, fixed broadband was already universally available in Andorra, Croatia, Czech Republic, Malta and the United Kingdom in 2009, and in Sweden and Bosnia and Herzegovina in 2008. In contrast, it was available in about two thirds of schools in Slovakia (66 per cent) in 2009, less than half of schools in the Russian Federation (43 per cent) and only 7 per cent of schools in Belarus in 2008.

By comparison, the proportion of schools with Internet connectivity is relatively low in most countries in Latin America and the Caribbean. In fact, the proportion of schools with Internet connectivity was less than 15 per cent in a number of South and Central American countries, including Dominican Republic (12 per cent) in 2013, Guyana (4 per cent), Nicaragua (6 per cent) and Paraguay (9 per cent) in 2010 and Suriname (6 per cent) in 2009. Some countries that had low levels of school connectivity appear to be 'leapfrogging' directly to broadband Internet connectivity and bypassing the use of narrowband. For example, in Nicaragua and El Salvador where approximately 6 per cent and 24 per cent of schools had Internet connections, respectively, all were via fixed broadband.

There is an advanced state of Internet connectivity in a number of Caribbean island countries where 100 per cent of schools in Anguilla, Aruba, Barbados, British Virgin Islands, Saint Kitts and Nevis, Saint Lucia and Sint Maarten were connected to the Internet by 2010 – all using fixed broadband. Opposing the trend, Saint Vincent and the Grenadines demonstrates the coexistence of broadband and other types of Internet connection. For example, of the 68 per cent of schools with Internet, half (34 per cent) had fixed broadband.

Fixed broadband connectivity in schools presents a challenge for several large South American countries, with a substantial urban-rural divide. Brazil and Argentina, for example, show that both fixed broadband and other types of connectivity coexist. For example, while 46 per cent and 36 per cent of schools were connected to the Internet in Brazil and Argentina, respectively in 2010, 38 per cent and 22 per cent were connected via fixed broadband. Bandwidth constraint is particularly challenging in Colombia where only 8 per cent of a total of 71 per cent of connected schools had a broadband connection in 2011.

Uruguay, on the other hand, with its ambitious country driven *El Ceibal* project, provides an example of a middle income country that has been able to achieve a relatively high level of connectivity in schools. By 2009, it was able to provide fixed broadband to 96 per cent of schools, including both urban and rural subregions. Yet, while Uruguay demonstrates substantial progress, central authorities have reported that for 70 per cent of primary schools, school Internet connections were such that only half of all laptop computers could be online at the same time. Meanwhile, Chile's *Enlaces* initiative, which partners with the private sector, has also been very effective in improving connectivity rates among schools. The result is that 78 per cent of schools were connected to the Internet in 2013, compared to just 44 per cent in 2009 (see Box 2.6).

A number of economies in Eastern Asia and South Eastern Asia display high levels of school connectivity, with all or most schools having fixed broadband Internet access in Brunei Darussalam; China, Hong Kong; the Republic of Korea; Singapore and Thailand. Other Asian countries with high levels of Internet connectivity included Kazakhstan (97 per cent) in Central Asia, and Armenia, Georgia and Bahrain in Western Asia (100 per cent) in 2012. While fixed broadband Internet was universal in Bahrain, about one third (29 per cent) and half (50 per cent) of all schools in Georgia and Kazakhstan, respectively, were connected via fixed broadband. Having invested heavily in e-materials, there is an ongoing recognition in Kazakhstan of a lack of efficiency resulting from problems in bandwidth, particularly in rural areas (ADB, 2012). Oman provides an example of a country that has shown significant progress in connecting its schools to the Internet, increasing from 62 per cent in 2008 to 90 per cent in 2013.

Mongolia, a country with one of the lowest population densities in Asia, has also made considerable efforts and has connected 91 per cent of its primary and secondary schools to the Internet – with 40 per cent having a fixed broadband connection in 2012. In addition to school connections, Mongolia also provides Internet access to pupils through fixed and mobile community centres (ADB, 2012). Yet despite this positive trend, some schools in Mongolia have terminated Internet access voluntarily due to high costs. To resolve this situation, Mongolia's Ministry of Education, Culture and Science has attempted to meet schools' Internet costs from central budget funds to ensure continued connectivity.

Internet connectivity in schools has been particularly scarce in a number of developing countries across Asia. In 2011, it was available in less than 10 per cent of schools in Nepal (5 per cent); while in 2012, Internet connectivity was also scarce in Kyrgyzstan (6 per cent), Cambodia (7 per cent), and in Bangladesh (5 per cent). Unfortunately, data on Internet connectivity in schools are lacking for India and China, the two most populated nations in Asia.

Internet data are unavailable for most countries in Oceania. In Australia, where almost all schools had achieved full Internet connectivity by 2003 and 97 per cent had fixed broadband by 2010, the National Broadband Network is building a national fibre-optic data network that will connect 90 per cent of schools with speeds up to 100 Mbit/s.[13]

Data on Internet connectivity are also reasonably scarce in Africa and the data that do exist suggest that there is much room for improvement. For example, 10 per cent or fewer schools were connected in Ethiopia (2 per cent), Morocco (3 per cent) and Senegal (5 per cent) in 2008, Lesotho (10 per cent) in 2009, and Sudan (4 per cent) in 2013. In contrast, the proportion rises to 81 per cent and 85 per cent of schools in Tunisia and Mauritius, respectively, in 2008. Data on fixed broadband Internet for Africa are scarce; Chart 2.3 shows that 2 per cent of schools were connected via fixed broadband in Morocco in 2008, compared to 75 per cent of schools in Mauritius. In Botswana, where about one quarter of schools had an Internet connection (23 per cent) by 2009, all connections were via fixed broadband.

Chart 2.3: Schools with total and fixed broadband Internet, 2012 or LYA[8]

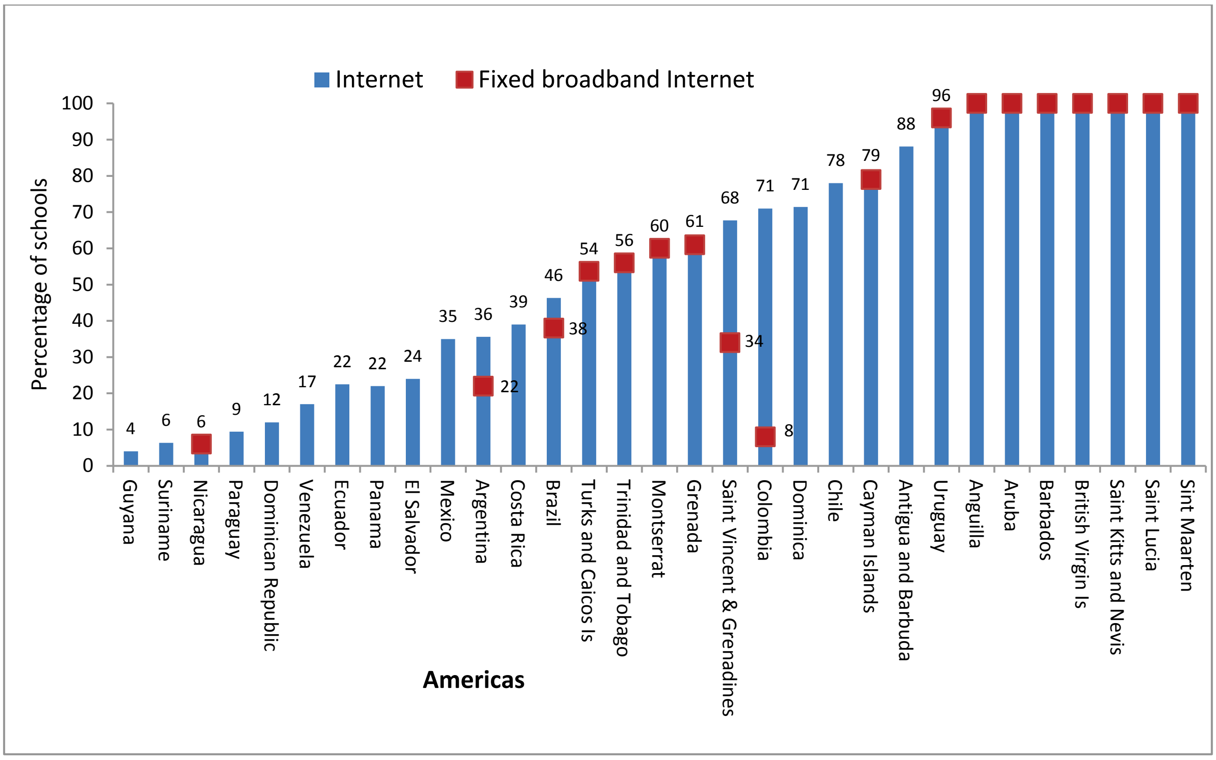
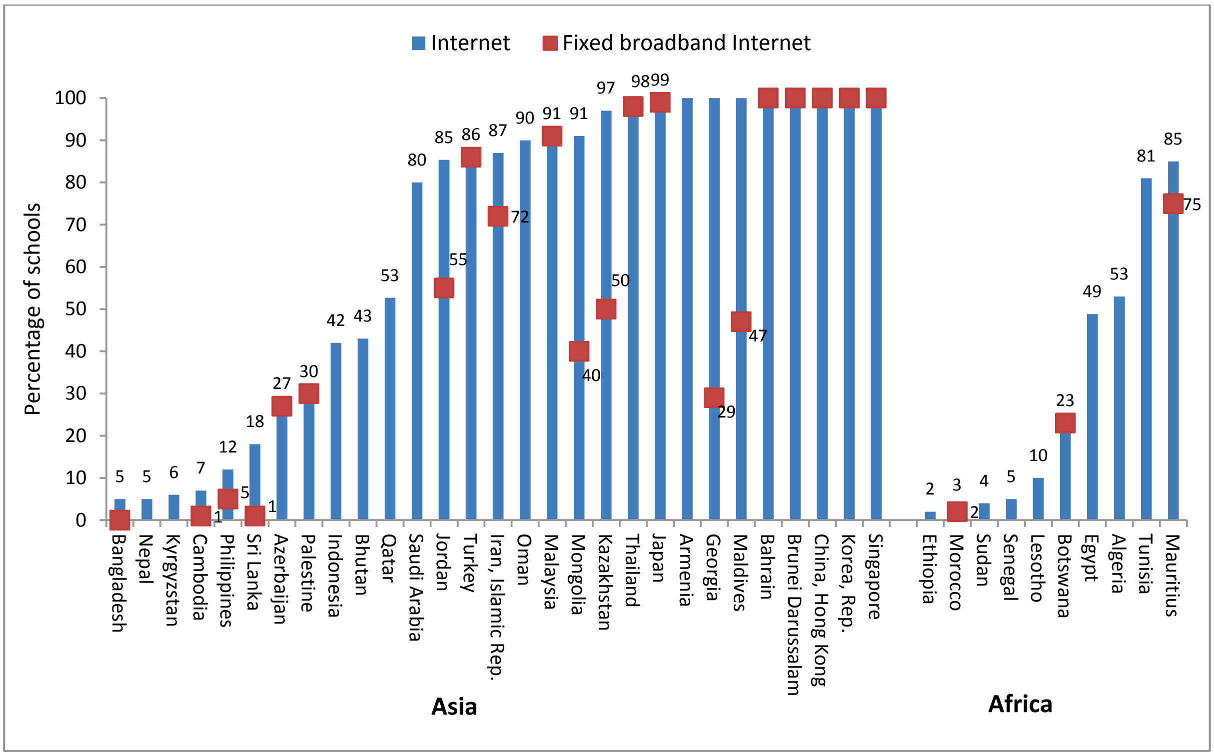
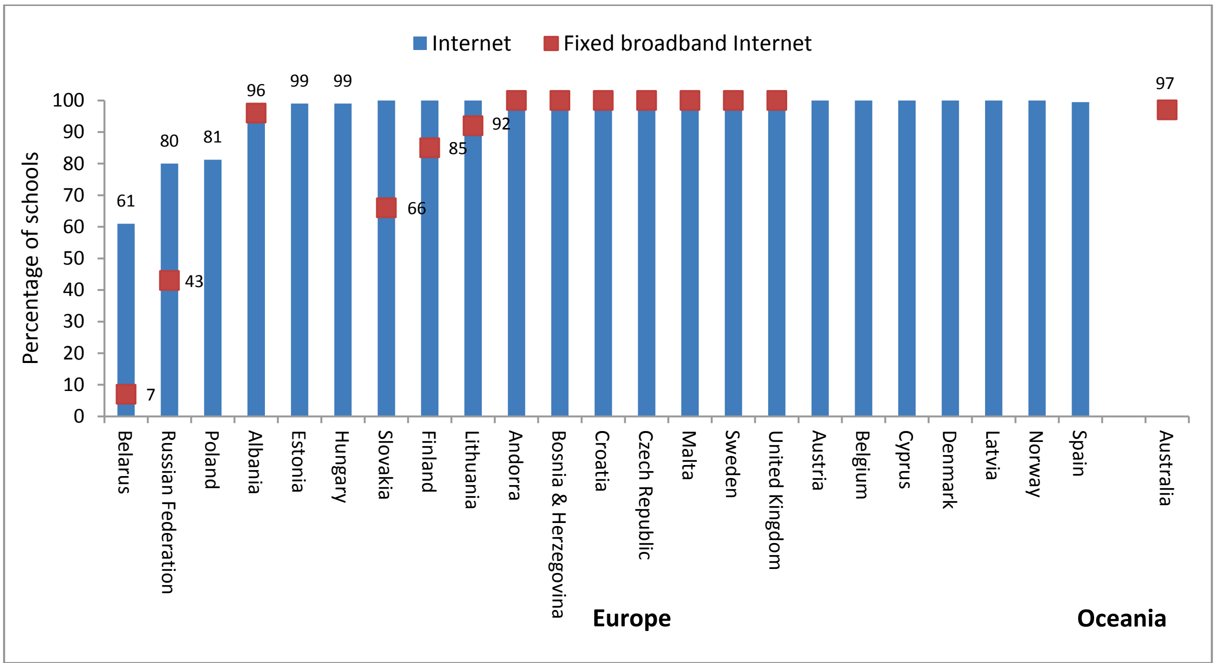


Chart 2.3: Schools with total and fixed broadband Internet, 2012 or LYA (cont.)





Source: UIS database, Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Notes:

1. Reference years range from 2008 to 2013 (2009 to 2013 for the Americas; 2008 to 2013 for Africa, Asia and Europe; and 2010 for Australia). Full details can be found on the UIS website, http://www.uis.unesco.org/Communication/Documents/wsis-tables-2014.pdf.
2. Data for Nicaragua, Philippines and Indonesia do not include upper secondary. Data for Jamaica refer to upper secondary only. Data for Costa Rica and Mexico refer to lower secondary. Data for Guyana, Nicaragua and Indonesia refer to primary and lower secondary. Data for Cambodia include pre-primary schools. Data for Anguilla, Barbados, Chile, Colombia, Dominican Republic, Guyana, Jamaica, Mexico, Montserrat, Nicaragua, Sint Maarten, Trinidad and Tobago, Azerbaijan, Bangladesh, Bhutan, Cambodia, Kazakhstan, Malaysia, Maldives, Morocco, Philippines, Sri Lanka, Singapore, Tunisia, Belarus and Russian Federation refer to public schools. Data for Palestine refer to West Bank schools only.

Box 2.6: Partnering to connect schools in Chile: The Enlaces initiative

In the early 1990s, Chile initiated educational reform of its primary and secondary system to adjust to the information society, by incorporating ICTs into schools. The initial vision for the reform was built around the construction of a National Educational Network, also known as *Enlaces*, through which teachers and students could develop professional and pedagogical communities.

Like many national ICT in education programmes, Enlaces began as a connectivity pilot project. However, unlike other programmes, Enlaces established strong links with universities from the outset to help ensure the inclusion of components that focus on teacher professional development and digital content. This contrasts with many other middle income countries where the focus was on the technology itself and the importance of maintaining a holistic perspective was not appreciated.

The education system in Chile is decentralized between public schools, which are managed by municipal governments, and private schools. Each sector is responsible for most of its own administrative and financing aspects. Enlaces only applies to municipal subsidized schools; however, the size of the private sector is large, accounting for 43 per cent of primary and secondary students.[14] With the support of Enlaces, Chile extended Internet connectivity to about three quarters (75 per cent) of primary and secondary schools under the Enlaces banner by 2009, resulting in a connection rate of approximately 55 per cent of all schools in Chile. However, since then, the proportion of schools (public and private) with an Internet connection increased to 70 per cent by 2012 and 78 per cent by 2013.

From the point of view of middle income countries, implementing a national connectivity initiative of this magnitude can be costly. A crucial step in the development of Enlaces was the agreement that the Ministry of Education negotiated with one of the largest telephone companies in the country – Telefonica CTC Chile. The company agreed to provide telephone lines, e-mail accounts and dialup Internet at no cost for a period of ten years to all the schools in the regions where the company had a telephone network (this covered the majority of the Chilean Schools). Moreover, a focus from an early stage was on connecting rural schools. For example, it was decided to begin the rural Enlaces component with a focus on the pedagogical use of technology inside the classroom – even if the schools did not yet have Internet access. In parallel, there was a task team designing a national solution for providing sustainable Internet access to all the rural schools – and communities – in the following years.

As part of its efforts to promote broadband connectivity, since 2004 Enlaces has attempted to reach agreements with multiple operators to offer preferential fees to educational facilities. Enlaces also established a fund through which schools could apply for a subsidy equal to 50–100 per cent of the broadband connection fee. More recently, Enlaces has worked with the Fondo de Desarrollo de Telecomunicaciones, the country's universal service fund, to roll out fibre optic cable to Chile's largest schools (Ministerio de Educación, 2008).

The success of the Enlaces pilot led to its formal acknowledgement as the national education technology programme for Chile. A decade later it was officially absorbed within the Ministry of Education. This evolution – from pilot to national programme to becoming part of the MOE – established a model that was realized later in many other middle income and developing countries.

Source: UIS research.

Conclusions and recommendations

Evidence suggests that in a number of countries progress is being made towards the achievement of Target 2. Yet, despite this, it is still not possible to provide a comprehensive review. For example, while data have been collected for an increasing number of countries since the launch of the UIS international data collection on ICT in education (that is, 118 countries by the year 2014), data are still missing for many developing countries, particularly in Asia, Africa and Oceania. Moreover, demonstrating progress is further complicated by a lack of time series data for the majority of countries, thus preventing reliable measurements of change over time. However, the situation should improve as the UIS is currently conducting statistical capacity-building activities in Africa, to be followed by data collections. More generally, the UIS is moving towards conducting a biennial global data collection on ICT in education beginning in 2015.

Setting targets and measuring progress in the area of ICTs in education involves a balancing act between identifying quantifiable information to monitor international goals and taking into account the diversity of circumstances among countries in terms of stage of development, infrastructure, income and socio-economic factors. The four indicators identified to monitor Target 2 attempt to reconcile these two conflicting aspects by monitoring both old and new technologies, which may be found to varying degrees in both developing and developed countries.

However, it is possible to draw some conclusions in respect of both developed and developing countries and regions, especially in terms of LCRs and Internet access in schools – the two indicators that are currently tracked by the greatest number of countries. Existing data on the LCR show that there are sizeable variations between countries, with relatively high levels of computer access in most developed and high-income economies and lower ratios in the developing world, particularly in low income countries. While in general it must be seen as advantageous to have more computers for fewer students, it is not clear what the ideal ratio might be. This will depend a lot on national circumstances and on how computers are used; it is suggested that more research be conducted in respect of this indicator.

Since time series data are scarce, interpreting change requires caution. Nevertheless, evidence shows that LCRs are generally decreasing across many countries, while school Internet rates are increasing – both generally and for fixed broadband specifically. However, change is not uniform and occurs at different rates in different countries. Typically, countries that have strong policies and set targets for ICT in education with high-level government and sector-wide support show the most rapid change. This is true for a number of countries including Colombia, Chile and especially Uruguay in Latin America, as well as for Oman, Jordan, Thailand and Georgia in Asia.

The data presented in this chapter also highlight that schools in developed countries, especially in Europe and in high income countries in East Asia and the Caribbean, are almost universally connected, typically to high-speed broadband networks, and have relatively low LCRs. While countries will differ on policy related to LCR targets, given the ubiquity of ICT in education in these countries, little further progress can be expected based on the current indicators.

At the opposite end of the continuum, while some progress has been made in a number of developing countries, LCRs frequently remain too high and school Internet connectivity rates too low to provide pupils with access to advanced forms of ICT in education. This is true of some countries in Latin America and the Caribbean, and especially so for many countries in Asia and Africa, where the minority of schools have Internet connections and where LCRs are too high to provide pupils with meaningful learning opportunities. Since LCRs can mask disparities between those schools with many computers, those with few, and those with none, it is difficult to shed light on the extent of disparity within countries.

Only relatively few countries collect data on the proportion of schools with older ICTs, namely radios and televisions. 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, or ad hoc use of radios and televisions, 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, or replaced by, Internet access in the long term. There is some evidence for a small number of countries that the use of radios and televisions for education is decreasing, while for others it is increasing. Given the enormous potential for radio and television in some of the world's least developed countries, monitoring these indicators in conjunction with the LCR and Internet connectivity is the most reasonable way forward.

As stated in the mid-term report (ITU, 2010), to make Target 2 as concrete and measurable as possible, it was suggested that the word "all" be included in order to seek to connect 100 per cent of schools to either old or to new ICTs (or both) depending on national circumstances. Given that universal connectivity remains elusive for many middle and low income countries, it is recommended that Target 2 retains its current form for the post-2015 monitoring period.

Based on current analysis, and considering the rapidly evolving ICT landscape, some additional indicators may be important for effectively monitoring Target 2 during the post-2015 agenda. The 'Learner-to-computer ratio in schools with computer-assisted instruction', which is also a core *Partnership* ICT in education indicator, would shed additional light on the actual level of computer access available in schools and would be particularly useful for developing countries, where many schools do not yet have computers and other similar devices.

Additionally, the 'Learner-to-computer connected to the Internet ratio' (LCCIR), would provide additional information on the degree of school connectivity by shedding light on capacity to interface with the Internet and the multitude of educational resources available online. Previous analysis has indicated that while countries may have some success in building a computer infrastructure, connecting schools to the Internet may lag behind. While these data have been somewhat more challenging to obtain, particularly in developing countries, the LCCIR would nevertheless shed additional light on the relative connectivity of schools since indicators 2.3 (LCR) and 2.4 (proportion of schools with Internet access) do not capture the full extent to which all computers in schools are connected.

The UIS regularly collects the relevant data to calculate both these additional indicators. While data will not be universally available in the post-2015 environment, increased capacity building in countries will contribute to improvements of ICT in education statistics over time.

Several recommendations are made concerning actions that governments can take to improve ICT connectivity in schools. They are:

- Strengthen existing electrical infrastructure. A lack of electricity is arguably the biggest barrier to extending access to ICTs, including the Internet.
- Recognise the potential of fixed broadband, WiMax, and mobile broadband (3G and 4G) Internet, and aim to equip all schools (including in rural areas) with high-speed Internet.
- In countries with difficult terrain (for example, mountainous), consider building a combination of wireless and satellite-based telecommunications with low-cost Very Small Aperture Terminal (VSAT) apparatus for downlink of data and images.
- Consider the use of both radios and televisions to connect schools in situations where more advanced forms of ICT are not feasible or available.

- Low cost computers are an effective strategy to rapidly increase the computer resources in a country, but this policy option should be weighed carefully against other educational priorities, including building schools and hiring and training teachers.
- Recognise the role of community media centres to play a role in extending the reach of ICT to pupils when ICTs are not available in schools. Negotiate schedules and form partnerships with public and private partners (for example, Internet cafés) in order to access ICTs.
- Establish partnerships with multiple levels of government and the private sector, particularly with telecommunications companies, to negotiate low cost access to Internet services.
- 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.

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Endnotes

[1] The original WSIS indicator was worded slightly differently “Connect universities, colleges, secondary schools and primary schools with ICTs”.

[2] There are a number of examples of schools that provide access to the Internet for the general community 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] This figure represents the number of countries for which data for any of the four indicators are available.

[4] The scope of all the indicators is ISCED levels 1–3, that is, public and private schools from primary to upper secondary education unless otherwise stated. The International Standard Classification of Education (ISCED) is a classification system for education statistics. The data collected for this report refer to ISCED97 whereby ISCED 1, ISCED 2 and ISCED 3 refer to primary, lower secondary and upper secondary education levels, respectively.

[5] See GRID: http://www.fosigrid.org/europe/georgia-europe.

[6] The use of televisions is negligible in primary and upper secondary institutions, compared to 57 per cent of lower secondary institutions that use televisions for educational purposes.

[7] In Myanmar, data for radios only cover secondary schools.

[8] Latest year available. Notes on reference years are under the chart.

[9] These refer to computer and Internet use for educational purposes respectively (indicators 7.3 and 7.4 in Target 7).

[10] LCR values in Cambodia reflect secondary education only. Data to calculate the primary LCR are unavailable.

[11] Note that the original indicator 2.4 included other forms of Internet access, such as narrowband and mobile broadband.

[12] Fixed broadband is considered to be the most effective method for connecting to the Internet. UIS data have focused on general ('any') Internet access as well as fixed broadband Internet access. The definitions used differ somewhat from those in the WSIS framework document (Partnership, 2011). That document distinguished i) broadband Internet, which included both fixed (wired) and wireless broadband (for example, satellite, terrestrial fixed wireless, fixed WIMAX, terrestrial mobile wireless access) and ii) fixed narrowband.

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

[14] See http://www.chile-usa.org/education.html.

CONNECT ALL
SCIENTIFIC AND
RESEARCH CENTRES
WITH ICTs

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

Executive summary

In today's information society, the ways in which knowledge is created, processed, diffused and applied have been revolutionized – in part through rapid developments in ICTs (UNESCO, 2013). While the ICT revolution has not occurred at a uniform pace in all regions, to a large extent it has led to the creation of dynamic networks, cross-border collaborative processes, and internationalization of research and higher education. In line with the goal of making the benefits of ICTs available for all, Target 3 aims to connect all scientific and research centres with ICTs. The ICTs defined by the Target 3 indicators include broadband Internet[2] and connections to national research and education networks (NRENs). Data from multiple sources indicate that the target of "all" scientific and research centres has not been achieved, although significant progress has been made according to the three indicators for Target 3.

Indicator 3.1 focuses on connecting scientific and research centres with broadband Internet. Where data were available, connectivity was found to be high – typically 100 per cent – but there were a few countries that have yet to achieve this target. The conclusions that can be drawn from Indicator 3.1 were limited because of the low data availability and it is recommended that this indicator be removed. Indicator 3.2 measures whether a country has one or more NRENs and what their bandwidth is. Significant progress has been made in increasing the total number of NRENs, regional NRENs and countries with a NREN. Bandwidth has also increased considerably from megabit capacity to gigabit capacity. Progress was particularly noteworthy in Africa where the number of regional NRENs increased from none before 2006 to three by the end of 2013. Should there be tracking of Target 3 post-WSIS, it is recommended that monitoring of Indicator 3.2 be continued, with the possible addition of connectivity to NREN consortia, as regional NRENs will play a pivotal role in facilitating international research collaboration. Indicator 3.3 measures the proportion of public scientific and research centres that have direct or indirect broadband Internet access to a NREN, where at least one exists in the country. In most countries for which data are available, the majority of universities and research centres are connected to a NREN. On the other hand, very few government departments engaged in research and development (R&D) are connected to NRENs, suggesting that this is one area for greater collaboration between policy-makers, and scientific and research centres.

Target 3 indicators focus on infrastructure (connection to broadband Internet and NRENs) as a reflection of a country's ability to participate in international research. In the current review of the indicators, it is obvious that a focus on advanced infrastructure will not be sufficient post-2015, given the current and emerging needs of a dynamic research milieu. Should there be a post-WSIS target on technology and scientific research, it could consider the nature of information and knowledge that are shared, such as: different software models, innovative forms of networking, ways of adapting ICT infrastructure, software tools and applications, and international R&D efforts. An issue of interest would be open access to scientific publications and data. Open access is gaining traction with both funding organizations and the scientific community. It was endorsed in 2013 as a principle for sharing research funded by the European Commission.[3] Open access to scientific publications and data would also address the current inequality in access to scientific information and knowledge in the world. Developing countries, particularly least developed countries (LDCs), continue to lag behind in access to scientific information and knowledge, as well as the benefits of science and technology. Easier access to knowledge and information should help to narrow the gap. As a way of moving forward, tracking the availability of open access scientific knowledge could be linked to WSIS Target 9 – Encourage the development of content.

Finally, the current review makes a strong recommendation for the intensification of global multistakeholder partnerships. The role of scientists and academics is essential in endeavours to share the benefits of technology and innovation; open access to data and knowledge is a key means for achieving this goal. To facilitate the achievement of a target on technology and scientific research, a conducive policy environment for sharing scientific knowledge will be fundamental in coming years.

Introduction

Historically, universities and other research centres have been at the forefront of scientific discovery. Many of the world's major technology companies began their life in universities and research institutions: Facebook was conceived at Harvard, Google at Stanford, Philips at the Eindhoven University of Technology, and Lenovo at the Chinese Academy of Sciences (Lambert, 2013). In each of these cases, a university or research centre played a pivotal role in incubating innovation.

International collaboration has brought together scientific groups that work on major challenges in areas such as health, climate change and renewable energy. In the area of technology, international research programmes are focusing on 3D imaging techniques, big data visualization, cybersecurity and mobile cloud computing, among others. The importance of science, technology and innovation, knowledge-sharing and capacity building for eradicating poverty and achieving sustainable development was confirmed at the Rio+20 Conference and the 2013 ECOSOC[4] Annual Ministerial Review (UNESCO, 2013). In order to make progress towards the Millennium Development Goals (MDGs) and other major global challenges, access to high-speed Internet is vitally important to enable researchers to connect with scientific communities around the world. When researchers can connect with their colleagues, they are better able to gain access to broader technical perspectives, pool their knowledge with others so as to advance their scientific disciplines, respond to changing patterns of scientific funding, and fulfil escalating demands for the rationalisation of scientific investment (Katz and Martin, 1997). In this sense, connectivity is an important prerequisite for the social and economic transformations that enable sustainable economic growth, human development and poverty eradication. Without connectivity, knowledge advancement and the impact of new discoveries could be limited.

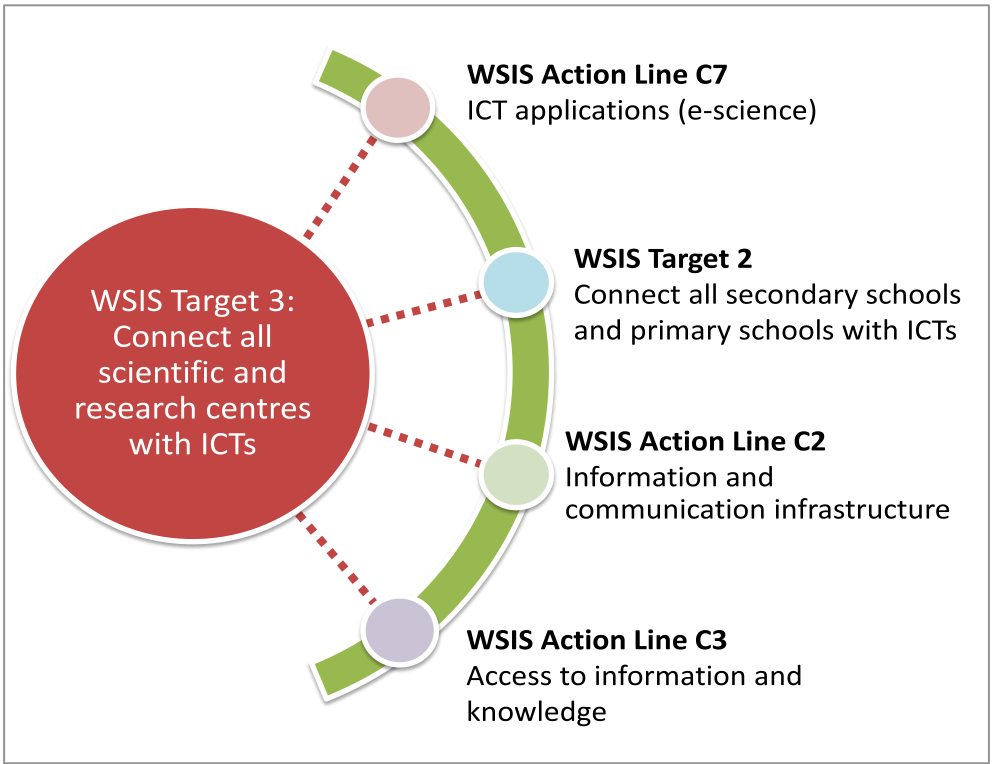
Target 3 is to “connect all scientific and research centres with ICTs.” **Connectivity** has been interpreted as meaning high-speed Internet connection (ITU, 2010).This chapter focuses on public entities in the government and higher education sectors. Business enterprises and private non-profit sector entities are excluded for practical reasons (see *Partnership*, 2011). While the focus on public entities provides a feasible means for data collection, one limitation it poses is that private entities in the higher education sector are not covered by the target.

Other than WSIS Action Line C7 that defines its scope, Target 3 is also related to:

- WSIS Target 2: Connect all secondary schools and primary schools with ICTs (which originally included connecting universities)
- Action Line C2 (Information and communication infrastructure)
- Action Line C3 (Access to information and knowledge).

Figure 3.1 illustrates the relevance of Target 3 to other WSIS action lines and to Target 2.

Figure 3.1: Relevance of Target 3 to other WSIS action lines and targets



Action Line C7 focuses on ICT applications, including e-science. It 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." (ITU, 2005) The focus on improving access to ICTs addresses an important challenge for researchers in developing countries who face high access costs for scientific journals and poor Internet connections.[5]

WSIS Target 2 originally included connecting universities and colleges with ICTs and was amended to track the availability of ICTs in primary and secondary schools only. Monitoring basic ICT infrastructure was deemed to be less relevant for higher-education institutions, since they are expected to have basic access to radios, televisions and computers (ITU, 2010). Post-WSIS, countries could consider examining targets 2 and 3 together in order to evaluate the overall status of ICT access in their educational institutions. Target 2 covers ISCED[6] levels 1 to 3, while Target 3 covers ISCED levels 5 and 6. Note that ISCED level 4, Post-secondary non-tertiary education, is not tracked in either Target 2 or 3 and the two targets focus on different types of ICT (Target 2 on basic ICT access and Target 3 on high-speed Internet connectivity).

Action Line C2 emphasizes the centrality of information and communication infrastructure in achieving the goal of digital inclusion (ITU, 2005). In relation to this, the achievement of Target 3 (as currently defined) implicitly involves the establishment of broadband network infrastructure in order to provide high-speed Internet connectivity to scientific and research centres. Action Line C2 also states the need to optimize connectivity between major information networks by:

- encouraging the creation and development of regional ICT backbones and Internet exchange points

- reducing interconnection costs
- broadening network access.

As national, regional and international broadband network infrastructure strengthens, connectivity among scientific and research centres should also improve.

Action Line C3 focuses on the role of ICTs in allowing people around the world to access information and knowledge (ITU, 2005). In relation to Target 3, Action Line C3 specifically refers to facilitating access to journals and books, and archives of scientific information – to be achieved by connecting scientific and research centres with high-speed Internet. Action Line C3 also includes other objectives pertaining to scientific research, including:

- Encourage research and promote awareness of different software models.
- Encourage research on the information society, including on innovative forms of networking, adaptation of ICT infrastructure, tools and applications.
- Undertake international R&D efforts aimed at making available adequate and affordable ICT equipment for end users.

These objectives are currently not covered by Target 3 and could be the focus of possible future targets on scientific research.

Scientific and research centres

Target 3 focuses on connectivity between scientific and research centres, which can be seen as an indication of a country's capacity to participate in international research. Scientific and research centres play a critical role in coping with emerging challenges, such as sustainable development and rising demographic pressures. For individual countries, the vitality of scientific research centres can be tied to the sustainability and growth of their economies. For example, through their R&D efforts, scientific and research centres generate intellectual capital that can be used in business innovation. Intellectual capital generates a knowledge base that can be mobilised for coping with major challenges and stimulating private sector entrepreneurship. To deal with the complex problems in the world today, scientific and research centres increasingly need to connect with one another to share resources and leverage the domain knowledge of other experts. Where technology gaps are evident, efforts should be made to close the gap so that the outcomes of scientific research can benefit all, including the most vulnerable and marginalized.

For an accurate assessment of Target 3, it is first important to identify the scientific and research centres within a country. This report initially adopted the recommendation of the 2011 WSIS statistical framework (*Partnership*, 2011) to use definitions from the UIS and OECD manuals.[7] Based on the two manuals (OECD, 2002; UIS, 2010a), the scope of scientific and research centres is all R&D-performing higher education and government organizations, defined according to the UIS manual but excluding units covered by other sectors, as follows:

- The higher education sector is composed of all universities, colleges of technology and other institutions providing tertiary education at International Standard Classification of Education (ISCED[8]) levels 5 and 6, whatever their source of finance or legal status. It also includes all research units, experimental stations and clinics operating under the direct control of, or associated with, higher education institutions. The treatment of borderline cases is discussed in the *Frascati manual* (OECD, 2002).

- The government sector is composed of all departments, offices and other bodies that furnish, but do not normally sell to the community, those common services, other than higher education, which cannot otherwise be conveniently and economically provided, as well as those that administer the state and the economic and social policy of the community. (Public business enterprises mainly engaged in market production and sale of goods and services are included in the business enterprise sector.) Non-profit institutions controlled and mainly financed by government, but not administered by the higher education sector, are also included. Government organizations include all levels of administration, that is: central or federal, state or provincial, and local or municipal.

The 2011 WSIS statistical framework also made recommendations for allocating units to business sectors and maintaining homogeneity across countries. However, it acknowledged that the homogeneity of units is likely to be impossible to achieve in the government sector and difficult for the higher education sector. More detailed discussions follow in the assessment of the individual indicators.

National research and education networks (NRENs)

As research and scientific challenges become more complex, research institutes need to connect with one another to share resources and develop cohesive solutions. In this chapter, ICT connectivity within the research community is defined as the existence of a **national research and education network (NREN),**[9] and is tracked by indicators 3.2 and 3.3. According to the 2011 WSIS statistical framework (*Partnership*, 2011), a 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" (p.24).

NRENs provide connectivity and services to higher education establishments (typically universities) and research institutes, but can also support schools, further education colleges, libraries and other public institutes. In some cases, services may be provided to government and healthcare sectors as well. There is usually only one recognised NREN in each country, although some countries may have separate networking organisations for different research and educational sectors. Where there is more than one networking organisation though, it is usual for international connectivity to be arranged through one of these organisations, or alternatively an umbrella organisation, which then becomes the de-facto NREN. In larger countries, it is also common to have separate regional or metropolitan networks interconnected by the NREN.

When NRENs were first highlighted by the *World Telecommunication/ICT Development Report 2010: Monitoring the WSIS Targets, A mid-term review* (WTDR) (ITU, 2010), they were introduced as high-capacity networks with three common characteristics:

- They are Internet Service Providers that are closely identified with the respective networks.
- They are a mix of dedicated channels and public Internet access, often through a combination of dedicated backbones, leased lines or private sector operators.
- They connect a range of different institutions, often with different needs.

Similarly, Europe's Delivery of Advanced Network Technology to Europe (DANTE)[10] notes that NRENs act as high-capacity ICT infrastructures to support the work of researchers, promote collaboration, transfer data and share information or confirm experiments. In addition, it notes that NRENs can facilitate new research in their own right, by providing platforms and experimental test-beds for testing new services and advanced networking technologies.

NREN version 2 (NREN v2)

As testimony to the global progress in NRENs, there is already international discussion for NREN version 2 (NREN v2), which is envisioned as more than just networks. Instead of being specialized regional ISPs, version 2 NRENs will be essential global platforms for research and education institutions. On NREN v2 platforms, research institutes will be able to develop new technologies, solve common challenges, and develop common solutions in a collaborative environment – all of which are goals that go beyond connectivity.

Other proposed changes to transform NREN to NREN v2 include: from knowledge carrier to knowledge multiplier, from neutral collaboration connection to collaboration enabler, and from disinterested community service to community developer. With NREN v2, research and education institutes would be able to work in distributed laboratory environments, gain remote access to rare scientific instruments, and conduct large-scale computation. Box 3.1 describes the launch of the world's first intercontinental 100 Gbit/s link, called the Advanced North Atlantic 100G (ANA-100G), which will enable these collaborative research efforts.

Box 3.1: World's first intercontinental 100 Gbit/s link for R&E demonstrated

TERENA is the Trans-European Research and Education Networking Association. During the TERENA Networking Conference held in the Netherlands in 2013, six of the world's leading research and education (R&E) networks[11] demonstrated the world's first transatlantic 100 gigabits per second (Gbit/s or one billion bits per second) transmission link for research and education between North America and Europe.

The intercontinental 100 Gbit/s link, called the Advanced North Atlantic 100G Pilot Project (ANA-100G), will be used for engineering and testing the new transmission link, applications, resources, monitoring techniques and advanced technologies such as software-defined networking. According to SURFnet (the NREN of The Netherlands), the 100 Gbit/s Transatlantic connection reflects two trends in scientific research: science is increasingly data driven with datasets from large-scale experiments at the tera-scale level, and these experiments are increasingly carried out by international collaborations in which researchers around the globe expect immediate access to the datasets. The operation of this ultra high-speed link across the Atlantic Ocean also illustrates how the close collaboration between research and education networks and the commercial sector continues to evolve, with the ongoing deployment of cutting-edge networking technologies that underpin groundbreaking, globally collaborative science and discovery.

Demonstrations of the intercontinental 100 Gbit/s link included large data transfers between Maastricht and Chicago that took a few minutes, compared with many hours over the public Internet. The Transatlantic link will also advance high-end projects such as the experiments at the Large Hadron Collider in Switzerland, the ITER fusion reactor in France and similar international programs.

Source: SURFnet (2013).

Even as network administrators explore modalities to transform NREN to NREN v2, the fundamental intent of Target 3 remains relevant and that is to track a country's ability to participate in international research. Given the complexity of today's scientific challenges, demands on computation power will only increase; therefore research centres will increasingly look to NRENs as dedicated platforms for scientific advancements. Connectivity to NRENs and the degree of connectivity could be indicative of an economy's stock of intellectual capital. In fact, more finegrained measurement of NRENs would be possible as the number of countries with a NREN increases and connectivity between NRENs improves.

The rest of this chapter reviews the indicators for Target 3, reports the strong progress made towards the achievement of this target, since the 2010 mid-term review (ITU, 2010), and highlights pathways to accelerate progress for countries that are unlikely to achieve the target. Limitations, recommendations and conclusions are provided at the end of the chapter.

Data availability and scope

The following three indicators were identified in the 2011 WSIS statistical framework to track WSIS Target 3:

> Indicator 3.1: Proportion of public scientific and research centres with broadband Internet access
>
> Indicator 3.2: Presence of a national research and education network (NREN), by bandwidth (Mbit/s)
>
> Indicator 3.3: Proportion of public scientific and research centres with Internet access to a NREN.

Indicator 3.1 measures the proportion of public scientific and research centres with broadband Internet access. The indicator is focused on connectivity and does not provide any information on what the access is used for. Although broadband is of interest here, the rate of data transfer and processing required for some scientific research may far exceed broadband speeds currently available to the average consumer.

Indicator 3.2 measures whether a country has one or more NRENs and what their bandwidth is. The presence of a NREN indicates a country's ability to participate in national and international research. Bandwidth refers to the total capacity of NRENs in mega bits per second (Mbit/s).[12] Bandwidth determines the speed at which data are delivered to, and sent from, Internet users. It is measured in the number of bits that can be transferred per second.

Indicator 3.3 measures the proportion of public scientific and research centres that have direct or indirect broadband Internet access to a NREN, where at least one exists in the country. Table 3.1 presents the data sources used for measuring Target 3.

Table 3.1: Data sources for indicators for measuring Target 3

	Indicator	Data source	Data availability
3.1	Proportion of public scientific and research centres with broadband Internet access	Partnership on Measuring ICT for Development 2013 WSIS targets questionnaire	Very low. Only 16 countries provided data through the 2013 WSIS targets questionnaire. In the 2009 questionnaire, 24 countries provided data.
3.2	Presence of a national research and education network (NREN) by bandwidth (Mbit/s).	*Partnership* 2013 WSIS targets questionnaire, TERENA, NREN websites	Very low for questionnaire. Only 12 countries provided data through the 2013 WSIS targets questionnaire. TERENA had 59 countries with data available by end 2013.
3.3	Proportion of public scientific and research centres with Internet access to a NREN	*Partnership* 2013 WSIS targets questionnaire, TERENA	Very low for questionnaire. Only 15 countries provided data through the 2013 WSIS targets questionnaire. TERENA had 55 countries with data available by end 2013.

Source: ITU.

Indicators 3.1 and 3.3 are not collected on a regular basis by countries. Data for indicators 3.1, 3.2 and 3.3 were collected by the *Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013* (*Partnership*, 2013). Of the 55 countries that responded to the survey at the time of writing, 14 to 16 had data available for Target 3. For indicators 3.2 and 3.3, the annual survey of NRENs conducted by the Trans-European and Education Networking Association (TERENA, 2013) served as the primary source of information for European and other responding countries.

Achievements against Target 3

Overall, significant progress has been made in terms of connecting scientific and research centres with ICTs. The target of "all" public scientific and research centres has not been achieved but there is evidence to suggest that steady progress has been made since 2003. Data availability has improved significantly in recent years as more NRENs are established and make their information publicly available (however, data availability remains a challenge for Indicator 3.1). One major sign of progress is that connection speeds have improved to the extent that data were reported in 2013 using giga bits per second (Gbit/s)[13] rather than mega bits per second (Mbit/s) as determined by the 2011 WSIS statistical framework.

Public scientific and research centres with broadband Internet access

Indicator 3.1 measures the proportion of public scientific and research centres with broadband Internet access. Table 3.2 shows the results from the 2013 WSIS targets questionnaire. Sixteen countries had data available and 13 reported that all public scientific and research centres had broadband Internet access. Uruguay reported 63 per cent, Republic of Congo 70 per cent and Dominican Republic 91 per cent. In the 2009 WSIS targets questionnaire, 15 out of 16 countries reported 100 per cent broadband Internet access for public scientific and research centres. With the exception of Bhutan, Bulgaria and Singapore (which reported 100 per cent in both surveys), countries that participated in the 2013 survey were different from those that participated in the 2009 survey.

Table 3.2: Proportion of public scientific and research centres with broadband Internet access

2013 WSIS targets questionnaire		2009 WSIS targets questionnaire	
Country	Proportion of public scientific and research centres with broadband Internet access	Country	Proportion of public scientific and research centres with broadband Internet access
	%		%
Azerbaijan	100	Albania	96
Bhutan	100	Andorra	100
Bulgaria	100	Bhutan	100
Congo	70	Bosnia & Herzegovina	100
Dominican Republic	91	Botswana	100
Estonia	100	Bulgaria	100
Finland	100	Croatia	100
Iran, Islamic Rep.	100	Denmark	100
Lithuania	100	Djibouti	100
Maldives	100	Egypt	100
Moldova	100	Hungary	100
Serbia	100	Korea, Rep.	100
Singapore	100	Latvia	100
United Arab Emirates	100	Morocco	100
Uruguay	63	Netherlands	100
Viet Nam	100	Singapore	100

Source: ITU and Partnership on Measuring ICT for Development (2009 and 2013 WSIS targets questionnaires).

Given the low data availability for Indicator 3.1, the disaggregations by type and size of organizations recommended by the 2011 WSIS statistical framework were not tenable. As with many other indicators in this report, data from least developed countries (LDCs) were not available. This poses a major challenge for assessing the technology gap between LDCs, developing and developed countries.

Where data are available, broadband Internet access was high but comparisons between countries and over time was not possible. Furthermore, this indicator is not tracked at the international level by any organization and this makes monitoring very challenging. Given these limitations, it is recommended that the indicator be dropped from any possible future monitoring post-WSIS.

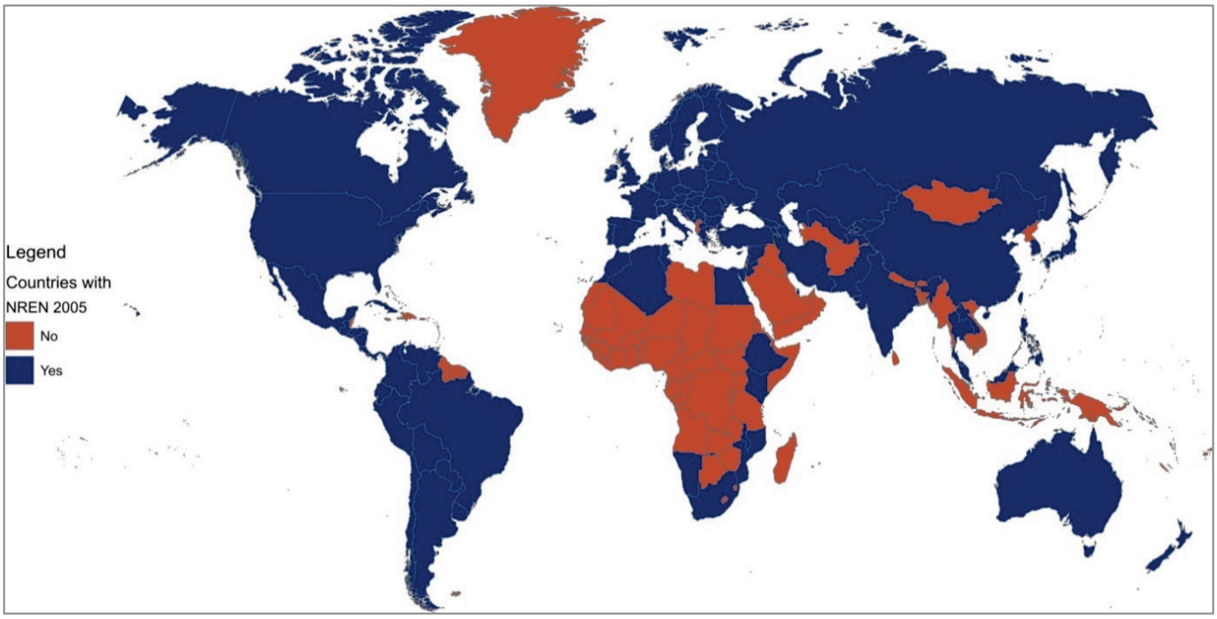
Countries with a national research and education network (NREN)

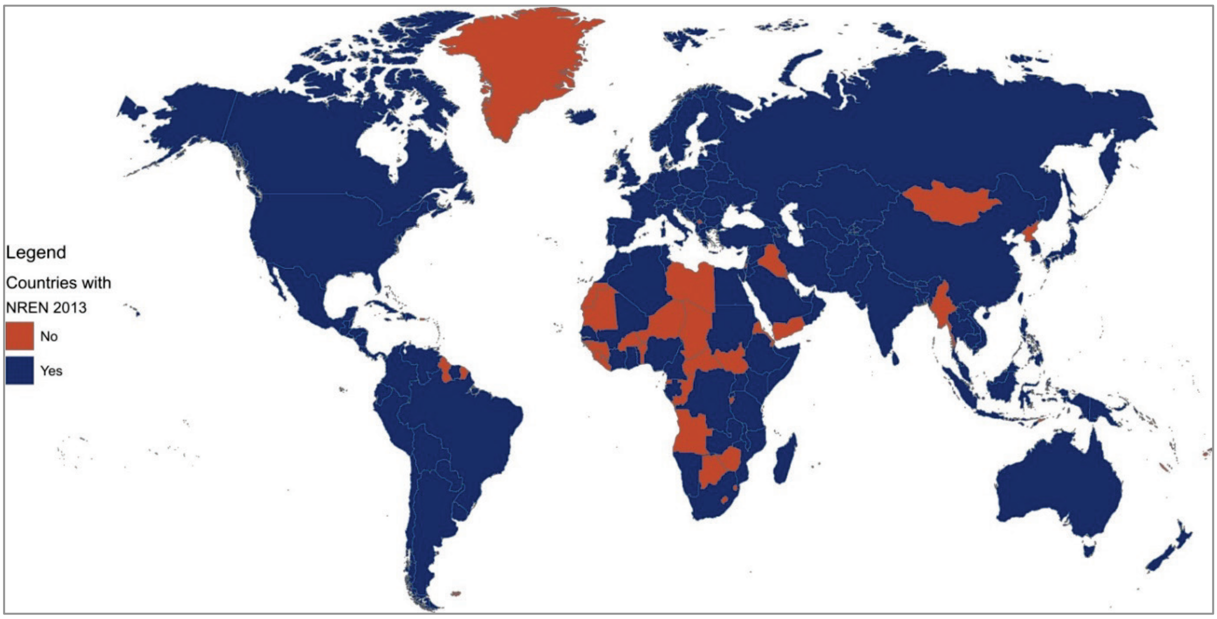
Indicator 3.2 measures whether a country has one or more NRENs and what their bandwidth is. The presence of a NREN indicates a country's ability to participate in national and international research.

In 2013, there were 170 known NRENs in 137 countries (out of a total of 206 countries tracked) (see Annex 3.1). Therefore, about two-thirds of countries tracked had at least one known NREN. By comparison, in 2009, 121 countries had at least one NREN and in 2005, an estimated 98 countries had at least one NREN (see Figure 3.2 for countries connected by at least one NREN in 2005 and 2013 respectively).

In terms of NRENs by region, in Europe, there were 39 countries with at least one known NREN in 2013, compared with 41 in Asia, 28 in the Americas, 26 in Africa and 3 in Oceania. In relative terms, 89 per cent of countries in Europe had at least one NREN, 80 per cent in Asia, 74 per cent in the Americas, 48 per cent in Africa and 16 per cent in Oceania (see Chart 3.1).

Figure 3.2: Countries with a national research and education network, 2005 and 2013





Source: ITU research based on TERENA Compendium and other publicly available information (see also Annex 3.1).

Substantial regional disparities still exist, with African and Oceanic countries lagging behind the rest of the world. Of the 19 countries in Oceania, only Australia, New Zealand and Papua New Guinea had a NREN in 2013; the other 16 countries had no known NREN. In Africa, 26 out of 54 countries had a NREN. Only 14 of the 34 LDCs in Africa had a NREN.

Data over time were not consistently available over the monitoring period. The most consistent data source was the Trans-European Research and Education Networking Association (TERENA). TERENA publishes the TERENA Compendium[14] that provides a reference source of research and education networking in Europe (and beyond) since 2001. Of the 54 countries tracked by the *Compendium*, a record high of 59 NRENs responded to the 2013 TERENA questionnaire. This number has varied between 41 and 53 from 2003–2012.

At the time of writing, the concept of a NREN appears to be very well established and the identification of NRENs was fairly easy. Measurement of NREN bandwidth was less straightforward, as different data sources had slightly different interpretations of the term.

Bandwidth is defined in the 2011 WSIS statistical framework as the total capacity of NRENs in mega bits per second (Mbit/s). Bandwidth determines the speed at which data are delivered to, and sent from, Internet users. It is measured in the number of bits that can be transferred per second. TERENA adopts the concept of typical core usable backbone capacity on the network, meaning typical core capacity of the linked nodes in the core. The term "usable" is included because some NRENs have unused dark fibre with a very high theoretical capacity. For networks that do not have a core backbone (for example, because they have a star topology), TERENA asks for the maximum capacity into the central node of the network (TERENA, 2013). This definition is in line with the ITU definition of Internet bandwidth (ITU, 2011).

The TERENA Compendium also collects data on bandwidth of NRENs in its annual survey. Table 3.3 shows the bandwidth of the 65 NRENs that provided bandwidth information between 2012 and 2013. Fifty-nine NRENs provided data for the TERENA Compendium, six countries responded to the 2013 WSIS targets questionnaire and six countries responded to both questionnaires. Five NRENs reported core usable capacity below 1 giga bits per second (Gbit/s) – ASNET-AM (Armenia), GRENA (Georgia), KazRENA (Kazakhstan), SudREN (Sudan) and RAU2 (Uruguay). The highest core usable bandwidths of 100 Gbit/s were reported by DFN (Germany) and Internet2 (United States). Other NRENs that reported high bandwidths were mostly located in Europe; the highest of these was RENATAR (France) with 60 Gbit/s. CANARIE (Canada) had a bandwidth of 50 Gbit/s.

Only six NRENs based in African countries provided information about their bandwidth: CERIST (Algeria), Eeb@le (Democratic Republic of Congo), EUN (Egypt), MAREN (Malawi), MARWAN (Morocco) and SudREN (Sudan). All six had bandwidths less than or equal to 5 Gbit/s.

Table 3.3: Bandwidth of selected NRENs, 2013/2012

Country	NREN	TERENA/Partnership* bandwidth	Country	NREN	TERENA/Partnership* bandwidth
Albania	ANA	10 Gbit/s	**Korea, Rep.**	KREONET	10 Gbit/s
Algeria	CERIST	1.2 Gbit/s	**Latvia**	SigmaNet	1 Gbit/s
Armenia	ASNET-AM	0.2 Gbit/s	**Lithuania**	LITNET	10 Gbit/s (10 Gbit/s*)
Australia	AARNet	20 Gbit/s	**Luxembourg**	RESTENA	1 Gbit/s
Austria	ACOnet	10 Gbit/s	**Malawi**	MAREN	1 Gbit/s
Azerbaijan	AzScienceNet	1 Gbit/s	**Malta**	UoM/RicerkaNet	10 Gbit/s
Belarus	BASNET	10 Gbit/s	**Moldova**	RENAM	1 Gbit/s (10 Gbit/s*)
Belgium	BELNET	20 Gbit/s	**Montenegro**	MREN	1 Gbit/s
Bosnia & Herzegovina	SARNET	1 Gbit/s	**Morocco**	MARWAN	1 Gbit/s
Brazil	RNP	10 Gbit/s	**Netherlands**	SURFnet	20 Gbit/s
Bulgaria	BREN	2 Gbit/s (1 Gbit/s*)	**New Zealand**	REANNZ	10 Gbit/s
Canada	CANARIE	50 Gbit/s	**Norway**	UNINETT	10 Gbit/s
Chile	REUNA	2.5 Gbit/s*	**Poland**	PIONIER	40 Gbit/s
Congo (Dem. Rep.)	Eeb@le	100 Mbit/s*	**Portugal**	FCCN	20 Gbit/s
Croatia	CARNet	10 Gbit/s	**Romania**	RoEduNet	10 Gbit/s
Cyprus	CyNET	1 Gbit/s	**Russia**	e-ARENA	20 Gbit/s
Czech Republic	CESNET	10 Gbit/s	**Serbia**	AMRES	1 Gbit/s (1
Denmark	DeIC; UNI-C	10 Gbit/s	**Singapore**	SingAREN	15 Gbit/s
Egypt	EUN	5 Gbit/s	**Slovak Republic**	SANET	10 Gbit/s
Estonia	EENet	10 Gbit/s (12 Gbit/s*)	**Slovenia**	ARNES	10 Gbit/s
Finland	Funet	10 Gbit/s	**Spain**	RedIRIS	40 Gbit/s
France	RENATAR	60 Gbit/s	**Sudan**	SudREN	0.3 Gbit/s
Georgia	GRENA	0.5 Gbit/s	**Switzerland**	SWITCH	10 Gbit/s
Germany	DFN	100 Gbit/s	**T.F.Y.R. Macedonia**	MARnet	1 Gbit/s
Greece	GRNET S.A.	1.5 Gbit/s	**Thailand**	ThaiREN; Uninet	51 Gbit/s*
Hungary	NIIF/HUNGARNET	20 Gbit/s	**Turkey**	ULAKBIM	10 Gbit/s
Iceland	RHNet	10 Gbit/s	**Ukraine**	URAN	10 Gbit/s
Iran, Islamic Rep.	IRANET/IPM	1 Gbit/s*	**UAE**	ANKABUT	10 Gbit/s*
Ireland	HEAnet	30 Gbit/s	**UK**	Janet	40 Gbit/s
Israel	IUCC	10 Gbit/s	**United States**	Internet2	100 Gbit/s
Italy	GARR	10 Gbit/s	**Uruguay**	RAU2	155 Mbit/s*
Japan	NII	20 Gbit/s (82 Gbit/s*)			
Kazakhstan	KazRENA	165 Mbit/s			

Source: TERENA Compendium 2013 and 2012; Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013 (*Partnership* data are indicated by *).

TERENA (2008) noted that NREN bandwidth increased from megabit capacity in 2003 to gigabit capacity in 2008. This trend has continued and the number of countries with capacity of 10 Gbit/s or above has grown from 14 in 2008 to 40 in 2013.

Regional or NREN consortia[15]

Although Indicator 3.2 did not specify the monitoring of regional NRENs or NREN consortia, scientific networking has been developing in this direction in recent years. This section uses available data to describe regional or NREN consortia. Table 3.4 lists regional or NREN consortia and regions served, while Figure 3.3 shows a timeline of the starting year of operations. Figure 3.4 from GÉANT shows the geographic coverage of the regional or NREN consortia. Before 2003, there were seven regional NRENs, and by 2010, there were 12. RedCLARA covered Latin America, GÉANT covered Europe, EUMEDCONNECT the Mediterranean, CAREN Central Asia, and TEIN and APAN the Asia-Pacific. CANARIE covered Canada and Internet2 the United States. Both CANARIE and Internet2 are NRENs but have wide geographical reach and provide pan-network connectivity to the other regional NRENs.

Table 3.4: Regional or NREN consortia and regions served

Regional or NREN consortia	Region
AfricaConnect	Sub-Saharan Africa
Asia-Pacific Advanced Network (APAN)	Asia-Pacific
Arab States Research and Education Network	Arab States
Central Asian Research and Education Network	Central Asia
Canada's Advanced Research and Innovation Network	North America
Caribbean Knowledge and Learning Network	Caribbean
EUMEDCONNECT3	Southern and eastern Mediterranean
GÉANT network	Europe
Internet2	North America
Nordic Infrastructure for Research & Education	Nordic countries
Cooperación Latino Americana de Redes Avanzadas	Latin America
Trans-Eurasia Information Network (TEIN)	Asia-Pacific
UbuntuNetAlliance	Eastern and Southern Africa
West and Central African Research and Education Network	Western and Central Africa

Source: ITU Research.

Note: See Annex 3.2 for a list of regional or NREN consortia and their members.

Box 3.2 discusses the networks, TEIN and CAREN, in the Asia-Pacific region.

Box 3.2: Research and education networks in Asia and the Pacific

In the Asia-Pacific region, several policy initiatives are contributing to Target 3 – connect all scientific and research centre with ICTs. The Trans-Eurasia Information Network (TEIN), and the Central Asian Research and Education Network (CAREN) provide good illustrations of the efforts of the region to connect its education and research networks.

The Trans-Eurasia Information Network Initiative (TEIN)

Endorsed by the ASEM-3 Summit (October 2000, Seoul), the Trans-Eurasia Information Network (TEIN) Initiative seeks to connect research networks in Asia and Europe in order to promote information exchanges in research and education. The ASEM leaders emphasized the need to establish information and research networks between the two regions and among ASEM partners in order to facilitate the flow of knowledge and information. The TEIN network allows for high speed and high volume exchange of data and information between research and education centres. It facilitates a wide range of applications to enhance research and education, including e-learning, videoconferences and online research collaboration. TEIN supports collaboration across disciplines including medicine, climate and environmental monitoring, high energy physics and agriculture. In 2012, the Medical Tele Collaboration project was implemented with ten TEIN partners to perform live surgeries.

The TEIN initiative was unveiled in several stages. The first stage created a Paris-Seoul connection on December 2001. The second phase of the Trans-Eurasia Information Network programme (TEIN2) was launched in May 2004 and raised the initiative’s ambition and coverage with the involvement nine Asian partners, of which six were significant beneficiaries of European Commission financing (China, Indonesia, Malaysia, Philippines, Thailand and Viet Nam) with three Asian partners participating at their own cost (Japan, Singapore and the Republic of Korea), and in some cases making in-kind or financial contributions to the TEIN2 programme. Australia was also connected to the TEIN2 network at its own cost. The TEIN2 programme was managed by DANTE (Delivery of Advanced Network Technology to Europe), in cooperation with Asian partners.

The third phase of the Trans-Eurasia Information Network programme (TEIN3) further developed the electronic network infrastructure for Asian research and education by reaching South Asia and included Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka, Cambodia and Laos. The management responsibility of the network was transferred from DANTE to Asia. The fourth phase of the Trans-Eurasia Information Network programme (TEIN4) and the establishment of TEIN*CC (Trans-Eurasia Information Network-star Cooperation Center) in the Republic of Korea was endorsed at the 8th ASEM in Brussels on October 2010.

The Central Asian Research and Education Network and cooperation with TEIN

The Central Asian Research and Education Network (CAREN) provides over 500 universities and research centres across Central Asia with high speed broadband Internet connection. In January 2009, the CAREN regional network was launched to connect the academic communities of Central Asia to GÉANT (the research and education networking project serving Europe) through fibre optic connections. CAREN replaced the previous Virtual Silk Highway project.

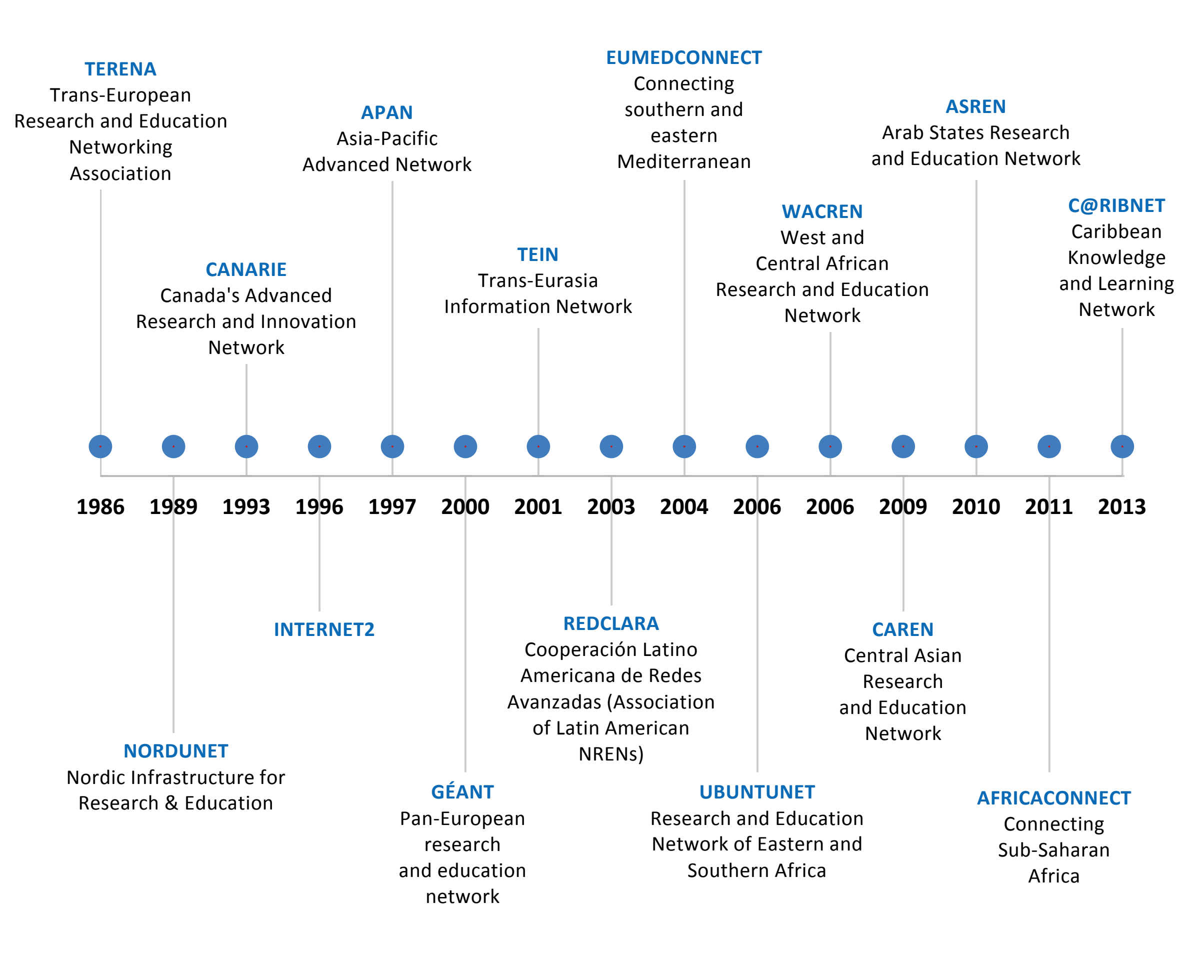
The CAREN project is coordinated by DANTE and currently involves the national research and education networks (NRENs) in Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan. Uzbekistan is expected to join the project in due course.

A memorandum of Understanding between the Trans-Eurasia Information Network (TEIN4) and the NRENs of Kazakhstan Kyrgyzstan, Tajikistan and Turkmenistan was signed in April 2013 in Ashgabat (Turkmenistan). It is expected to stimulate the development of joint applications and to foster the exchange of know-how and resources to promote cooperation between the scientific and educational communities of the two networks.

This agreement will allow universities, research institutes, medical centres and libraries of Central Asian countries to work more closely with its partners in the rest of Asia as well as in Europe. Through the TEIN-CAREN network, research and education network users will be able to access digital libraries, utilize a variety of online databases, and quickly and securely exchange large amounts of data around the world.

Source: UNESCAP, TEIN.

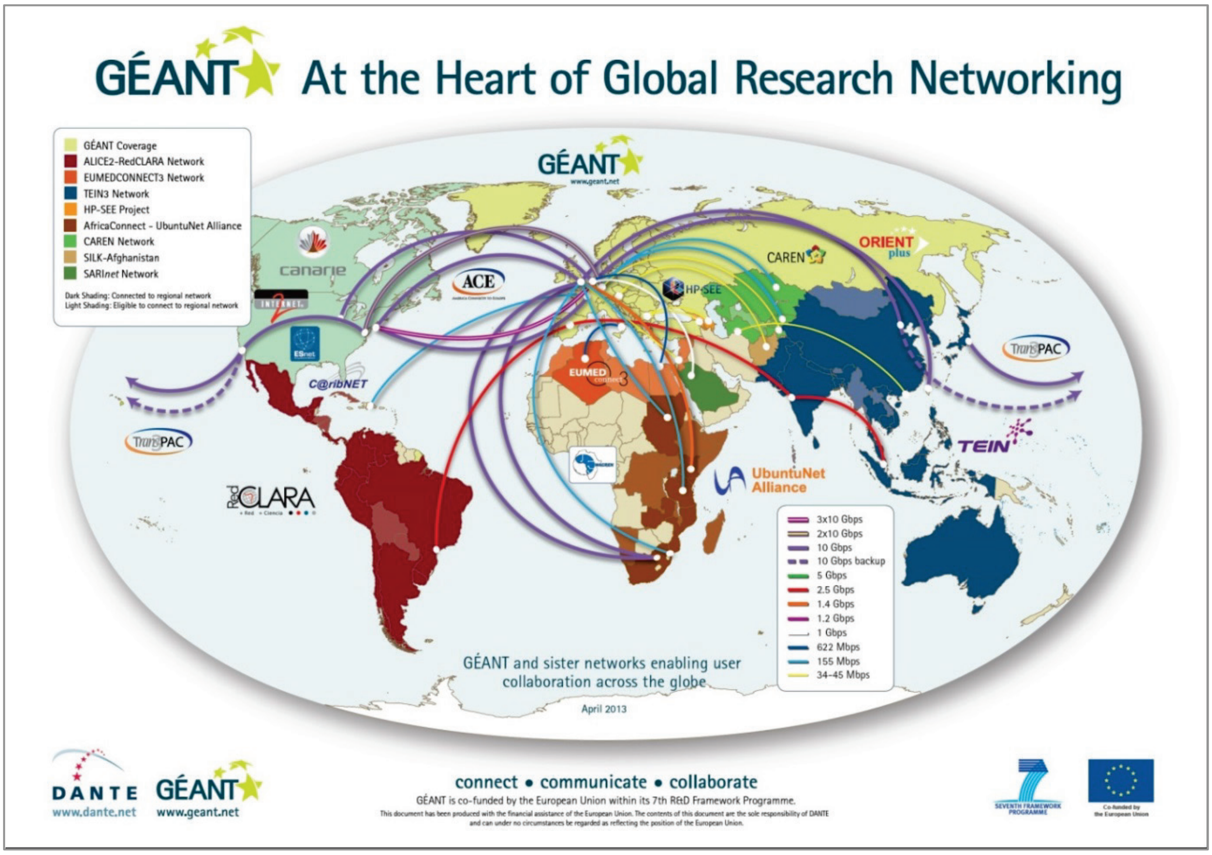
Figure 3.3: Timeline of starting year for regional NRENs and NREN consortia



Source: ITU Research.

Note: Starting year indicates publicly available official launch dates. However, regional NRENs typically take years to plan, test and implement so the definition of “starting year” varies from network to network. Networks may also have been implemented in phases. For instance, EUMEDCONNECT3 began as EUMEDCONNECT in 2001.

Figure 3.4: Coverage of regional or NREN consortia, 2013



Source: GÉANT (2013).

Since the WTDR 2010, three more regional NRENs have started operations: ASREN now serves the Arab states, AfricaConnect serves sub-Saharan Africa and C@ribNET serves the Caribbean countries.

In Africa, network administrators now have access to not just one but several regional NRENs, namely AfricaConnect, UbuntuNet and WACREN (see Box 3.3). AfricaConnect serves sub-Saharan African countries; UbuntuNet serves Eastern and Southern African countries; and WACREN serves Western and Central African countries. In the Americas, network administrators from the Caribbean countries are organizing themselves to form the Caribbean Knowledge and Learning Network, C@ribNET. Thus, all five world regions (Africa, Americas, Asia, Europe and Oceania) are now covered by at least one regional NREN.

Box 3.3: AfricaConnect – a regional Internet network for research and education in Africa

The AfricaConnect project is an initiative between the African Caribbean Pacific Islands (ACP) Secretariat and the European Commission (DEVCO). Its aim is to establish a high-capacity Internet network for research and education in Southern and Eastern Africa, thus providing the region with a gateway to global research collaboration (AfricaConnect, 2013). The project will support the data communications needs of the research and education community in the region by providing dedicated high speed data communications infrastructure that will connect African NRENs – both to each other and to other regional research and education networks worldwide. The project is expected to last four years and began in May 2011. It project comprises 20 project partners, including 15 African NRENS, 5 European NRENS and the UbuntuNet Alliance.

The objectives of AfricaConnect include:

- Foster the development of cooperative research programmes between European and the African research and education communities.
- Provide infrastructure that supports the development and deployment of the applications exploiting work done in Europe regarding the information society.
- Support the fulfilment of the region's Millennium Development Goals.
- Develop staff capacity at all levels in the existing African NRENs, taking into account their immediate needs. Due to low Internet penetration in the region, there is a lack of skilled technical, operational and managerial staff.
- Open up the research activities in the region and build cooperation with researchers in the rest of the world. Specific research application areas cover the fields of: health, climate, agriculture, education and environment.

Source: www.AfricaConnect.eu.

Work is currently in progress to develop connections between and among the regional NRENs. For instance, the ORIENTplus project connects the research and education communities of Europe and China. It links the Chinese NRENs, CERNET (China Education and Research Network) and CSTNET (China Science and Technology Network), with the 50 million users of the pan European GÉANT network via super-fast connectivity between Beijing and London (DANTE, 2013).

Impact of connectivity on increasing capacity for scientific research

In order to address challenges such as climate change, sustainable development, conflicts, human rights, rising inequality and demographic pressures, scientists and researchers increasingly have to work with colleagues in the rest of the world to develop integrated solutions. Regional NRENs and NREN consortia facilitate intra-region collaboration as well as connections to other regional NRENs. Connectivity to more advanced NREN consortia offers positive spillovers in technical expertise and experience. Very often, the availability of a regional NREN prompts countries that do not have NRENs to establish their own in order to join more advanced networks. Box 3.4 describes how 35 000 Cambodian researchers were connected with the rest of the world through the Trans-Eurasia Information Network (TEIN3). The connection to the high capacity regional network not only improved access to locally-relevant computing applications; it is also prompting universities and research centres to improve their infrastructure so that they can connect to the network and to other universities.

Box 3.4: CamREN – Connecting Cambodian researchers to the rest of the world

In April 2012, Cambodia became the most recent country to connect to the Trans-Eurasia Information Network (TEIN3). The new link initially connects to the Institute of Technology of Cambodia (ITC) in Phnom Penh and aims to connect Cambodia's 35 000 researchers with scientists around the world. The anticipated outcomes of this connection include improving the quality and quantity of research conducted in Cambodia's higher education institutes and research centres. Applications using the network include climate research and meteorology, food security and health programmes.

Initially, researchers connected to CamREN were invited to ITC as a pilot experience to get international data and documents. CamREN is the NREN of Cambodia and is a network of five leading universities in Cambodia: Institute of Technology of Cambodia (ITC), Royal University of Phnom Penh (RUPP), Royal University of Law and Economy (RULE), University of Health Science (UHS) and National Institute of Education (NIE). CamREN's mission is to facilitate the connection of all the other universities and research centres. In a second step, all universities will provide the same services in their own libraries. In the final step, other universities (public and private) in Cambodia will be invited to join the network according to their interest and development of their research activities.

The development of CamREN will be boosted by its link to TEIN3, as it works to strengthen national and international research collaboration. To achieve the physical connection, CamREN worked closely with VinaREN, the NREN of neighbouring Viet Nam. VinaREN arranged a dedicated link from its network in Hanoi to ITC and provided access to its existing TEIN3 connection. The TEIN3 network extends to the South Asian sub-continent, serving over 45 million users in more than 8 000 academic institutions and research centres across Asia. Starting with a single circuit between France and the Republic of Korea in 2001, TEIN3, the third generation of the project, now links 17 countries in the region to each other and to the global research community.

Source: TEIN3 (2013).

While Indicator 3.2 shows that Target 3 has not been achieved, significant progress has been made in increasing the total number of NRENs, regional NRENs and countries with a NREN. Bandwidth has also increased considerably from megabit capacity to gigabit capacity. Looking forward, the demand for information-sharing and digitally-driven data collection will only intensify. NRENs and regional NRENs help to meet these demands by improving access to, and use of, information and knowledge that will facilitate the achievement of the MDGs. To maintain the current momentum in the progress made according to Indicator 3.2, stakeholders can look into improving the policy environment, redesigning infrastructure investment and investing in higher education so that the full potential of NRENs can be realized.

Should there be a post-WSIS target related to scientific research, tracking should include connectivity to NREN consortia because regional NRENS will undoubtedly play a central role in enabling interconnectivity and collaboration with other regional NRENs. Given that Target 3 measures the capacity of a country to participate in international research, connectivity to a regional NREN would add another dimension to the measurement of that capacity.

Public scientific and research centres with Internet access to a NREN

Indicator 3.3 measures the proportion of public scientific and research centres that have direct or indirect Internet access to a NREN, where at least one exists in the country. This indicator monitors the extent of connectedness of public scientific and research centres to NREN(s) and, like indicators 3.1 and 3.2, focuses on infrastructure. Indicator 3.3 can also serve as a proxy indicator for the collective research capacity of public scientific and research centres in a country. However, the indicator does not monitor the quantity or quality of scientific research that results from the connectivity.

Data for indicator 3.3 were collected by the 2013 WSIS targets questionnaire, in a survey conducted by the *Partnership* in 2013. Data connectivity and bandwidth are also collected by TERENA for European Union countries (and other countries that respond to their annual survey). Table 3.5 shows information collected by the WSIS targets questionnaire on the proportion of public scientific and research centres with Internet access to NRENs. Data availability was low, with only 15 countries providing data for this indicator. The values of Indicator 3.3 varied greatly between countries, ranging from zero in Bhutan (which is planning to implement its NREN – DrukREN) to 100 per cent in Bulgaria, Estonia, Japan, Lithuania and Singapore.

Table 3.5: Public scientific and research centres with Internet access to a NREN

Country	Percentage	Country	Percentage
Bhutan	0	**Moldova**	89
Bulgaria	100	**Serbia**	59
Chile	27	**Singapore**	100
Congo	90	**Thailand**	90
Estonia	100	**United Arab Emirates**	19
Iran, Islamic Rep.	4	**Uruguay**	63
Japan	100	**Venezuela**	32
Lithuania	100		

Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

TERENA also collects data on connectivity and bandwidth, by types of institutions for European Union countries and some other countries that respond to their annual survey. The TERENA data deviate from the guidelines in the 2011 WSIS statistical framework in two ways. First, Indicator 3.3 (and 3.1) refer to 'proportions of entities with ICT' and recommended the following disaggregations:

- type of organization (higher education and government)
- size of organization in ranges of persons employed: 1-9, 10-49, 50-249 and 250 or more
- type of government organizations (if possible).

The suggested size classifications were not used by TERENA. Also, TERENA collects data disaggregated by types of institutions and the extent of coverage in ranges (greater than 80 per cent being most extensive and less than 20 per cent being least extensive). Table 3.6 shows NRENs and connectivity to institutes based on data from the TERENA Compendium 2012.[16]

Table 3.6: NRENs and connectivity to institutions

Country	NREN	Universities	Research Institutes	Institutes of further education	Government departments[17]
Algeria	ARN; CERIST; CNTI	57 (over 80%)	25 (over 80%)	34 (over 80%)	4 (20%–40%)
Armenia	ASNET-AM	2 (20%–40%)	35 (over 80%)	..	.. (60%–80%)
Australia	AARNet	41 (over 80%)	24 (40%–60%)	13 (20%–40%)	1 ..
Austria	ACOnet	36 (over 80%)	29 (20%–40%)	1 (over 80%)	35 (20%–40%)
Azerbaijan	AzRENA; AzScienceNet	..	30 (over 80%)	..	..
Belarus	BASNET	10 (20%–40%)	57 (20%–40%)	..	8 (under 20%)
Belgium	BELNET	65 (over 80%)	37 (over 80%)	6 (under 20%)	50 (20%–40%)
Bosnia & Herzegovina	SARNET	25 (60%–80%)	1 (20%–40%)	1 (20%–40%)	..
Bulgaria	BREN	22 ..	50 ..	2 ..	..
Canada	CANARIE	89 ..	70 ..	184 ..	50 ..
Croatia	CARNet	141 (over 80%)	36 (over 80%)	46 (over 80%)	9 (under 20%)
Cyprus	CyNET	6 (over 80%)	2 (under 20%)	3 (20%–40%)	..
Czech Republic	CESNET	26 (over 80%)	25 (40–60%)	10 (20%–40%)	39 (20%–40%)
Denmark	DeIC; UNI-C	8 (over 80%)	12 (20%–40%)	7 (20%–40%)	4 (under 20%)
Estonia	EENet	21 (over 80%)	21 (over 80%)	16 (20%–40%)	3 (20%–40%)
Finland	Funet	51 (over 80%)	12 (40%–60%)	..	8 (under 20%)
France	RENATAR	445 (over 80%)	368 (over 80%)	335 (60%–80%)	20 (under 20%)
Georgia	GRENA	10 (20%–40%)	5 (20%–40%)	18 (20%–40%)	2 (under 20%)
Germany	DFN	.. (over 80%)	.. (60%–80%)	.. (over 80%)	.. (under 20%)
Greece	GRNET S.A.; Ariadnet	43 (over 80%)	28 (over 80%)	146 (60%–80%)	727 (20%–40%)
Hungary	NIIF/HUNGARNET	25 (over 80%)	73 (over 80%)	28 (over 80%)	4 (20%–40%)
Iceland	RHNet	9 (over 80%)	11 (60%–80%)	2 (under 20%)	..
Ireland	HEAnet	25 (over 80%)	10 (60%–80%)	10 (over 80%)	8 (under 20%)
Israel	IUCC	12 ..	5 ..	..	..
Italy	GARR; INFN	139 (over 80%)	203 (over 80%)	0 (under 20%)	5 (under 20%)
Kazakhstan	KazRENA	51 ..	7 ..	..	2 ..
Korea, Rep.	KOREN; KREONET	51 (20%–40%)	61 (60%–80%)	..	18 (20%–40%)
Kyrgyzstan	KRENA-AKNET	27 (40%–60%)	17 (20%–40%)	.. (20%–40%	1 (under 20%)
Latvia	SigmaNet	15 (40%–60%)	13 (20%–40%)	4 (under 20%)	0 (under 20%)
Lithuania	LITNET	42 (over 80%)	31 (over 80%)	55 (40%–60%)	35 (under 20%)
Luxembourg	RESTENA	6 (over 80%)	22 (over 80%)	1 (over 80%)	14 (under 20%)
Malta	UoM/RicerkaNet	1 (over 80%)	3 (40%–60%)	2 (40%–60%)	.. (under 20%)
Moldova	RENAM	5 (over 80%)	36 (60%–80%)	1 (under 20%)	1 (under 20%)
Montenegro	MREN	19 (over 80%)	2 (60%–80%)	1 (over 80%)	1 (20%–40%)
Morocco	MARWAN	15 (over 80%)	8 (40%–60%)	80 (over 80%)	2 (under 20%)
Netherlands	SURFnet	14 (over 80%)	32 (over 80%)	64 (over 80%)	..
New Zealand	KAREN; REANNZ	8 (over 80%)	13 (over 80%)	13 (60%–80%)	2 (under 20%)
Norway	UNINETT	8 (over 80%)	81 (40%–60%)	56 (over 80%)	..
Poland	PSNC; PIONIER	180 (over 80%)	194 (over 80%)	.. (under 20%)	.. (under 20%)
Portugal	FCCN	42 (over 80%)	12 (over 80%)	..	13 (20%–40%)
Romania	RoEduNet	50 (over 80%)	55 (over 80%)	10 (60%–80%)	30 (under 20%)
Russia	e-ARENA; RUNNet/ RBNet; FREEnet	250 (60%–80%)	240 (40%–60%)	.. (20%–40%)	.. (under 20%)

Country	NREN	Universities	Research Institutes	Institutes of further education	Government departments[17]
Serbia	AMRES	87 (40%–60%)	41 (20%–40%)	9 (under 20%)	2 (under 20%)
Singapore	SingAREN	4 (20%–40%)	2 (20%–40%)	.. (under 20%)	1 (under 20%)
Slovak Republic	SANET	38 (over 80%)	20 (40%–60%)	7 (20%–40%)	.. (under 20%)
Slovenia	ARNES	4 (over 80%)	54 (over 80%)	20 (over 80%)	18 (under 20%)
Spain	RedIRIS	90 (over 80%)	170 (over 80%)	0 (under 20%)	75 (under 20%)
Sweden	SUNET	30 (over 80%)	4 (60%–80%)	9 (60%–80%)	20 (under 20%)
Switzerland	SWITCH	43 (over 80%)	10 (20%–40%)	3 (under 20%)	6 (under 20%)
T.F.Y.R. Macedonia	MARnet	19 (20%–40%)	5 (40%–60%)	..	1 (under 20%)
Tanzania	TERNET	4 (under 20%)	1 (under 20%)	4 (under 20%)	..
Turkey	ULAKBIM	89 (over 80%)	18 (20%–40%)	.. (over 80%)	6 (under 20%)
Ukraine	URAN; UNREN; UARNet	64 (over 80%)	16 ..	..	1 (under 20%)
United Kingdom	Janet	200 (over 80%)	35 (over 80%)	550 (over 80%)	6 (20%–40%)

Source: TERENA Compendium 2012, Table 2.2.1.

Note: .. not available.

Table 3.6 shows that in most countries, the majority of universities and research centres are connected to a NREN. Three in four countries (37 out of 50) had more than 80 per cent of universities connected by the NREN(s). Russia, and Bosnia and Herzegovina had between 60 to 80 per cent of universities connected by NREN(s) and remaining countries had a lower level of connection or had data missing. The data are consistent with the overall results from Table 3.5 above that suggest that universities and research centres are connected to a large extent.

However, Table 3.6 also shows that very few government departments engaged in R&D are connected to NRENs. Two in three countries (31 out of 43) had fewer than 20 per cent of their government departments engaged in R&D connected to NRENs. This suggests missed opportunities as government departments implement far-reaching policies that can advance progress made towards the MDGs; such efforts are likely to be strengthened by stronger connections to scientific research through NRENs. Government departments also determine the extent of resources that can be mobilized for the development of NRENs; NREN administrators could therefore do more to reach out to government departments engaged in R&D. For NRENs to be sustainable, the commitment of all major stakeholders is required. For research centres and universities, having direct access to government departments means potentially gaining access to large data sets that can enrich their research. Without strong links to government departments, NRENs may not be fully realizing their potential for enabling policy-relevant research and innovation. Even as Table 3.6 shows good connectivity between NRENs and universities and research centres, it also suggests that there is room for greater collaboration between policy-makers, and scientists and academics.

On the other hand, TERENA (2013) noted that NRENs may be advantaged if they can operate independently of government, with advantages including easier decision-making processes and the ability to recruit and retain suitably-qualified staff. There is of course no 'one-size-fits-all' model for the establishment and development of NRENs, and their future development at country level depends on factors such as the priority given to R&D.

Besides facilitating innovation and collaboration, NRENs also serve the important function of making the delivery of tertiary education viable for developing countries. Box 3.5 describes the challenges that Caribbean tertiary institutions face and the role that NRENs play in meeting those challenges. This case study also illustrates why the consideration of local context is important in implementing NREN development plans.

Box 3.5: Caribbean NRENs and tertiary education

Tertiary institutions in the Caribbean face a number of challenges with regard to the quality of education they can offer.[18] Apart from the University of the West Indies, which had a student population of 48 000 in 2012, most colleges and universities are relatively small and offer a narrow range of programmes. Because of their size, institutions do not have the critical mass required to offer all the programmes needed to satisfy the demand for skilled professionals in the Caribbean. These smaller universities and colleges are also unable to individually afford the cost of infrastructure and resources required to adequately deliver courses to students. There are only a few institutions offering programmes in the areas of critical need such as science and technology; this situation is exacerbated by a lack of qualified lecturers in mathematics and science subjects.

Without the prospect of quality education, young and talented Caribbean citizens are leaving their home countries in order to complete their education. In Jamaica, roughly 80 per cent of the potential number of tertiary graduates has left the country. The resulting 'brain drain' is likely to hold back the development of Caribbean countries.

One way that Caribbean universities can improve their capacity to deliver higher quality education is to work in networks. By establishing a NREN and connecting it to the regional NREN (C@ribNET), universities can improve the viability of their education and research efforts. In November 2013, UWI conducted its first telemedicine transmission from its campus in Jamaica to medical students and staff in Trinidad and Tobago, and Barbados, using C@ribNET. This was a demonstration of how a regional NREN can “enable much greater teaching and learning possibilities and reach the thousands of students that matriculate annually but are not afforded tertiary education due to lack of space” said Mr Ken Sylvester, CEO of the Caribbean Knowledge and Learning Network, CKLN.

About C@ribNET

The aim of C@ribNET is to bridge the digital divide in the region and achieve social cohesion of Caribbean people through digital inclusion. The Caribbean was, until recently, one of the few regions of the world without a regional research and education network. Through C@ribNET, communities of interest are now being organised to implement priority applications such as a digital library, a shared student information system for tertiary institutions, and applications supporting issues such as climate change, disaster management, crime and security, telehealth and culture.

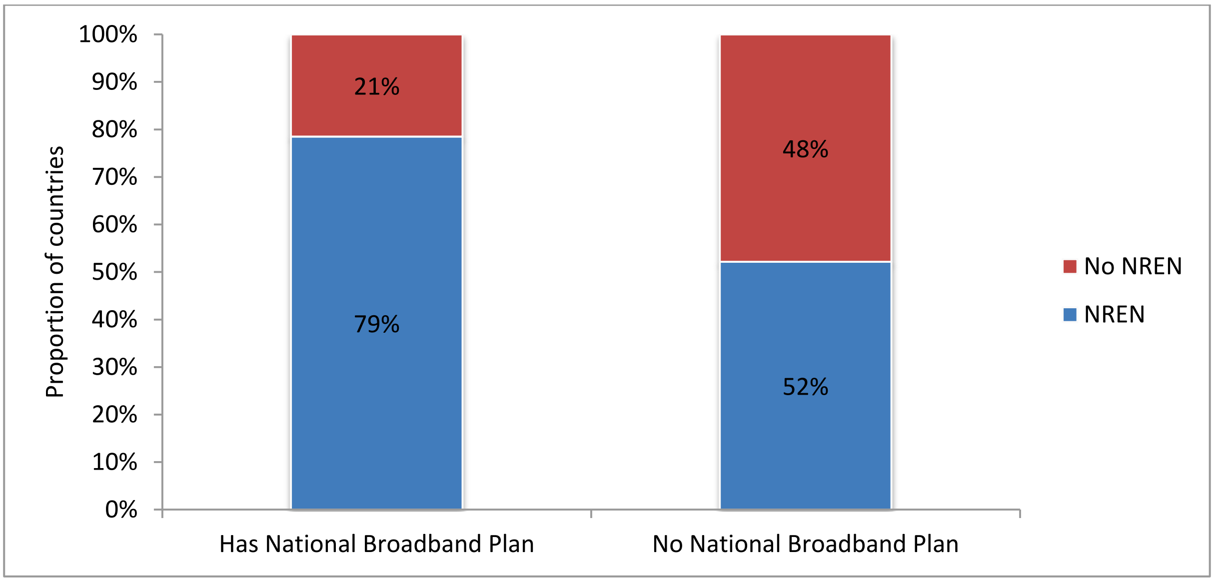
Source: www.ckln.org.

NRENs and national broadband plans

Ideally, the development of national broadband plans would bring together policy-makers and NREN administrators. Research conducted by the Broadband Commission for Digital Development (Broadband Commission for Digital Development, 2013) suggests that the introduction or adoption of a national broadband plan is associated with, on average, 2.5 per cent higher fixed broadband penetration and 7.4 per cent higher mobile-broadband penetration. This improvement is a logical consequence of the focusing of policies and efforts that is associated with development of a national broadband plan.

This section examines the relationship between the presence of a national broadband plan and a NREN. Chart 3.1 illustrates the status of national broadband plans and NRENs in the 193 countries that provided information to the Broadband Commission for Digital Development (2013).[19] The chart shows that countries that had a national broadband plan in 2013 were much more likely to also have a NREN. Of the 193 countries for which data are available, 135 had broadband plans and 79 per cent of these countries had at least one NREN. Of the 46 countries with no national broadband plan, slightly over half had at least one NREN. Of the 12 countries reporting that they were in the planning phase of a national broadband plan, five had a NREN and seven did not.

Chart 3.1: Status of national broadband plans and NRENs, 2013



Source: ITU research.

National agencies that implement a national broadband plan and NREN in tandem could benefit from synergies between the two sets of activities, in the form of streamlined processes and resulting cost savings. Formulating national broadband plans that encompass the implementation of NRENs would allow countries to incorporate the infrastructure needs of scientific and research institutes.

Conclusions and recommendations

In the information society, the ways in which knowledge is created, processed, diffused and applied have been revolutionized – in part through rapid developments in ICT (UNESCO, 2013). Sophisticated ICTs can facilitate the creation of dynamic networks, cross-border collaborative processes and internationalization of research and higher education. In line with the goal of making the benefits of ICT available for all, the aim of Target 3 is to connect all scientific and research centres with ICTs. The indicators defined by Target 3 include broadband Internet and connections to NRENs. Data from the three indicators for Target 3 indicate that the target of “all” scientific and research centres has not been achieved, but that significant progress has been made.

Indicator 3.1 focuses on connecting scientific and research centres with broadband Internet. Where data were available, connectivity was high – typically 100 per cent – but there were a few countries that had yet to achieve this target. Unfortunately, the conclusions that can be drawn from Indicator 3.1 are limited because of very low data availability. Should there be tracking post-WSIS, it is recommended that Indicator 3.1 be dropped because lack of data results in a limited and unrepresentative picture of the connection of scientific and research centres with broadband Internet. In addition, there is no international organization collecting data for Indicator 3.1, therefore making it difficult to update.

Indicator 3.2 measures whether a country has one or more NRENs and what their bandwidth is. For this report, Indicator 3.2 was extended to include monitoring of regional NRENs and NREN consortia. Significant progress has been made in increasing the total number of NRENs, regional NRENs and countries with a NREN. Bandwidth has also increased considerably from megabit capacity to gigabit capacity. Progress was particularly noteworthy in Africa, where the number of regional NRENs increased from none in 2010 to three by the end of 2012. Looking forward, it is recommended that monitoring of this indicator be continued, with the addition of monitoring of regional NRENs and NREN consortia.

Indicator 3.3 measures the proportion of public scientific and research centres that have direct or indirect broadband Internet access to a NREN, where at least one exists in the country. In most countries for which data are available, the majority of universities and research centres are connected to a NREN. On the other hand, very few government departments engaged in R&D are connected to a NREN, suggesting that this is an area requiring greater collaboration between policy-makers, and scientific and research centres.

As the requirements of research and education continue to evolve, any effort to track progress should keep pace with technological developments. The current indicators focus on infrastructure (connection to broadband Internet and NRENs) as a reflection of a country's ability to participate in international research. Indeed, the three action lines that inform Target 3 emphasize the role of ICTs in networking of research institutions and thereby supporting access to, and production of, information and knowledge. Should there be future monitoring of this area post-WSIS, a revised target could include the means of sharing information and knowledge, including different software models, innovative forms of networking, ways of adapting ICT infrastructure, and software tools and applications.

To mobilize resources required to continue the development of NRENs and regional NRENs, network administrators are increasingly engaging other stakeholders, such as government departments. NRENs may offer a variety of services and activities beyond infrastructural connectivity. As an example, a paper produced by NORDUnet on the role of NRENs in 2020 (NORDUnet, 2013) proposes that NRENs should adopt a user-centric approach that integrates the following concepts of NRENs:

1. as global network service providers
2. as community service providers
3. as e-science enablers
4. as e-education enablers
5. as innovative framework providers.

The preceding discussion suggests three possible areas related to science and research in the information society that could be tracked post-2015.

First, in order to ensure that developing countries that are just beginning to establish their NRENs are not left behind, it is important to monitor the presence of a NREN in the country.

Second, researchers will find that global partnerships and major research programs will offer resources and capabilities that are beyond those that can be mustered by a single country. Thus, the linkages between the national NREN to regional NRENs should also be tracked to reflect the trend in global collaborative research.

Third, Target 3 should evolve from measuring infrastructure to measuring impacts and outputs of the infrastructure. As scientific and research centres around the world become increasingly inter-connected, attention should also turn to the impact of NRENs in terms of generating and sharing scientific knowledge. Developing countries, particularly LDCs, continue to lag behind in access to scientific information and knowledge and open access to research articles and data would help to narrow the gap. Open access has reached a 'tipping point' according to the European Commission (2013). Following recommendations arising from three studies, the European Commission has mandated open access for scientific publications that are produced with funding from *Horizon 2020*, the EU's Research and Innovation funding programme for 2014–2020.[20] The articles produced from Horizon 2020-funded research will either immediately be made accessible online by the publisher, or researchers will make their articles available through an open access repository no later than six months (12 months for articles in the fields of social sciences and humanities) after publication.

As a way of moving forward, tracking the availability of open access scientific knowledge could be linked to WSIS Target 9 (Encourage the development of content). Tracking of the other suggested indicators could be done in collaboration with TERENA and other regional NRENs, given their increasing reach. The key challenges here are the standardization of statistical units and harmonizing efforts so that data collected are compatible and collection efforts are not duplicated.

Finally, one recommendation made earlier was that global multistakeholder partnerships need to be intensified. The role of scientists and academics is essential in the endeavour to share the benefits of technology and innovation. Open access to data and knowledge is a key means of achieving this goal and a conducive policy environment for sharing scientific knowledge would be fundamental to the achievement of a target on technology and scientific research.

Annex 3.1: List of known NRENs by end 2013

Country	NREN	Country	NREN
Afghanistan	AFRENA	**Lithuania**	LITNET
Albania	ANA	**Luxembourg**	RESTENA
Algeria	ARN; CERIST; CNTI	**Madagascar**	iRENALA
Argentina	Innova-Red; RETINA	**Malawi**	MAREN
Armenia	ASNET-AM	**Malaysia**	MYREN
Australia	AARNet	**Mali**	MaliREN
Austria	ACOnet	**Malta**	UoM/RicerkaNet
Azerbaijan	AzRENA; AzScienceNet	**Mexico**	CUDI
Bahamas	BAHAREN	**Moldova**	RENAM
Bangladesh	BDREN	**Montenegro**	MREN
Barbados	BREN	**Morocco**	MARWAN
Belarus	BASNET	**Mozambique**	MoRENet
Belgium	BELNET	**Namibia**	X-net
Belize	BELREN	**Nepal**	NREN
Bhutan	DrukREN	**Netherlands**	SURFnet
Bolivia	BOLNET; ADSIB	**New Zealand**	KAREN; REANNZ
Bosnia and Herzegovina	SARNET	**Nicaragua**	RENIA
Brazil	RNP	**Nigeria**	ngREN
Brunei Darussalam	BRUNET	**Norway**	UNINETT
Bulgaria	BREN	**Oman**	OMREN
Cambodia	ITC	**Pakistan**	PERN
Cameroon	CameroonianNRET	**Palestinian Authority**	PALNREN; GCC; PAD12
Canada	CANARIE	**Panama**	RedCyT
Chile	REUNA	**Papua New Guinea**	PNGARNet
China	CERNET; CSTNET	**Paraguay**	ARANDU
China, Hong Kong	HARNET	**Tajikistan**	TARENA
Colombia	RENATA	**Peru**	RAP
Congo (Democratic Republic of the)	Eeb@le	**Philippines**	PREGINET; ASTI
Costa Rica	RedCONARE	**Poland**	PSNC; PIONIER
Cote d'Ivoire	RITER	**Portugal**	FCCN
Croatia	CARNet	**Qatar**	Qatar Foundation
Cuba	RedUniv	**Romania**	RoEduNet
Cyprus	CyNET	**Russia**	e-ARENA; RUNNet/RBNet; FREEnet
Czech Republic	CESNET	**Rwanda**	Rwednet
Denmark	DeIC; UNI-C	**Saudi Arabia**	Sarinet; ISU
Dominican Rep.	RADEI	**Senegal**	snRER
Ecuador	CEDIA	**Serbia**	AMRES
Egypt	EUN	**Singapore**	SingAREN

Country	NREN	Country	NREN
El Salvador	RAICES	**Slovak Republic**	SANET
Estonia	EENet	**Slovenia**	ARNES
Ethiopia	EthERNet	**Somalia**	SomaliREN
Finland	Funet	**South Africa**	TENET; SANReN
France	RENATAR	**Spain**	RedIRIS
Gabon	GabonREN	**Sri Lanka**	LEARN
Georgia	GRENA	**Sudan**	SudREN; SUIN
Germany	DFN	**Suriname**	SUREN
Ghana	GARNET	**Sweden**	SUNET
Greece	GRNET S.A.; Ariadnet	**Switzerland**	SWITCH
Guatemala	RAGIE	**Syria**	HIAST; SHERN
Haiti	CORPUHA	**T.F.Y.R. Macedonia**	MARnet
Honduras	UNITEC	**Tanzania**	TERNET
Hungary	NIIF/HUNGARNET	**Thailand**	ThaiREN; Uninet
Iceland	RHNet	**Togo**	TogoREN
India	ERNET; NKN	**Trinidad and Tobago**	TTRENT
Indonesia	INHERENT-DIKTI	**Tunisia**	CCK; RNRST
Iran, Islamic Rep.	IRANET/IPM	**Turkey**	ULAKBIM
Ireland	HEAnet	**Turkmenistan**	TuRENA
Israel	IUCC	**Uganda**	RENU
Italy	GARR; INFN	**Ukraine**	URAN; UNREN; UARNet
Jamaica	JREN	**United Arab Emirates**	ANKABUT
Japan	SINET; JGN2plus; MAFFIN, NII	**United Kingdom**	Janet
Jordan	JUNet/UniCo	**United States**	Internet2; NLR; CalREN
Kazakhstan	KazRENA	**Uruguay**	RAU2
Kenya	KENET	**Uzbekistan**	UzSciNet
Korea, Rep.	KOREN; KREONET	**Venezuela**	REACCIUN
Kyrgyzstan	KRENA-AKNET	**Viet Nam**	VinaREN; NACESTI
Lao P.D.R.	LERNET	**Zambia**	ZAMREN
Latvia	SigmaNet		
Lebanon	CNRS		

Source: ITU research based on TERENA Compendium and other publicly available information.

Annex 3.2: Regional or NREN consortia and their members by end 2013

Arab States Research and Education Network			
Algeria	Oman	Saudi Arabia	Tunisia
Egypt	Morocco	Somalia	United Arab Emirates
Jordan	Palestine	Sudan	
Lebanon	Qatar	Syria	
UbuntuNetAlliance – Eastern and Southern Africa			
Congo	Malawi	Somalia	Uganda
Ethiopia	Mozambique	South Africa	Zambia
Kenya	Namibia	Sudan	
Madagascar	Rwanda	Tanzania	
West and Central African Research and Education			
Cote d'Ivoire	Ghana	Niger	Senegal
Gabon	Mali	Nigeria	Togo
Asia-Pacific Advanced Network (APAN) – Asia/Pacific			
Australia	Japan	New Zealand	Sri Lanka
China	Korea, Rep.	Pakistan	Thailand
China, Hong Kong	Malaysia	Philippines	Viet Nam
India	Nepal	Singapore	
Central Asia Research and Education Network			
Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan
Cooperación Latino Americana de Redes Avanzadas			
Argentina	Costa Rica	Guatemala	Peru
Bolivia	Chile	Mexico	Uruguay
Brazil	Ecuador	Panama	Venezuela
Colombia	El Salvador	Paraguay	
Nordic Infrastructure for Research & Education			
Denmark	Iceland	Norway	Sweden
Finland			
Trans-European Research and Education Networking			
Albania	Estonia	Latvia	Romania
Armenia	Finland	Lithuania	Serbia
Austria	France	Luxembourg	Slovakia
Azerbaijan	Germany	Malta	Slovenia
Belarus	Greece	Moldova	Spain
Belgium	Hungary	Montenegro	Sweden
Bulgaria	Iceland	Netherlands	Switzerland
Croatia	Ireland	Norway	TFYR of Macedonia
Cyprus	Israel	Poland	Turkey
Czech Republic	Italy	Portugal	United Kingdom
Denmark			

Source: ITU research based on TERENA Compendium and other publicly available information.

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Endnotes

[1] The original WSIS indicator was worded slightly differently "Connect scientific and research centres with ICTs". Note that universities have been included in this target and removed from Target 2.

[2] Refers to high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s (*Partnership*, 2011).

[3] Open Access policy for FP7 research has been endorsed since 2008, http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=1300&lang=1.

[4] United Nations Economic and Social Council.

[5] See http://www.unesco.org/new/en/communication-and-information/flagship-project-activities/unesco-and-wsis/implementation-and-follow-up/unesco-and-wsis-action-lines/c7-e-science/.

[6] International Standard Classification of Education.

[7] WTDR 2010 used definitions from UNESCO's "Questionnaire on Statistics of Science and Technology" (UIS, 2010b). 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". It includes research related to economics or sociology, but excludes routine testing, censuses and market studies.

[8] See the International Standard Classification of Education (UNESCO, 1997) at http://www.unesco.org/education/information/nfsunesco/doc/isced_1997.htm.

[9] The term "NREN" was originally a service mark of the U.S. government but the term is now applied to national research and education networks more widely.

[10] 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.

[11] Internet2, NORDUnet, ESnet, SURFnet, CANARIE, and GÉANT.

[12] However, note that this report also uses the unit Gbit/s to describe this indicator.

[13] 1 Gbit/s = 1024 Mbit/s.

[14] See http://www.terena.org/activities/compendium/.

[15] At a regional level, NRENs join together to form regional research and education (R&E) networks, greatly enhancing the opportunities for working together on issues of concern to more than just one country. NREN consortia can comprise research institutes within a country, for example, Consortium GARR in Italy, or between countries, for example, the GÉANT consortium that comprises NRENs from over 65 countries, see http://www.dante.net/Research_Networking/Pages/Home.aspx.

[16] The 2013 TERENA Compendium has been made available after this chapter was completed (http://www.terena.org/activities/compendium/index.php?showyear=2013).

[17] Refers to government departments involved in research and development.

[18] See NRENs in the Caribbean at http://www.ckln.org/home/content/publications.

[19] Of those countries, 12 reported that they were in the planning phase of a national broadband plan. Those countries are excluded from Chart 3.1.

[20] See http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=1294&lang=1.

CONNECT ALL PUBLIC LIBRARIES, MUSEUMS, POST OFFICES AND NATIONAL ARCHIVES WITH ICTs

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

Executive summary

WSIS Target 4 measures the extent to which public libraries, museums, post offices and national archives are connected with ICT. Those institutions are highly relevant to the information society as repositories of, and public access points to, knowledge and information. They are also centres of learning and education, communication and commerce. Connecting public libraries, museums, post offices and national archives with ICT serves multiple purposes:

- Bringing those institutions online increases the reach and accessibility of their holdings.
- Public libraries and post offices are in a unique position to provide access to ICTs.
- Beyond providing access to ICTs, libraries can serve as a venue for ICT education and capacity building.
- ICTs can improve the operations of these institutions.

The tracking of each of the subtargets of Target 4 is hampered by a lack of comprehensive and internationally comparable data. Available data suggest that many libraries, museums, post offices and archives had a broadband Internet connection and some sort of web presence by 2013 (or latest year for which data are available). Even less information is available on the extent of digitization, but available data suggest that a lot remains to be done in terms of digitizing cultural heritage and making it available online. With regards to public libraries and post offices as providers of public Internet access, available data show that while some progress has been made, libraries and post offices remain largely untapped as public access venues.

Moving forward, post-2015 discussions should distinguish between public access to ICTs and online content related to culture, in particular:

1. Despite the continuous growth in Internet access, there will continue to be a need for public access to the Internet for the foreseeable future – in particular for poor and underserved rural communities in developing countries. Public libraries and post offices are in a unique position to provide public access to ICTs: they are open to the public, their branches are widely spread and they constitute an established source of information.
2. Libraries, museums and archives are repositories of knowledge and information. They present an authoritative source of content and can put information into context. By digitizing books, documents and objects and making them available online, libraries, museums and archives are major providers of online cultural content.

Future tracking of the ICT-connectedness of libraries, museums, post offices and archives could thus be divided into two parts and merged with possible post-2015 targets focusing on online content creation and connecting people with ICTs.

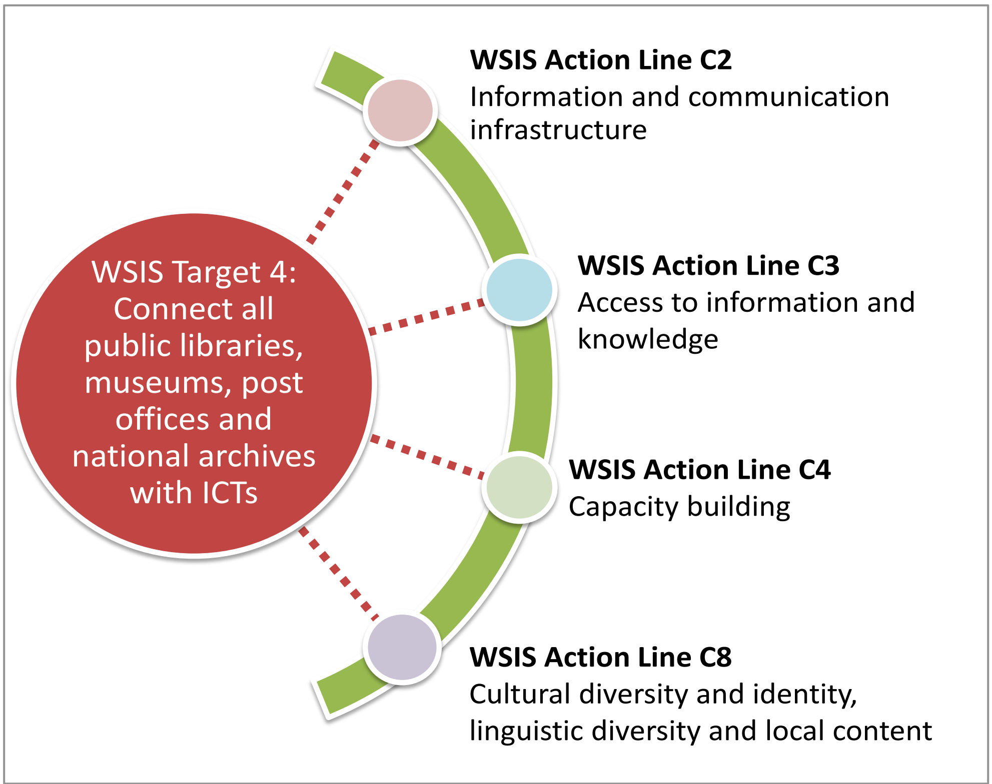
Introduction

WSIS Target 4 measures the extent to which public libraries, museums, post offices and national archives are connected with ICTs. Those institutions are highly relevant to the information society as repositories of, and public access points to, knowledge and information. They are also centres of learning and education, communication and commerce. Connecting public libraries, museums, post offices and national archives with ICTs serves multiple purposes:

- Bringing those institutions online increases the reach and accessibility of their treasury of information.
- Public libraries and post offices in particular are in a unique position to provide access to ICTs given that they are open to the general public, established as resources of information and their branches can generally be found throughout a country.
- Beyond providing access to ICTs, libraries in particular, can serve as a venue for ICT education and capacity building.
- ICTs can improve the operations of these institutions; this ranges from post offices offering track-and-trace services to archives and museums digitizing content to preserve their collections.

Given the numerous purposes that connecting public libraries, museums, post offices and national archives with ICTs can serve, Target 4 is relevant to a number of WSIS action lines as shown in Figure 4.1.

Figure 4.1: Relevance of Target 4 to WSIS action lines



Action Line C2 (Information and communication infrastructure) is concerned with ICT infrastructure and calls on governments to "… 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 the context of national e-strategies." (ITU, 2005)

Action Line C3 (Access to information and knowledge) includes several calls for action with regards to public libraries and archives. In particular, it calls for the "… creation and development of a digital public library and archive services … including reviewing national library strategies and legislation, developing a global understanding of the need for "hybrid libraries",[2] and fostering worldwide cooperation between libraries." Furthermore, Action Line C3 supports open access to information by stating that "Encourage initiatives to facilitate access, including free and affordable access to open access journals and books, and open archives for scientific information." Action Line C3 calls on governments to "… establish sustainable multipurpose community public access points. 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 ...".

Action line C4 (capacity building) relates, among other things, to the capacity building potential of public libraries and post offices and calls on governments to "Promote e-literacy skills for all, for example by designing and offering courses for public administration, taking advantage of existing facilities such as libraries, multipurpose community centres, public access points and by establishing local ICT training centres with the cooperation of all stakeholders." Action Line C4 furthermore underlines the importance of designing "… specific training programmes in the use of ICTs in order to meet the educational needs of information professionals, such as postal workers and other relevant professional groups."

Finally, Action Line C8 (Cultural diversity and identity, linguistic diversity and local content) is concerned with public libraries, archives and museums as generators of content and stewards of a country's cultural heritage. In particular, it calls on countries to "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." Furthermore, it calls on countries to "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." Action Line C8 also includes a call to "Support local content development, translation and adaptation, digital archives, and diverse forms of digital and traditional media by local authorities."

Target 4 is furthermore linked to Target 1. Post offices and libraries can serve rural communities as public Internet access venues and thus contribute to the achievement of Target 1 (Connect all villages with ICTs and establish community access points). Post offices and libraries are also important providers of online content, and in particular local content, and are thus highly relevant to 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).

While Target 4 is highly relevant to different WSIS action lines, there are serious limitations regarding the availability of data for this target. General statistics on public libraries, museums and national archives at the international level are lacking, let alone, statistics on ICTs. Ad hoc data collection exercises have found that definitions, functions and organizational structures of these institutions vary across countries, thus adding to the challenge of producing internationally comparable data. Post office statistics are an exception, as data are regularly collected by the Universal Postal Union (UPU) following well-established definitions.

This chapter will provide an analysis of data availability based on the indicators as defined in the 2011 WSIS statistical framework (*Partnership*, 2011) and a discussion on the achievement of the target for each of the institutions covered by WSIS Target 4, namely public libraries, museums, post offices and national archives. The conclusion will summarize the progress made in connecting these institutions with ICTs and provide recommendations for the way forward.

Achievements against Target 4

Public libraries

While access to the Internet continues to expand, it is still not available to the majority of the world's population. In 2013, 39 per cent of the world's population was using the Internet. In developing countries, the percentage was lower at 31 per cent and in least developed countries only 8 percent of individuals were Internet users. Millions of people around the world rely on public access venues, such as public libraries, to go online.[3] The library is often the only place in many communities where people can use ICTs to access information that will help them to improve their education, develop new skills, find jobs, build businesses, make informed agricultural and health decisions, or gain insights into environmental issues (Sey *et al*., 2013). Data from the International Federation of Library Associations and Institutions (IFLA) show that globally there are more than 330 000 public libraries, of which 73 per cent are located in developing and transitioning countries.[4] Public libraries reach populations underserved by other institutions, and they come with the support of library staff who are on hand to offer advice and training. As part of many countries' existing infrastructure, and often a key component of a country's cultural heritage, public libraries are known and respected institutions, in many cases established and maintained by governments.

A five-year research project (2007–2012) – the Global Impact Study of Public Access to Information & Communication Technologies – carried out by the Technology & Social Change (TASCHA) group at the University of Washington Information School, showed that public libraries play a critical role in extending the benefits of ICTs to a diverse range of people worldwide. The results show that a central impact of public libraries is promoting digital inclusion, information access and development of ICT skills through technology provision, particularly for marginalized populations and those who face challenges using and benefiting from computers and the Internet (Sey *et al*., 2013).

In the United States, public libraries have successfully made the transition from a traditional depot of books to also opening access to the web's almost endless wealth of information. A 2010 study, *How the American Public Benefits from Internet Access at U.S. Libraries* (Becker *et al*., 2010), shows that in US libraries "Internet access is now one of the most sought after public library services, and it is used by nearly half of all visitors." Research from the Pew Research Center confirms these findings: in a national survey conducted in 2012, it was found that 77 per cent of Americans say that free access to computers and the Internet is a "very important" service of libraries. This compares to 80 per cent of Americans saying that borrowing books – a traditional service offered by libraries – is a "very important" service (Zickuhr *et al*., 2013).

Apart from providing public access to the Internet, libraries are repositories of knowledge and information. They provide a venue in which to read and study as well as a collection of books, journals and other resources to the general public. The continuing growth of the information society has a direct and important impact on libraries, with more and more books, documents, journals and other resources available and accessed online. As the media that libraries are offering are evolving, the role of libraries is changing as well.

Box 4.1: The Economic Commission for Africa's digital institutional repository

In its over 50 years of existence, the United Nations Economic Commission for Africa (UNECA) has created and holds a vast quantity of information and knowledge in a variety of formats, including printed and electronic. These represent the corporate memory, providing historical evidence of its actions and decisions. Begun in 1959 as a traditional document repository accessed by a card catalogue, the UNECA library has adapted over time to provide its material in a digital format so that knowledge organizations and individuals can access it around the world. The information resources include published materials such as flagship publications, journal articles, conference proceedings, technical and annual reports, working papers, policy briefs, speeches, UN resolutions and various multimedia products, all which include information and research on economic and social developments in Africa.

In 2008, a proposal was brought forward to develop an institutional repository (IR) that would provide an online mechanism for collecting, preserving and disseminating all UNECA publications and other information resources in a digital format. Other overarching objectives were to establish and endorse an institutional framework, including policies and guidelines that promote proper development, the management and preservation of UNECA intellectual output, and the digitization and online dissemination of all print collections.

The IR hosts over 19 000 documents grouped into 13 categories, including amongst others, economic development, gender issues, political and legal questions, as well as transport and communications. The usage statistics indicate that the repository is widely accessed, with on average 200 000 hits and 100 000 documents downloaded per month by users from all over the globe (see table below).

UNECA institutional repository, number of views, top ten countries, 2013

Country	Views
United States	91,870
Korea, Rep.	5,077
Italy	4,583
China	2,072
Nigeria	1,726
France	849
Ireland	848
Ethiopia	573
United Kingdom	539
Ukraine	534

Today, the wealth of knowledge generated by UNECA since 1958 is well organized, preserved and widely accessible worldwide over the Internet. Furthermore, the IR activities have been streamlined with the regular knowledge and library services activities. Its activities are linked to the Access to Scientific and Socio-economic Knowledge in Africa (ASKIA) online portal, which was developed as a federated search engine to be a one-stop-shop able to meet the demand for knowledge from Africa and beyond. The first phase of the UNECA IR project was completed in 2011 and the second phase of sustaining the growth of the repository has continued since then. In 2014, the inclusion of multimedia resources such as videos, photos, speeches and press releases started, hence ensuring that all types of the Commission's information resources are captured in the UNECA IR.

Source: UNECA.

By digitizing their rich repository and making it available online, libraries can significantly extend their reach, facilitate access to information and better serve their users (see Box 4.1). The digitized library refers to everything from the offering of e-books, e-journals and other electronic resources, to the digitization of key national heritage documents or the availability of a digital card catalogue. By creating digital public libraries and providing free or affordable access to open access journals and books, libraries make an important contribution in promoting the information society.

Indicators for measuring the subtarget

Indicators 4.1 and 4.3 of Target 4 address the ICT connectivity of public libraries worldwide, and are designed to support the measurement of progress in the WSIS action lines whose goals indicate a requirement for high-speed Internet connectivity. Indicator 4.2 tracks public libraries as providers of public Internet access.

Indicator 4.1: Proportion of public libraries with broadband Internet access

Indicator 4.2: Proportion of public libraries providing public Internet access

Indicator 4.3: Proportion of public libraries with a web presence.

The choice of indicators acknowledges the diverse functions of libraries. Indicator 4.1 measures how far libraries themselves are connected to the Internet, which is of course the foundation for integrating ICTs in their work. Indicator 4.2 is concerned with how libraries are providers of Internet access to the general public. The third indicator (4.3), measures how far libraries are represented on the web – with a website/homepage or presence on another entity's website. The information made available on a library's webpage will vary considerably, thus a limitation of the indicator is that a web presence *per se* does not reveal anything about the quality of information.

Unfortunately, the availability of data for each of the indicators is variable at best. A 2007 library pilot survey, conducted by the UNESCO Institute for Statistics (UIS) in Latin America and the Caribbean, collected information on the number of public libraries with websites but it currently has no plans to resume its library survey in the short-term.[5]

The largest data collection exercise in relation to the indicators was undertaken by IFLA during the period 2005–2009 when it surveyed its member countries regarding the extent to which libraries are providing public Internet access across different library types, including public libraries.[6] These surveys provide some data for Indicator 4.2. The IFLA *World Report 2010* (IFLA, 2010) includes data from 122 countries.

A number of countries collect data on the ICT characteristics of their national public library networks. For example, in Australia, National and State Libraries Australasia (NSLA) published a statistical report on public libraries, including data on the 'number of service points with public access Internet terminals' and 'public use computer terminals' for the year 2011–12 (State Library of Queensland, 2013). In Europe, the Conference of National Librarians (CENL) has a Working Group on Performance Evaluation, which has defined indicators for measuring digital services by national libraries. Results are published in the national reports to CENL.[7] The Institute of Museum and Library Services carries out an annual data collection on public libraries in the United States. The survey measures 'usage sessions on public access Internet computers at public libraries' and the number of 'public access Internet computers available at public libraries'.[8]

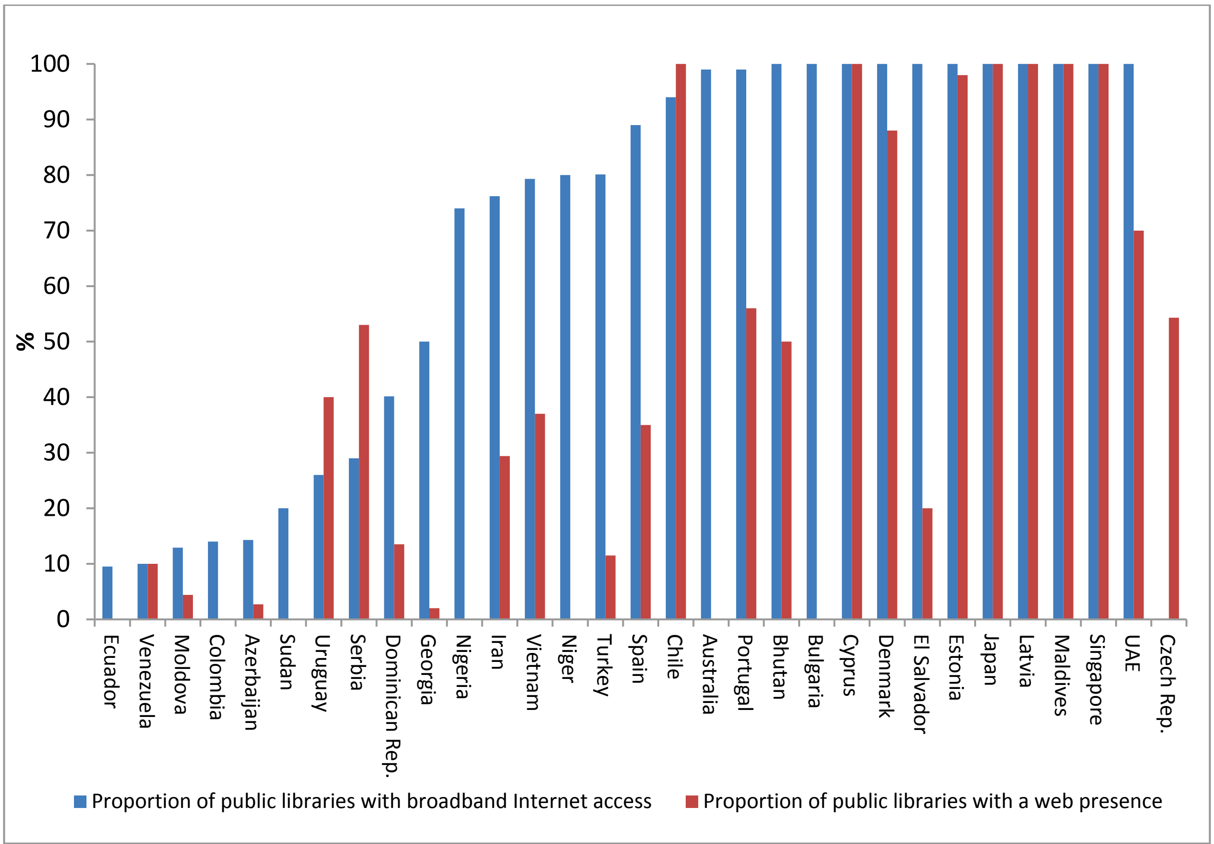
Apart from a lack of globally available and comparable data on libraries and ICTs at the global level, monitoring the subtarget is further complicated by issues concerning the definition of public libraries. In some countries, public libraries are centrally administered while in others, the system is decentralized. Therefore, it might not always be clear whether surveys capture all relevant public library units. Furthermore, how a public library is defined might differ as well.[9] For example, a study conducted by the University of Washington's TASCHA group revealed that "despite the information in many administrative sources, the majority of public libraries in the core research countries did not in fact meet the [study's] definition of public access" (Sey *et al*., 2013).

Status of the subtarget

The 2013 *Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013* (*Partnership*, 2013) collected information on the extent of ICT connectivity of public libraries. However, given the very low response rate, the results do not allow for conclusions at the global or regional level. Chart 4.1 shows that in 13 out of 30 countries that provided data on the proportion of public libraries with broadband Internet access, all (or nearly all) public libraries were connected in 2013. This includes mostly developed countries such as Denmark, Estonia, Japan and Latvia, but also some developing countries such as Bhutan, El Salvador and the Maldives.

The proportion of public libraries with a web presence is generally much lower, with only 7 out of 26 countries reporting that all (or nearly all) of their public libraries had a web presence. In half of those countries (13 out of 26), less than 50 per cent of the countries' public libraries had a web presence. In two countries, Niger and Sudan, no public library had a web presence and in Azerbaijan and Georgia very few (under 3 per cent) public libraries had a web presence. A comparison over time regarding the ICT connectivity of public libraries is very difficult to make, as the countries responding to the 2013 and 2009 WSIS targets questionnaires are almost completely different. Of the few countries that responded in both years, Denmark, Latvia and Singapore already had connected all public libraries by 2009. In the Czech Republic, the proportion of public libraries with a web presence almost doubled from 30 per cent in 2009 to 54 per cent in 2012. Turkey also made good progress and in 2013, 12 per cent of public libraries had a web presence, compared to only 3 per cent in 2009.

Chart 4.1: Public libraries with broadband Internet access/a web presence, 2013 or LYA[10]



Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013 (*Partnership*, 2013).

Note: Niger and Sudan have data on web presence, with a zero value.

The IFLA/FAIFE *World Report* series reveals information about the extent and growth of public access to the Internet in public libraries for the years 2007 and 2009 (IFLA/FAIFE, 2007; IFLA, 2010). It is difficult to compare all reports due to different numbers of countries responding each year[11] but by 2009 it was possible to see an overall increase in levels of public access to the Internet in public libraries among responding countries. Table 4.1 shows the number and percentage of public libraries offering Internet access by region. Respondents were asked to estimate the levels of public Internet access in bands of access ranging from less than 20 per cent to 81–100 per cent of public libraries in a country offering public Internet access.

Across Africa, public access to the Internet in public libraries is very low, with 14 of the 22 countries responding to the 2009 questionnaire indicating that they do not offer access to the Internet in more than 20 per cent of their public libraries.[12] In Asia the situation is somewhat better, with 6 out of 27 responding countries able to offer access in 81–100 per cent of public libraries. In Latin America and the Caribbean, public access has expanded over the duration of IFLA's data collection, and by 2009, ten of the 21 countries reported that 81-100 per cent of their public libraries were able to provide Internet access. This compares with 6 out of 22 countries in 2007. However, despite progress across both Asia and the Latin America and the Caribbean regions, there still remain a number of countries (31) reporting low rates of public access.

Europe's public libraries have been able to expand Internet access during the period of the IFLA surveys, with 59 per cent of responding countries in 2009 able to offer Internet access in 81–100 per cent of public libraries.

Overall, the 2009 IFLA results show an improvement over 2007, which in turn was an improvement on 2005. However, improvements in providing public Internet access in public libraries have not been evident everywhere, and four of the six countries that have reported less than 20 per cent access in 2007 or earlier (Moldova, Romania, Russia and Ukraine) were still at this level in 2009. In every contribution to the IFLA/FAIFE *World Report* series the United States, Canada, New Zealand and Australia all reported that 81–100 per cent of their public libraries offer Internet access.

The *World Report* series shows that there are significant differences between developed and developing countries in terms of providing public Internet access in public libraries. The necessary infrastructure to access the Internet, costs related to Internet access and the implied financial burdens are all factors that play an important role in the limited access to the Internet in public libraries of the developing world. From the overall statistics, it is evident that (Western) Europe, North America, Australia and New Zealand have the best Internet access in all categories, whereas Africa has the lowest.

Table 4.1: Public libraries offering public Internet access, by region, 2007 and 2009

In your estimate, what percentage of all public libraries in your country offers Internet access to users?

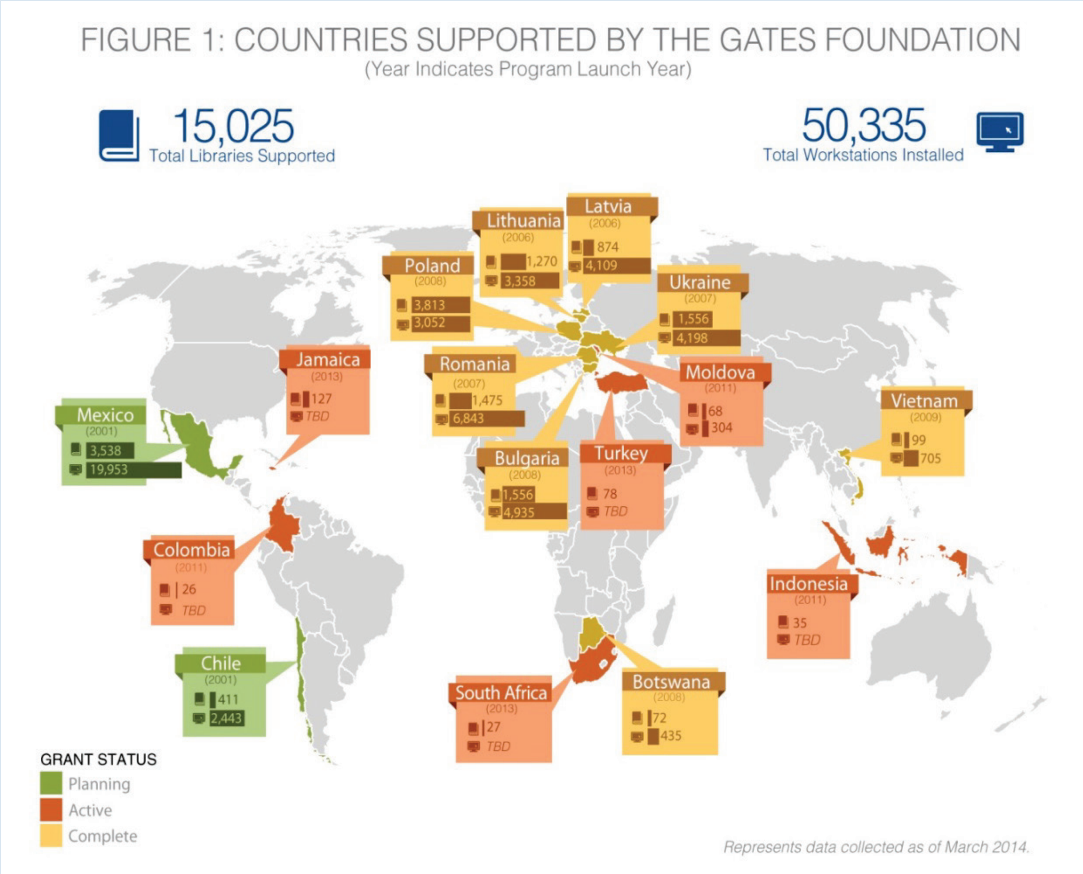
		Africa		Asia		Europe		Latin America & Caribbean		North America		Oceania		Total	
Percentage	Year	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
81–100%	2009	1	5	6	22	20	59	10	48	2	67	2	67	41	37
	2007	2	7	4	20	16	47	6	27	2	67	4	50	34	30
61–80%	2009	1	5	1	4	5	15	3	14	0	0	0	0	10	9
	2007	1	4	1	5	3	9	4	18	0	0	0	0	9	8
41–60%	2009	2	9	10	37	4	12	4	19	0	0	0	0	20	18
	2007	2	7	4	20	8	24	1	5	0	0	1	13	16	14
21–40%	2009	4	18	1	4	1	3	1	5	1	33	0	0	8	7
	2007	3	11	3	15	1	3	3	14	1	33	0	0	11	10
≤20%	2009	14	64	9	33	4	12	3	14	0	0	1	33	31	28
	2007	20	71	8	40	6	18	8	36	0	0	3	38	45	39
Total (N=)	2009	22		27		34		21		3		3		110	
	2007	28		20		34		22		3		8		115	
No data/ unknown	2009	4		5		0		1		0		2		12	
	2007	0		1		0		0		0		0		1	

Source: IFLA.

In a number of countries, the Bill and Melinda Gates Foundation's Global Libraries program has worked towards connecting more libraries with ICTs and has installed public access work stations and trained library workers (see Box 4.2). In Medellín (Colombia), the Red de Bibliotecas project has been successful in bringing Internet to the city's libraries (see Box 4.3).

Box 4.2: Global Libraries program

Since 2001, when it awarded its first country grant to the Government of Chile, the Global Libraries program of the Bill and Melinda Gates Foundation has leveraged over USD 260 million to connect 15 025 public libraries to the Internet in communities that serve almost 100 million people across 16 countries: Botswana, Bulgaria, Chile, Colombia, Indonesia, Jamaica, Latvia, Lithuania, Mexico, Moldova, Poland, Romania, South Africa, Turkey, Ukraine and Viet Nam. With more than 50 000 workstations installed and 20 000 library workers trained, this is the single largest multi-country philanthropic investment in public libraries.



The BiblioRedes program in Chile presents a successful country example. Established in 2002 in poor and isolated communities throughout Chile, the program provides access to computers and the Internet through libraries. Up until 2013, through a network of 412 public libraries and 18 regional training labs with computers and Internet access, a quarter of a million Chileans had been trained in digital literacy. The program was initiated with the support of the Bill and Melinda Gates Foundation but is now supported through government and municipal funding.

Source: Bill and Melinda Gates Foundation.

Box 4.3: Red de Bibliotecas project in Medellín, Colombia

In Medellín, Colombia, public and private sector organizations decided to bring Internet-connected computers to the metropolitan region´s libraries in 2006 through the Red de Bibliotecas project. By 2014, the Medellín metropolitan area hosted 63 libraries that all provide free ICT access to citizens. The project is being expanded to the rest of the state of Antioquia to reach 44 additional libraries. The project has encouraged public policies favouring the development of libraries equipped with ICTs and has trained librarians. Libraries have become integrated centres relied on by citizens for community participation, as well as training on a variety of topics and youth engagement.

Source: Red de Bibliotecas.

Museums

Museums play a crucially important role in society: they not only conserve the heritage of humanity, they are also charged with communicating this heritage to the wider public. Furthermore, museums function as fora on culture and history – and are also places of learning and education. ICTs can support museums in fulfilling these functions. An online exhibition, while it cannot replace a physical museum visit, can reach wider and new audiences. It also provides the possibility of connecting different collections across museums, countries and continents (see Box 4.4). Furthermore, the largest part of a museum's collection is not on regular display at exhibitions, thus ICTs can play an important role in opening up collections by making them available online. Apart from bringing collections and exhibitions online, ICTs can also enrich museum visits. Integrating ICTs into exhibitions can help make them more interactive and provide a complementary source of information to visitors. ICTs can thus add value to museum collections and increase their visibility and usability. Museums can furthermore profit from use of ICTs in their work of cataloguing and preserving objects.

Indicators for measuring the subtarget

Two indicators have been identified to track this subtarget of Target 4.

Indicator 4.4: Proportion of museums with broadband Internet access

Indicator 4.5: Proportion of museums with a web presence.

Indicator 4.4 measures the proportion of museums that have access to broadband Internet. Broadband Internet access facilitates the work of museums and constitutes the foundation for museums to make further use of ICTs.

Indicator 4.5 tracks the proportion of museums with a web presence. This can include a website, home page or presence on another entity's website.[13] With the help of a web presence, museums can provide practical information (such as directions and opening hours) as well as information on exhibitions to potential visitors. Museum websites can also go much further and host virtual exhibitions, provide additional information and material on ongoing exhibitions, or offer access to collection databases and digital materials. The information made available on a webpage will vary considerably, thus a limitation of the indicator is that a museum's web presence *per se* does not reveal anything about the quality of information.

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".[14] The 2009 UNESCO Framework for Cultural Statistics (FCS) provides further details on the institutions to be included (UNESCO Institute for Statistics, 2009).[15]

At the international level, no organization is compiling statistics on museums. In Europe, the European Group on Museums Statistics (EGMUS) is working on the collection and harmonization of Europe-wide museum statistics. EGMUS provides statistics going back to 1998 on a variety of indicators on museums, including some with high relevance to the subtarget.[16] They are:

- number of museums possessing a website
- number of museums connected to a museum portal
- number of museums making use of computers:
  - for administrative purpose
  - for visitor's information purposes (for example, interactive gallery system)
  - for having a database for electronic inventory
  - for having Internet access.

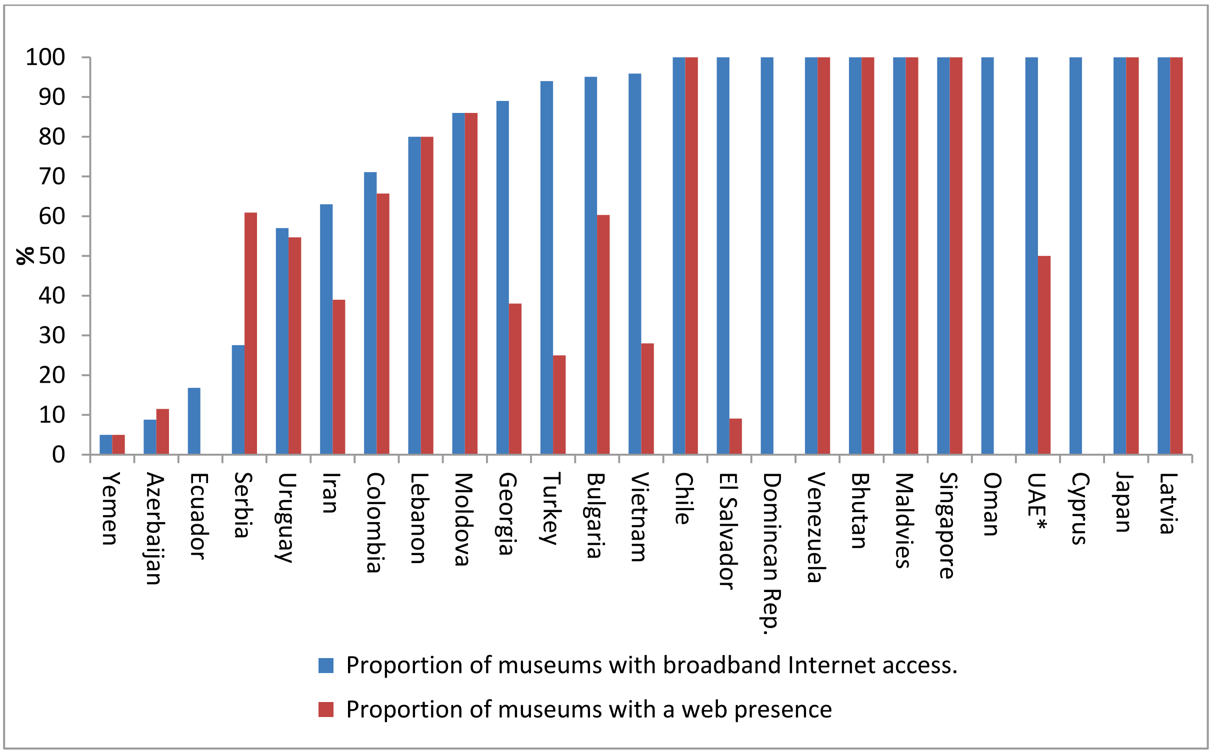
In addition, the European Commission funded project, ENUMERATE, carried out a series of surveys on digitization in European cultural heritage institutions, including museums, libraries, archives and institutes of archaeology and monument conservation, during the years 2012 to 2014. The topics covered are: collection size and growth; use of/access to digital collections; the cost of digital collections; and digital preservation.[17]

Status of the subtarget

Chart 4.2 presents the results of the 2013 WSIS targets questionnaire on the indicators relevant to this subtarget. The results show that in the majority of the 25 countries that provided data, at least 90 per cent of museums had broadband Internet access. Very few countries had only a small proportion of museums connected to broadband Internet. They were: Yemen (5 per cent), Azerbaijan (9 per cent) and Ecuador (17 per cent). Furthermore, Chart 4.3 illustrates that, for most countries, the levels of broadband Internet access and web presence are related. Exceptions include El Salvador and Turkey, where a very high proportion (94–100 per cent) of museums had broadband Internet access but a small proportion (9 and 25 per cent respectively) had a web presence.

There are substantial differences between countries regarding the number of museums. This can both be explained by the simple fact that some countries have more museums than others as well as to different definitions of museums being applied. This limits the comparability of data: countries with just a few museums located in cities will be more likely to be connected to ICT than countries with museums spread throughout their territory.[18] In addition, where there are a small number of museums, it is possible that they are relatively large and therefore more likely to be connected.

Chart 4.2: Museums with broadband Internet access/a web presence, 2013 or LYA[10]



Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Notes:

1. * estimate.
2. Colombia: Refers to museums under the Programa Fortalecimiento de Museos.

The ENUMERATE survey measures the extent to which European museums are connected with ICTs. The proportion of museums with a web presence was measured indirectly: institutions were asked to provide the address of their main website that is accessible for the general public.[19] As shown in Table 4.2, almost all European museums covered by the ENUMERATE survey had a web presence in 2012.

Table 4.2: Museums with a web presence, Europe, 2012

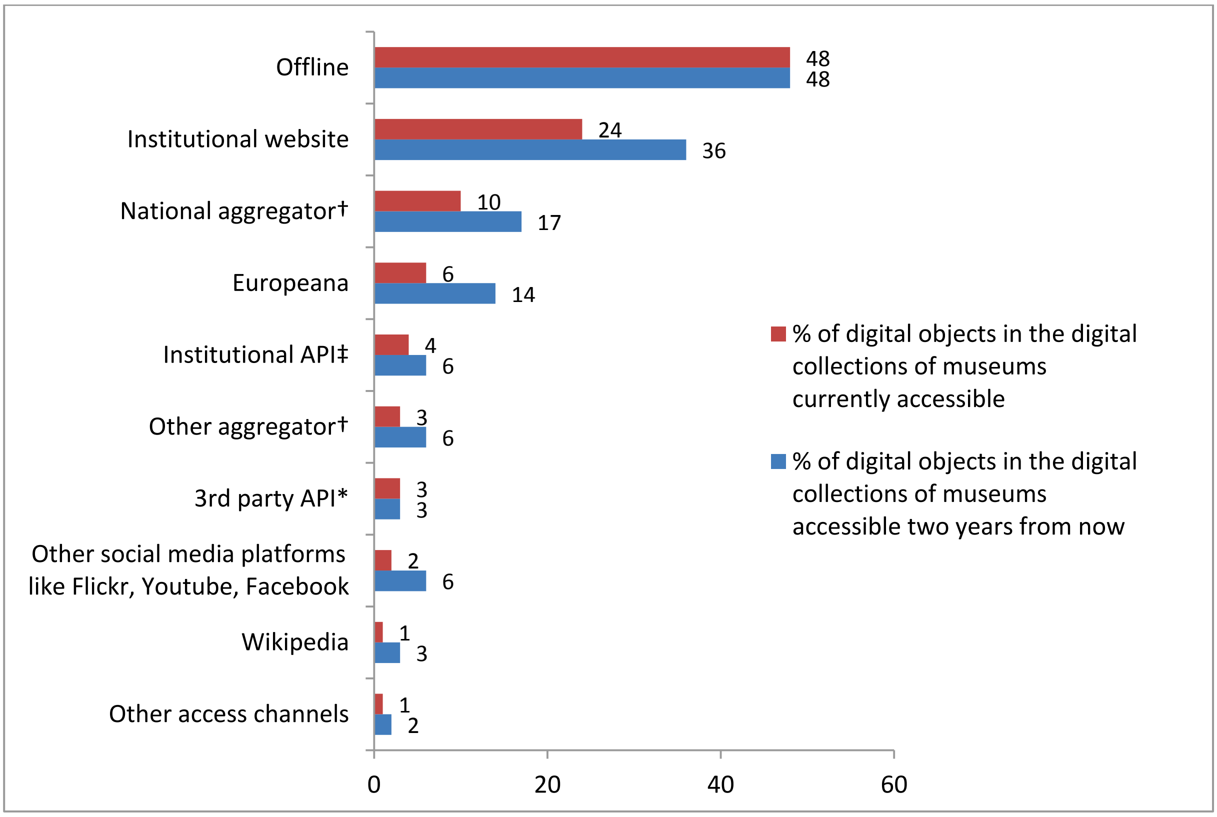
Country	Number of museums	Percentage with a web presence	Country	Number of museums	Percentage with a web presence
Austria	59	100	**Lithuania**	20	90
Belgium	27	100	**Luxembourg**	14	100
Cyprus	5	100	**Malta**	1	100
Czech Republic	73	97	**Netherlands**	93	100
Denmark	37	100	**Poland**	7	100
Estonia	6	100	**Portugal**	27	93
Finland	61	98	**Romania**	22	95
Germany	94	99	**Slovakia**	37	89
Greece	20	100	**Slovenia**	25	100
Hungary	14	86	**Spain**	87	89
Ireland	6	83	**Sweden**	17	100
Italy	18	100	**Switzerland**	58	91
Latvia	6	100	**United Kingdom**	28	96
Liechtenstein	2	50			

Source: ENUMERATE Core Survey 1, 2012.[20]

Apart from websites that are essentially initiated and maintained by individual museums, a growing number of institutions are involved in projects that aggregate digital collections on a national or international scale. In Europe, the Europeana portal is a major example of this initiative (see Box 4.4).

The ENUMERATE survey also included a question on the proportion of museum collections that are, and will be, available through a number of popular access channels. Offline access (48 per cent) and the institutional website (24 per cent) are widely used as a means to offer access to collections. An increase in the future is expected for access through the institutional website, national aggregator and Europeana (see Chart 4.3).

Chart 4.3: Accessibility of digital objects in museums, selected access channels, Europe, 2013



Source: ENUMERATE Core Survey 2, 2013.[21]

Notes:

1. Sample size is 317 museums.
2. †Organizations that compile and collect data from a group of data providers. National aggregators are organizations that collect data from cultural heritage institutions in a given country.[22]
3. ‡Software solution managed by the heritage institution to enable open access to the collection data.
4. *Software solution managed by third parties (for example, a commercial service provider) to enable open access to the collection data of the cultural heritage institution.

Museums are increasingly making use of social media to promote their collections and exhibitions as well as to engage in exchanges with visitors and online audiences. Through social media, museums can increase their visibility and encourage the virtual sharing of content. Table 4.3 shows the number of visits, both online and onsite, as well as the number of Facebook page 'likes' and Twitter followers for selected museums. The data illustrate that museum websites can greatly increase the reach of the institution. For example, New York's Metropolitan Museum of Art attracted 5.2 million onsite visitors in 2011, while almost ten times as many – 47 million visits – were made to the museum's website. The Metropolitan Museum of Art has over one million Facebook fans and close to 700 000 followers on twitter.

Table 4.3: Museum visits onsite, online (2011), Facebook 'likes' and Twitter followers (2014)

Institution	Location	Onsite (2011)	Online (2011)	Facebook likes (2014)	Twitter followers (2014)
		Number	Number	Number	Number
Musée du Louvre	Paris, France	8,500,000	..	1,219,483	82,381
British Museum	London, United Kingdom	5,842,138	8,700,000	505,055	271,798
Metropolitan Museum of Art	New York, United States	5,216,988	47,000,000	1,064,773	686,020
Tate	London, United Kingdom	5,061,172	17,887,851	646,145	1,045,360
National Gallery	London, United Kingdom	4,954,914	4,500,000	312,997	200,662
National Gallery of Art	Washington DC, US	4,775,114	..	145,906	43,996
Natural History Museum, London	London, United Kingdom	4,647,613	..	244,436	493,947
Museum of Modern Art	New York, United States	3,131,238	19,300,000	1,547,153	1,649,731
Centre Pompidou	Paris, France	3,130,000	..	380,234	100,426
National Museum of Korea	Seoul, Korea, Rep.	3,067,909	7,799,124	8,844	..
State Hermitage Museum	St. Petersburg, Russian Federation	2,490,387	..	19,864	131,792
Centro Cultural Banco do Brasil	Rio de Janeiro, Brazil	2,317,772	5,883,055	193,538	99,736
Museo UPR	San Juan, Puerto Rico	13,900	..	2,868	1,551
Centro Cultural Palacio La Moneda	Santiago, Chile	..	..	26,003	30,587
Museo Nacional de Colombia	Bogotá, Colombia	..	..	32,590	85,001
National Museums of Kenya	Nairobi, Kenya	..	..	3,023	245
MALI – Museo de Arte de Lima	Lima, Peru	..	..	144,173	15,028
The Mind Museum	Taguig, Philippines	..	..	115,948	3,213
Museum of Islamic Art	Ad Doha, Qatar	..	..	792,379	29,982

Source: Museum Analytics.[23]

Note: .. not available.

Box 4.4: Connecting cultural heritage across countries and continents

Europeana:

The Europeana portal brings together millions of digitized items – including images, text, sound and video – from more than 2 300 European galleries, libraries, archives and museums. Europeana was launched in 2008 and is co-funded by the European Union. The content available on Europeana also gets showcased in the form of virtual exhibitions themed around pan-European history from the *Napoleonic wars* to *The Euro*. Europeana exhibitions feature items found in collections across the continent and provide visitors with extensive curatorial information. A special online collection – Europeana 1914–1918 – is dedicated to the "untold stories and official histories of WW1" and combines items from libraries and archives across the globe with memories and memorabilia contributed by families throughout Europe. The collection includes a multitude of digitized items, such as 400 000 rare documents, 660 hours of unique film material and 90 000 personal papers and memorabilia. Europeana aims to give access to Europe's entire digitized cultural heritage by 2025.

Virtual Collection of Asian Masterpieces (VCM):

The Asia Europe Museum Network (ASEMUS) initiated the virtual collection of Asian Masterpieces in 2007. More than 120 museums contributed objects from their collections, which are exhibited on the VCM website. Those include major museums such as the British Museum, the Tokyo National Museum and the National Museum of Korea, but also smaller local museums like the Traditional Arts and Ethnology Centre in Luang Prabang, Laos and the Didrichsen Art Museum in Helsinki, Finland. The participating museums share 2 200 masterpieces of Asian culture online. This virtual collection brings together objects that are physically separated across museums and collections in Europe and Asia.

Source: Europeana[24] and Virtual Collection of Asian Masterpieces.[25]

Post offices

With over 640 000 post offices worldwide and almost half a million in developing countries, the postal network offers a unique physical network to provide better Internet connectivity to unconnected communities.

In outlying areas, post offices are often the only public service available and in many cases, they constitute a vital channel to communicate, and to exchange goods and services, between communities. Billions of people visit post offices every year for one reason or another. They send and receive mail, packages or money orders. They can also get access to government and related community services, as well as more sophisticated services such as account-based financial services or IT-based services.

Post offices themselves are important users of ICT in order to provide public Internet access points, new ICT-based postal services, improving their operations and for providing visibility of mail and packages for their customers (track-and-trace services) for which they rely on Internet access.

Indicators for measuring the subtarget

This section analyses the connectivity of post offices and the contribution of post offices in providing public access to the Internet. Two indicators were defined for this purpose:

Indicator 4.6: Proportion of post offices with broadband Internet access

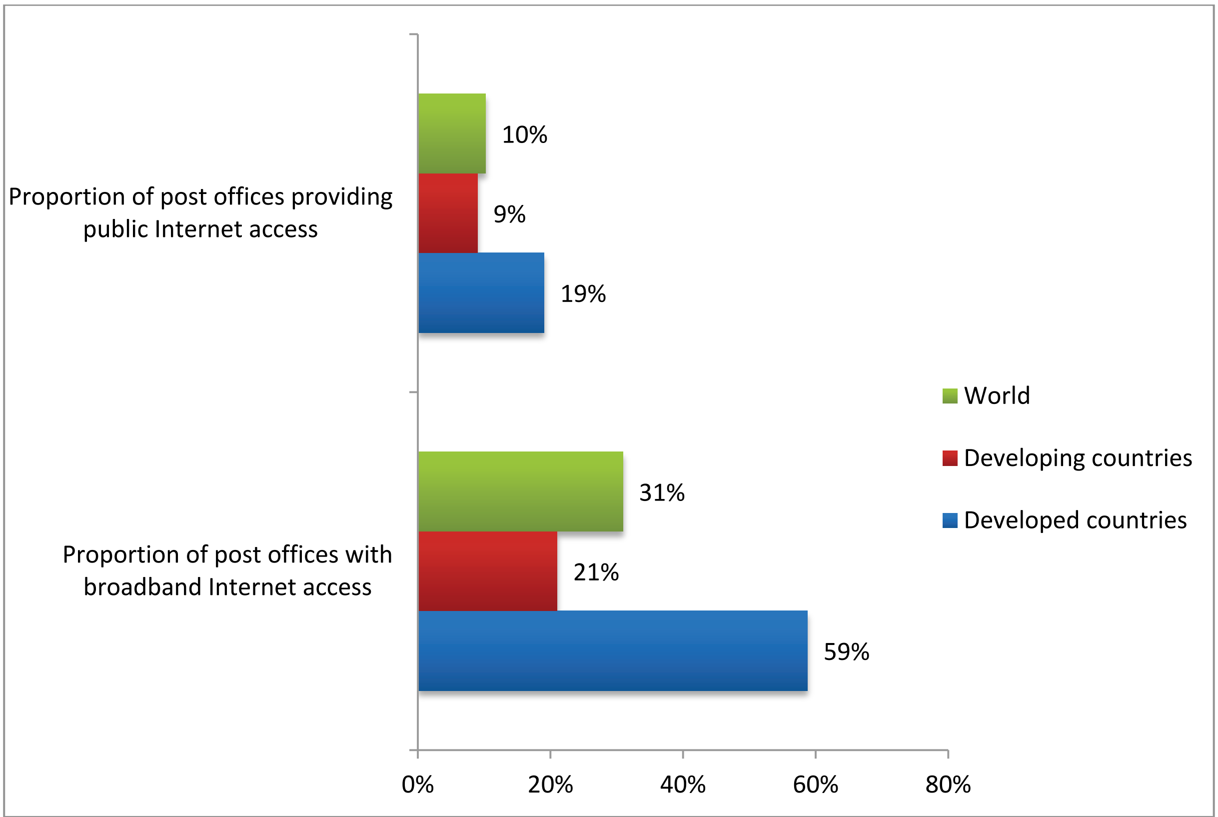
Indicator 4.7: Proportion of post offices providing public Internet access.

Whilst data on post offices providing public Internet access has been regularly collected by the UPU since 2005, data on post offices with broadband Internet access were only collected for the first time in 2013. In 2013, 81 countries (62 developing countries) provided data related to post offices providing public Internet access and 74 (54 developing countries) provided data on post offices with broadband Internet access.

Status of the subtarget

The actual achievements in expanding broadband access to post offices do not always match the potential of the postal network for providing Internet access to the public. As shown by Chart 4.4, at 2012 there was a significant difference between the availability of broadband Internet access in post offices and the provision of public Internet access. While 59 per cent of post offices in developed countries and 21 per cent in developing countries were equipped with broadband access technologies, only 19 per cent of post offices in developed countries, and 9 per cent in developing countries, offered public Internet access to their customers

Chart 4.4: Post offices providing Internet/with broadband Internet, by level of development, 2012

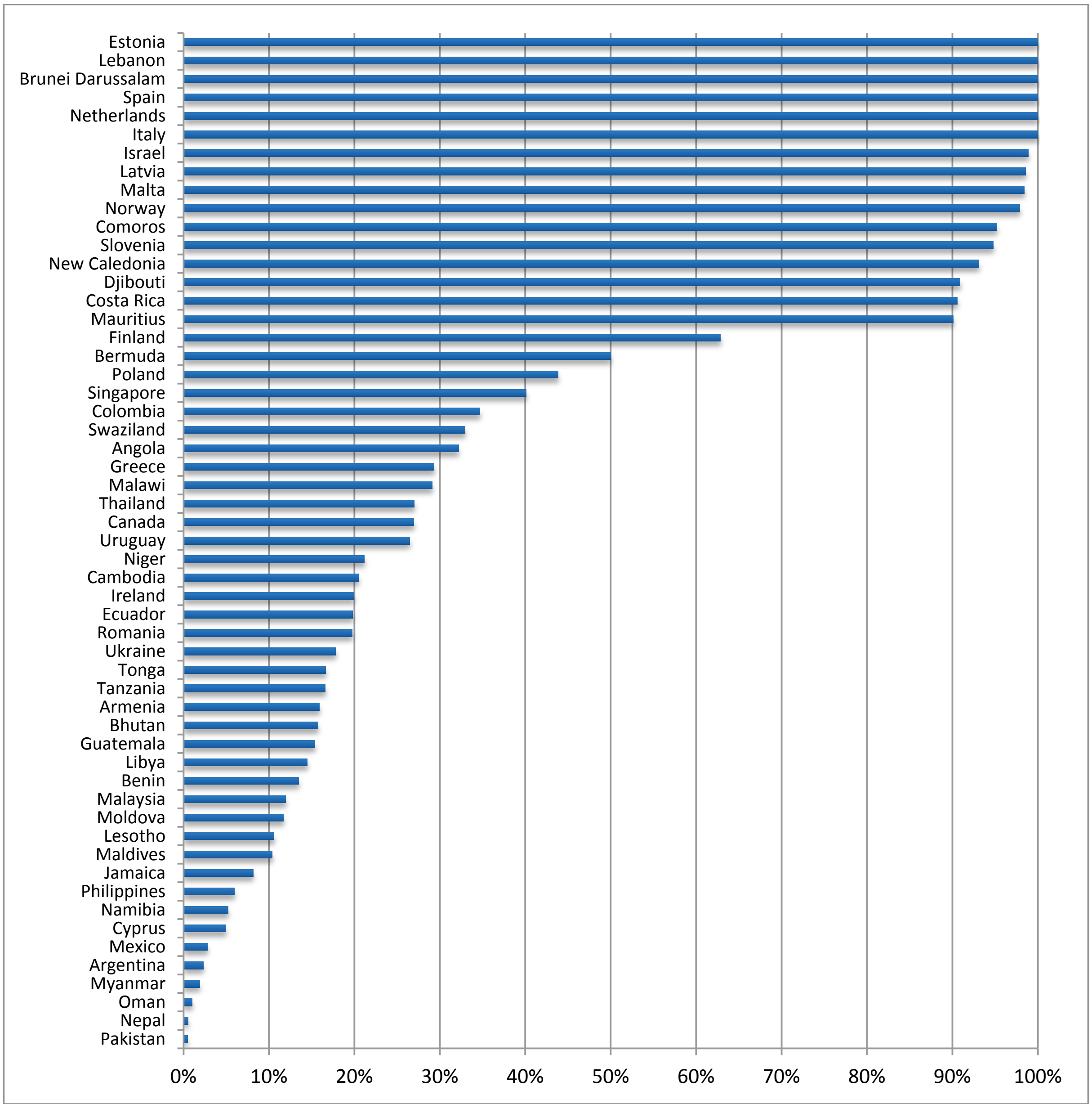


Source: UPU.

Note: Data are calculated as a simple average.

Charts 4.5 and 4.6 illustrate the untapped potential of post offices to provide public access to the Internet. While the proportion of post offices with broadband Internet access reached high levels in a significant number of countries in 2012 (Chart 4.5), only 12 countries offered public access to the Internet in 20 per cent or more of their post offices (Chart 4.6). In 16 countries out of 74 countries that provided data on the number of post offices with broadband Internet access, 90 per cent or more of all post offices were connected. This includes Brunei, Darussalam, Estonia, Italy, Lebanon, Netherlands and Spain, where all post offices had broadband Internet access.

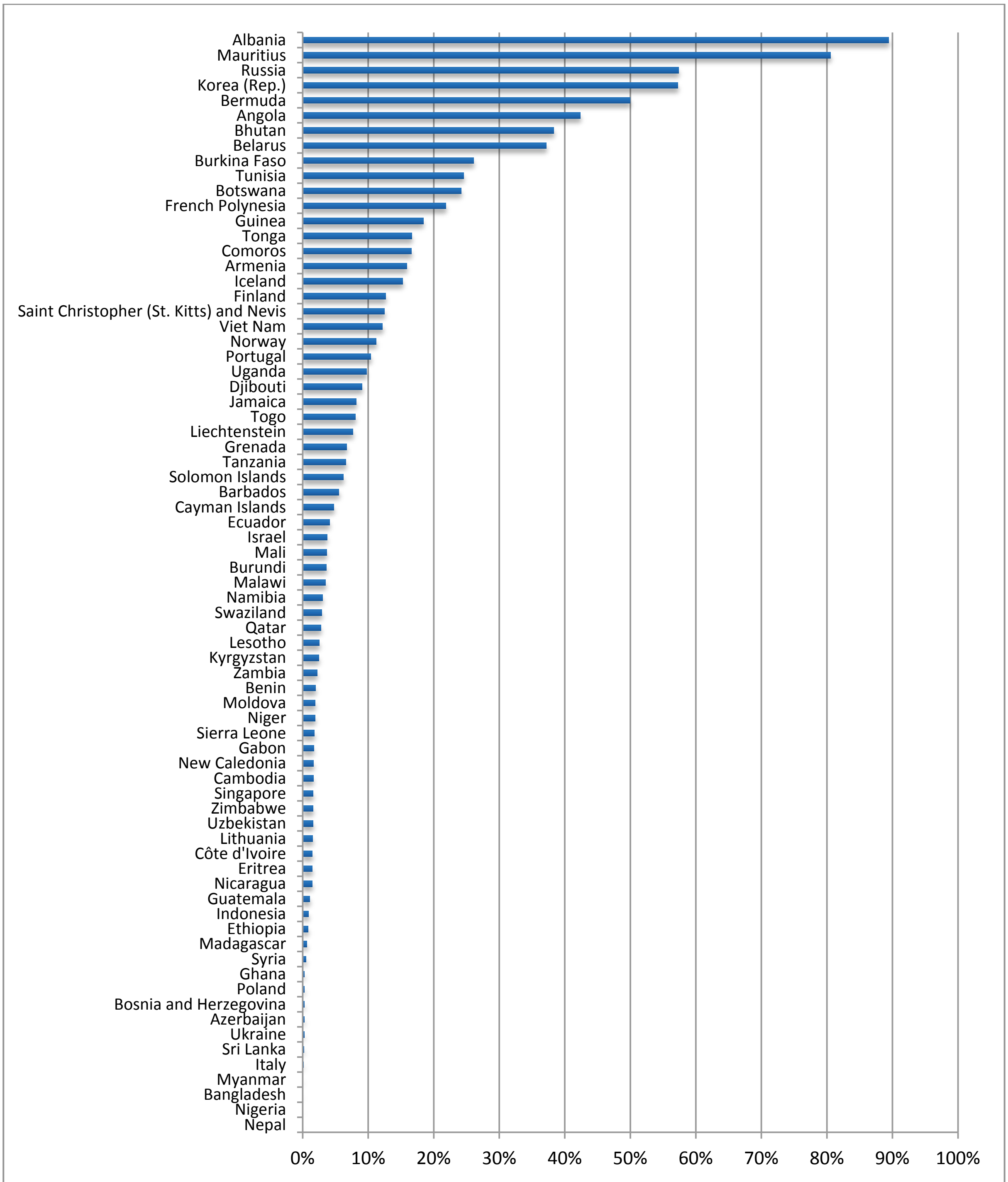
Chart 4.5: Post offices with broadband Internet access, by country, 2012



Source: UPU.

Note: The following countries had zero values (that is, no post offices in that country had broadband Internet access in 2012): Afghanistan, Albania, Belarus, Dominica, Georgia, Guinea, Jordan, Kenya, Kiribati, Mauritania, Nicaragua, Panama, Papua New Guinea, Senegal, Seychelles, South Africa, Suriname, Uzbekistan and Zimbabwe.

Chart 4.6: Post offices providing public Internet access, by country, 2012



Source: UPU.

Note: The following countries had zero values (that is, no post offices in that country provided public Internet access in 2012): Guyana, Iraq, Ireland, Lebanon, Malaysia, Oman, South Africa and Thailand.

Overall, 42 per cent of responding countries were equipped with broadband Internet in at least 20 per cent of their post offices (Chart 4.5).

Beyond providing public access to basic Internet services, expanding access to broadband Internet in post offices is critical in order to support financial and digital inclusion for underserved communities. The development of access to financial services through the postal network, either provided directly by the latter or in partnership with other financial institutions, is a vital element of economic development and inclusion of low-income people.

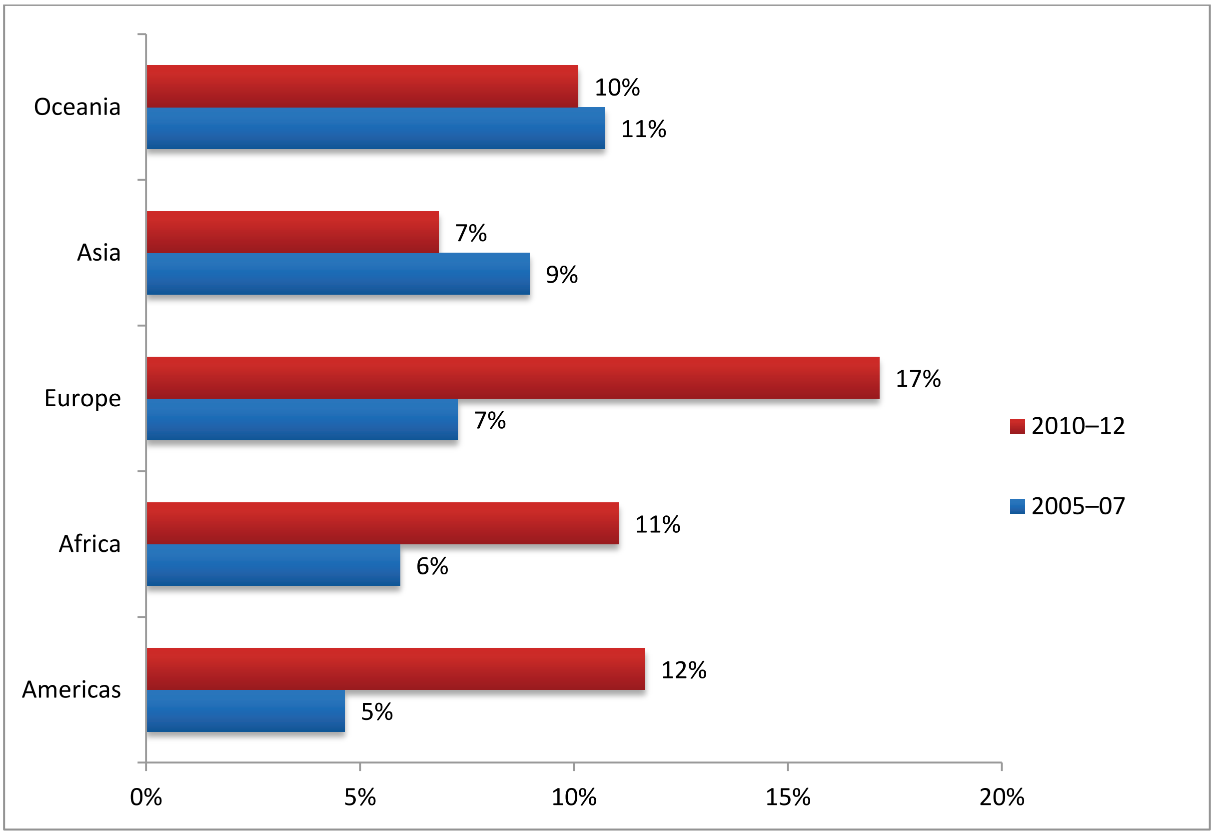
Broadband Internet access via the postal network in rural and underserved communities provides opportunities for small and medium business enterprises (SMEs) to participate in e-commerce opportunities, for example, selling their goods to more affluent urban or overseas markets, while using the post office as a facilitator for the exchange of goods, payments and related services. A connected post office network is also an important asset for governments to increase democracy and social inclusion via the provision of e-government services such as identity, registrations, licenses and social services (UPU, 2012).

A recent UPU study indicated that 20 per cent of post offices of surveyed communities in 25 sub-Saharan African countries were located in the three main urban areas of each country. This pattern was also found in a research project analysing the location of post offices in the postal network in Brazil. The rest of the post office network was evenly distributed across small- and medium-size towns and rural areas.[26] Anecdotal evidence suggests that post offices in other developing (as well as developed) countries have approximately the same urban/rural distribution. Assuming that to be the case, if public Internet access is initially offered in a country's three main urban centres, that would equate to around 20 per cent of all post offices in the country offering public Internet access. Where the proportion of post offices offering public Internet access is above 20 per cent, that would imply that some rural areas and small towns have public Internet access via post offices. A proportion above 45 per cent would imply that up to a third of all rural areas and small towns have public access to the Internet, while a proportion of 60 per cent would correspond to half of rural areas and small towns being connected. By 2012, the majority of countries had not reached the critical 20 per cent threshold for the provision of public Internet access through their post offices (Chart 4.6).

Post offices also contribute in other ways to improved Internet connectivity for underserved communities by providing enhanced Internet-based services such as secure Internet domain access e-commerce webshops for SMEs and e-payment facilities under post top level domain. Although this is not directly reflected by the two indicators defined above, these enhanced services are often mentioned as key factors in the sustainable success of connectivity investments (for example, see *ICTs, new services and transformation of the Post*, UPU and ITU, 2010).

Chart 4.7 compares the evolution of public access to the Internet through post offices in different regions of the world since 2005. While provision of Internet access through the postal network increased in Africa, the Americas and Europe between 2005 and 2012, it decreased for Asia and Oceania.[27] For instance, India only started connecting 10 per cent of its 155 000 post offices to the Internet recently. No region reaches the critical average threshold of 20 per cent of post offices providing public Internet access, at which point rural and small towns are likely to benefit from an increased public access to the Internet through the postal network. The most significant increases were found in a small number of developing countries, shown in Chart 4.8, and in an even smaller number of developed countries. The top performers, with an improvement of over 20 percentage points, were Albania, Mauritius, Angola, Belarus and Botswana (see Box 4.5). These countries have contributed to a substantial improvement of public access to the Internet by leveraging the reach of their postal networks.

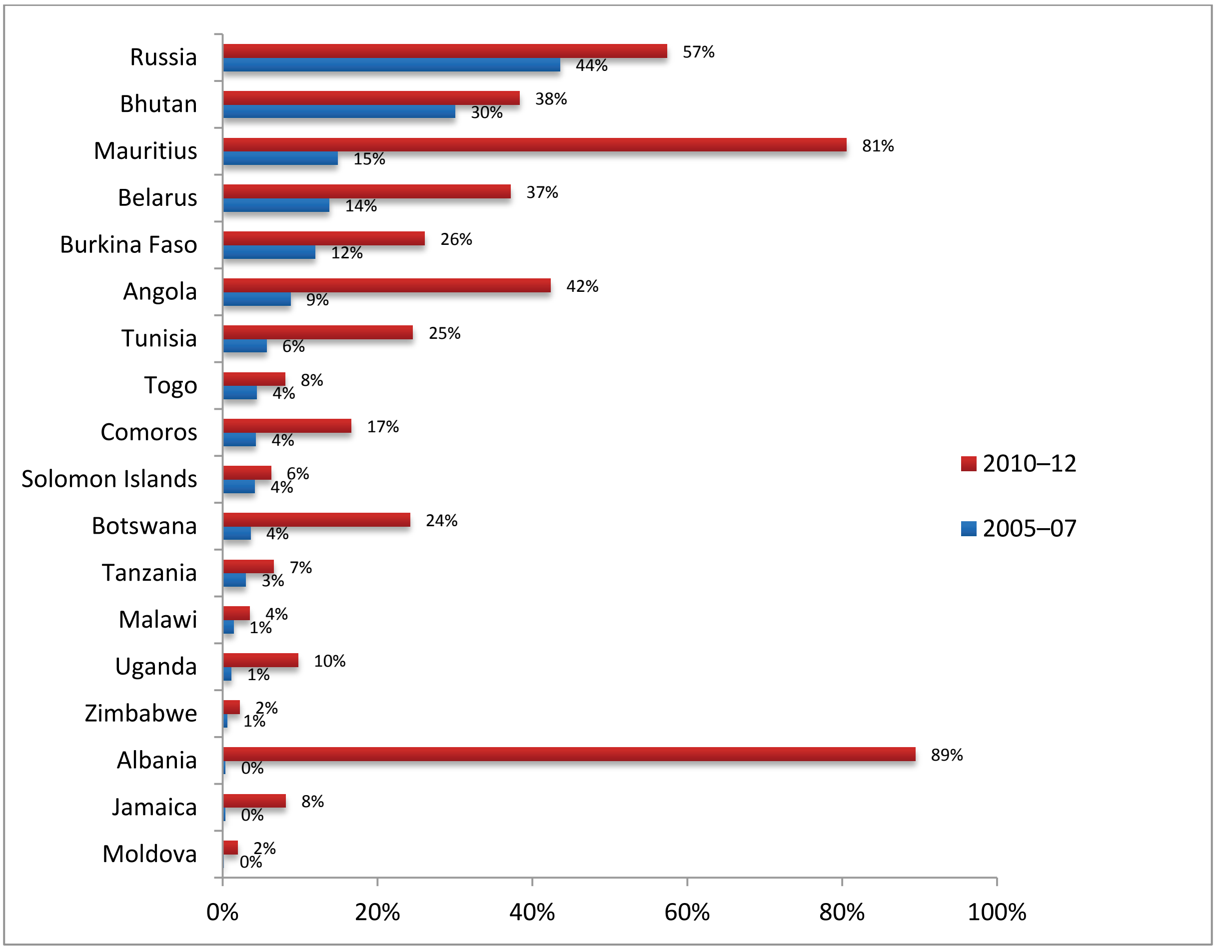
Chart 4.7: Post offices providing public Internet access, by region, 2005–07 and 2010–12



Source: UPU.

Note: Data are calculated as a simple average.

Chart 4.8: Post offices providing Internet access, top performing countries, 2005–07 and 2010–12



Source: UPU.

The results for indicators 4.6 and 4.7 indicate only a partial achievement of the objectives outlined in the WSIS outcome documents. In the development of the post-2015 agenda for the information society, stakeholders should increase their efforts to realize the potential of an ICT-enabled post office network as a facilitator of social and economic development.

Box 4.5: Kitsong centres offering access to ICTs in Botswana

In the urban areas of Botswana, access to ICT for people without computers or Internet connections at home is provided mainly by privately operated Internet cafés. Rural and remote areas have generally lacked such access, because of private operators' concerns about financial viability.

Botswana has one of the lowest population densities in the world. Delivering any type of universal service to such a sparse and widespread population presents enormous challenges to the government. Delivering ICT services where electricity and Internet connectivity are intermittent is even more challenging.

In 2016, Botswana will celebrate its 50th anniversary of independence. The Botswana Vision 2016 is the government's strategy to transform the country into a competitive and prosperous nation. Kitsong (knowledge) centres, offering access to information and communication facilities, are the means by which the Government of Botswana is narrowing the digital divide between urban and rural communities. Botswana Post, with its countrywide network of 192 postal facilities, was the natural choice to provide such centres. The government and Botswana Post had installed 49 Kitsong centres by 2009, with five more due to open in 2010.

Besides Internet access, Kitsong centres offer fax, photocopying, desktop publishing, printing and digital photography services. They also provide local content, such as agricultural information.

The number of people using Kitsong centres is growing, and the income of post offices with Kitsong facilities increased by an average of 25 per cent, compared to the situation in post offices without Kitsong centres (2006), reflecting the use of the new services. Clearly, if the number of customers is growing, there must be a perceived benefit to each individual using the centre. This may be for business reasons in obtaining information about markets; it may be for educational reasons with e-learning programmes; or it may simply be for social reasons, such as chatting or gaming.

The project has also led to greater computer literacy because these centres provide training in the use of computers. The government is pleased with the results achieved so far, seeing these centres as helping to meet its national objectives and its commitment to the United Nations Millennium Development Goals.

Botswana Post has also benefited from hosting the Kitsong centres. Besides contributing to increased revenue, Kitsong facilities have "revitalized Botswana Post by providing an injection of new technology based services".

Source: UPU/ITU.

Archives

The International Council on Archives defines archives as "the documentary by-product of human activity and … an irreplaceable witness to past events, underpinning democracy, the identity of individuals and communities, and human rights."[28] Connecting archives with ICTs is important, because it increases their reach and provides more people with access to the wealth of information preserved in their collections. Furthermore, ICTs can facilitate the archiving and improve the preservation of documents through digitization.

Indicators for measuring the subtarget

The indicators designated to track this subtarget reflect the different ways in which ICTs can serve archives and the different levels of connectedness.

Indicator 4.8: National archives organizations with broadband Internet access

Indicator 4.9: National archives organizations with a web presence

Indicator 4.10: Proportion of items in the national archives that have been digitized

Indicator 4.11: Proportion of digitized items in the national archives that are publicly available online.

Indicator 4.8 tracks whether national archives organizations have broadband Internet access. Broadband Internet access can facilitate the work of archivists and is likely to be a prerequisite for a web presence and the digitization of items.

Indicator 4.9 ascertains whether the national archives organization has a web presence. A web presence includes a website, home page or presence on another entity's website. Archives with a web presence can provide practical information to the public (such as opening hours or access to the archives) as well as information about their collection. The information made available on a webpage will vary considerably, thus a limitation of the indicator is that a web presence *per se* does not reveal anything about the quality of information.

Indicator 4.10 measures the proportion of items held in the national archives that have been digitized and can therefore be preserved and shared in digital format. The indicator refers to the proportion of the total number of catalogued items held in the national archives. By digitizing an item, the original object is protected from use, which should increase its lifespan. The unit 'digitized item' may be interpreted differently, for example, archives might define catalogued items in different ways. It is usually not known how many individual items there are in archival collections: archives typically measure their analogue collections in terms of shelf length needed to store the materials or in terms of the number of textual records created to enable access to the archival materials. Furthermore, the way in which an item has been digitized will vary, for example, the quality of digitization and the information associated with a digitized item will have an impact on its usability.

Indicator 4.11 measures the proportion of digitized items in the national archives that are publicly available online. Thus, this indicator goes one step further than Indicator 4.10 and tracks the proportion of items that are actually accessible. The same limitations with regards to the definition of 'digitized item' as well as the quality of digitization apply to Indicator 4.11. Furthermore, there might be considerable differences regarding the way in which the digitized item is presented online and thus accessible to the public.

Any type of organization that is engaged in archiving could be considered to be an archive. However, the scope of this subtarget is limited to national government archives, which allows for more comparability of data. Furthermore, the focus on national archives narrows data collection to one (or in some cases few) organization(s) per country. Some countries do not have national archives organizations. For those countries, no data on the connectivity of national archives with ICTs can be collected. Other countries have a decentralized archives systems with (several) sub-branches. For those countries, results for all sub-branches should be shown.

Despite the fact that national government archives are relatively well defined and limited in scope, no internationally coordinated data collection for this subtarget of WSIS Target 4 exists. In Europe, the European Commission funded project ENUMERATE, carried out two surveys (in 2012 and 2013) in order to monitor the progress on digitization of cultural heritage across the region, including in national archives. The ENUMERATE data covers 46 national archives in 17 European countries.[29]

Status of the subtarget

Responses to the 2013 WSIS targets questionnaire on indicators 4.8 and 4.9 revealed that in almost all countries, national archives organizations had broadband Internet access. Furthermore, of those national archives organizations with broadband Internet access, all had a web presence (see Table 4.4). This is an improvement on the situation in 2009, when archives in some developed countries did not have a web presence (ITU, 2010).[30] In Europe, where ENUMERATE collects data on Indicator 4.9, close to 100 per cent of national archives had a web presence in 2013.[31,32.]

Table 4.4: National archives organizations with broadband Internet/a web presence, 2013 or LYA[10]

Country	National archives organizations with broadband Internet access	National archives organizations with a web presence	Country	National archives organizations with broadband Internet access	National archives organizations with a web presence
	%	%		%	%
Bhutan	100	100	**Moldova**	73	9
Bulgaria	100	100	**Niger**	80	0
Cyprus	100	100	**Nigeria**	100	100
Dominican Rep.	100	100	**Norway**	100	100
El Salvador	100	100	**Oman**	95	100
Estonia	100	100	**Poland**	100	100
Georgia	100	100	**Portugal**	100	100
Iran, Islamic Rep.	100	100	**Senegal**	100	100
Latvia	100	100	**United Arab Emirates**	100	100
Lithuania	100	..	**Uruguay**	100	100
Maldives	100	100	**Venezuela**	100	100

Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Notes:

1. .. not available.
2. Countries responded to the question in different ways. Some indicated the proportion of archives organizations with broadband Internet access/a website, while others provided the total number of archives organizations with broadband Internet access/a website.

It is difficult to obtain exact figures on individual items in the collections of national archives (indicators 4.10 and 4.11). This was confirmed by the results obtained through the 2013 WSIS targets questionnaire. Only a few countries provided data for indicators 4.10 and 4.11. For those that did, comparability is an issue as respondents used estimation and the definition of what constitutes a digitized item differs across countries.

Table 4.5 shows the status of digitization in the countries that responded to the questionnaire. A relatively low proportion of items in the national archives have been digitized – less than 5 per cent in the majority of countries. Japan, Latvia and the United Arab Emirates are exceptions; even so, less than or equal to 10 per cent of items have been digitized in those countries. Looking at the proportion of items that are publicly available online, Chile, El Salvador and Japan, provide all of their digitized items online.

Table 4.5: Digitization and online availability of items in the national archives, 2013 or LYA[10]

Country	Proportion of items in the national archives that have been digitized	Proportion of digitized items in the national archives that are publicly available online
	%	%
Azerbaijan	5.0	..
Bulgaria	4.5	4.4
Chile	..	100
Cyprus	0.2	0.0
Dominican Rep.	..	70
El Salvador	..	100
Estonia	approx. 2–3	..
Georgia	0.1	0.001
Japan	8.5	100
Latvia	10.0	10
Lithuania	..	1.1
Niger	0.01	0.0
Portugal	1.6	1.5
Sudan	0.1	0.0
UAE	8.0	0.0
Uruguay	1.0	..
Venezuela	1.8	39

Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Notes:

1. Chile (2 727 535 documents) and El Salvador (225 documents) provided absolute values for the number of documents in the archives that had been digitized. All digitized documents were available online.
2. .. not available.

In the ENUMERATE surveys, respondents were asked to estimate the percentage of their analogue heritage collections that has already been digitally reproduced. Across Europe, the average percentage of the analogue heritage collections that have been digitally reproduced stands at 9 per cent in 2013. Taking into consideration the size of these institutions, the overall proportion in Europe is about 6 per cent.[33] The proportion of digitized items in the national archives that are publicly available online (Indicator 4.11) stands at 42 per cent (unweighted). If organization size is taken into account, this percentage is higher (53 per cent).

Conclusions and recommendations

The tracking of each of the subtargets of Target 4 over the period 2005 to 2015 is hampered by a lack of comprehensive and internationally comparable data. The available data do not allow for conclusions to be drawn on the ICT connectivity of public libraries, museums and national archives at the global or regional level. For post offices, there are more data available, enabling aggregation for developed and developing countries.

In almost half of countries – 13 out of 30 (43 per cent) that provided data, all (or nearly all) public libraries had broadband Internet access in 2013. The number of public libraries with a web presence is generally much lower, with only 7 out of 26 countries (27 per cent) reporting that all (or nearly all) of their public libraries had a web presence.

A higher proportion of countries that provided data (15 out of 25 countries, or 60 per cent) reported that all (or nearly all) museums were connected to broadband Internet. In the majority of those countries, at least 90 per cent of museums had broadband Internet access. Only seven (out of 22 countries) reported that all (or nearly all) museums had a web presence. Additional data from ENUMERATE show that almost all European museums had a web presence.

Data on post offices with broadband Internet access show that in 16 out of 74 countries that provided data on the number of post offices with broadband Internet access, 90 per cent or more of all post offices had broadband Internet access.[34]

Almost all countries (20 of 22 countries for Indicator 4.8 and 19 out of 21 for Indicator 4.9) that provided data on the connectivity of national archives organizations reported that all (or nearly all) archives had access to broadband Internet and a web presence.[35]

Even less information is available on the extent of digitization, but data suggest that a lot remains to be done in terms of digitizing cultural heritage and making it available online. Only 17 countries provided data on digitization by national archives organizations. These data show that a relatively low proportion of items has been digitized – less than 5 per cent in the majority of countries. Regarding the proportion of digitized items that are publicly available online, only three countries – Chile, El Salvador and Japan – provide all of their digitized items online. Additional data from Europe show that the average percentage of items in national archives that have been digitized is about 6 per cent of which 53 per cent are publicly available online.

Looking at public libraries and post offices as providers of public Internet access, available data show that while some progress has been made, libraries and post offices remain largely untapped as public access venues. The IFLA/FAIFE *World Report* provides data on public libraries as providers of public Internet access for the years 2007 and 2009 and found that by 2009 there was an overall increase in levels of public access to the Internet. However, there are significant differences between developed and developing countries in terms of providing public Internet access in public libraries. Data show that (Western) Europe, North America, Australia and New Zealand have the best Internet access in all categories, whereas Africa has the lowest. While provision of public access to the Internet through the postal network increased moderately in Africa, the Americas and Europe between 2005 and 2012, it decreased for Asia and Oceania. The most significant increases were found in a very limited number of developing countries. The proportion of post offices providing public Internet access was highest in Europe (17 per cent) in 2012.

The tracking of indicators 4.1 (proportion of public libraries with broadband Internet access), 4.4 (proportion of museums with broadband Internet access), 4.6 (proportion of post offices with broadband Internet access) and 4.8 (proportion of archives organizations with broadband Internet access) should be discontinued. These indicators, with the exception of Indicator 4.6, are not part of a regular data collection and, with growing connectivity, measuring access to broadband Internet by public institutions will become less relevant.

Moving forward, the attention should shift from access to ICTs to libraries, museums, post offices and archives as online content providers and public Internet access venues. Post-2015 discussions should distinguish between public access to ICTs and online content related to culture.

Despite growth in Internet access, there will continue to be a need for public access to the Internet for the foreseeable future – particularly for poor and underserved rural communities in developing countries. Research carried out by the TASCHA group reported in 2013 that while public ICT access can function as a (sometimes temporary) substitute for private access, it also acts as a (potentially permanent) complement to private access (Sey *et al*., 2013). The study concluded that it may take decades for some countries to reach high levels of quality home connectivity; therefore public ICT access will remain a critically important service that is likely to be relevant even when higher connectivity has been achieved. Public libraries and post offices are in a very good position to provide public access to ICTs: they are open to the public, their branches are widely distributed and they constitute an established source of information. Therefore, Target 4 indicators on public access to the Internet (indicators 4.2 and 4.7) could be measures for a possible future target that focuses on connecting people with ICTs. While Indicator 4.7 is collected by UPU through its regular data collection, Indicator 4.2 can only be retained if a robust data collection can be assured.

Libraries, museums and archives are important providers of online content related to culture. They present an authoritative source of content and can put information into context. By digitizing books, documents and (images of) objects and making them available online, these institutions are major providers of online cultural content. Apart from digitizing analogue material, libraries, museums and archives are also putting born-digital material, such as videos, e-books and electronic records online. Material may be made available through an institutional website, regional or international aggregator or social media. Unfortunately no data are being regularly collected on the extent of digitization in cultural heritage institutions, with the exception of data collected on European museums and national archives organizations by ENUMERATE.

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Endnotes

[1] The original WSIS indicator was worded "Connect public libraries, cultural centres, museums, post offices and archives with ICTs".

[2] The hybrid library is on the continuum between the conventional and digital library, where electronic and paper-based information sources are used alongside each other. See http://www.dlib.org/dlib/october98/10pinfield.html.

[3] Compare Becker *et al*. (2010) and Sey *et al*. (2013).

[4] See http://beyondaccess.net/wp-content/uploads/2013/07/Beyond-Access_Library_Map_EN_201304.png.

[5] See http://www.ifla.org/files/assets/statistics-and-evaluation/publications/Report_UNESCO_IFLA_GlobalLibStat_pretest.pdf.

[6] The IFLA statistical unit (public library service point) used in these surveys, which formed part of the IFLA World Report in 2005, 2007 and 2010, is consistent with the unit recommendation for Indicator 4.2.

[7] See www.cenl.org/members.php.

[8] See http://www.imls.gov/research/public_libraries_in_the_us_fy_2011_report.aspx and http://www.imls.gov/assets/1/AssetManager/Fast_Facts_PLS_FY2011.pdf.

[9] The UNESCO's Framework for Cultural Statistics, includes a definition of libraries, but not public libraries (http://www.uis.unesco.org/culture/Documents/framework-cultural-statistics-culture-2009-en.pdf). The 2011 WSIS statistical framework adopted the definition of public library used by a UIS pilot survey of libraries.

[10] Latest year available.

[11] Number of responding countries: 88 (2003); 84 (2005); 116 (2007); 122 (2009).

[12] Bands of access were allocated as 81–100 per cent of libraries; 61–80 per cent; 41–60 per cent; 21–40 per cent; less than 20 per cent.

[13] Including a related entity's website. It excludes inclusion in an online directory and any other webpages where the library does not have control over the content of the page.

[14] See http://icom.museum/the-vision/museum-definition/.

[15] Another classification that can be applied is ISIC Rev 4 Class 9102 "Museum activities and operations of historical sites and buildings" and Class 9103 "Botanical and zoological gardens and nature reserves activities", which is similar in scope to the FCS definition.

[16] See http://www.egmus.eu/en/statistics/choose_by_topic/.

[17] See http://www.enumerate.eu/en/surveys/.

[18] For example, the Maldives and Bhutan reported having only one and two museums, respectively.

[19] See http://www.enumerate.eu/en/surveys/core_survey_1/.

[20] See http://www.enumerate.eu/en/surveys/core_survey_1/.

[21] See http://www.enumerate.eu/en/surveys/core_survey_2/.

[22] See http://www.pro.europeana.eu/web/guest/aggregators-and-providers.

[23] Museum Analytics is an online platform featuring an online tool that collects information about more than 3 000 museums and galleries. The information is automatically collected or contributed by organizations. See http://www.museum-analytics.org/.

[24] See http://www.europeana.eu/.

[25] See http://masterpieces.asemus.museum/index.nhn.

[26] As illustrated in chapters 4 and 6 of Universal Postal Union (2014).

[27] The same countries in each region were used for the four-year comparison.

[28] See http://www.ica.org/125/about-records-archives-and-the-profession/discover-archives-and-our-profession.html.

[29] The following countries (number of national archives organizations shown in brackets) were included in the survey: Austria (1), Czech Republic (1), Denmark (1), Estonia (1), Finland (1), Germany (1), Greece (3), Hungary (9), Italy (5), Latvia (1), Liechtenstein (1), Luxembourg (1), Malta (1), Portugal (1), Slovenia (2), Spain (12), Sweden (4).

[30] See page 90 in: http://www.uis.unesco.org/Communication/Documents/WTDR2010_e.pdf.

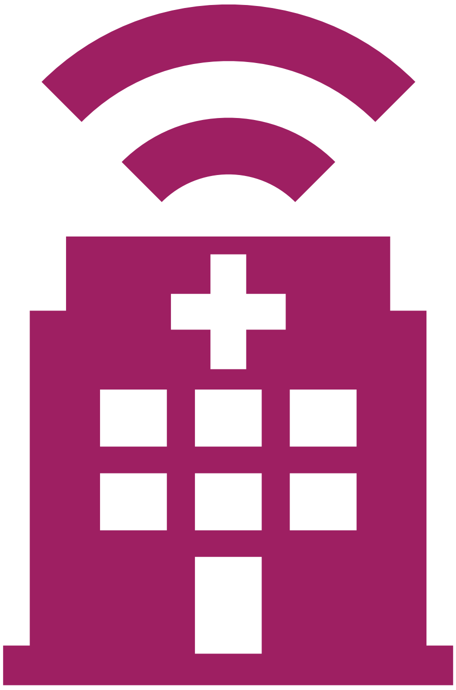
[31] See http://www.enumerate.eu/en/surveys/core_survey_1/.

[32] In the ENUMERATE Core Surveys (2012 and 2013), the proportion of national archives with a web presence was measured in an indirect way: institutions were asked to provide "the address of your institution's main website that is accessible for the general public".

[33] The weighing by size of the National archives was performed according to their total annual budget. See: http://www.enumerate.eu/en/surveys/core_survey_2/.

[34] Data are not comparable across different institutions, as different number and set of countries provided data on specific indicator.

[35] It should be noted that in many countries there is only one national archive organization. Thus, Indicator 4.4 cannot be compared with the other indicators on access to broadband Internet as they measure the connectivity of a significantly higher number of institutions.



CONNET ALL
HEALTH CENTRES
AND HOSPITALS
WITH ICTs

Target 5: Connect all health centres and hospitals with ICTs[1]

Executive summary

In 2003, the World Summit on the Information Society (WSIS) brought together key players from around the globe to begin deliberations on how to bridge the digital divide that separates rich from poor countries. The ambitious mission included a target to connect health centres and hospitals. The health sector is recognised as information intensive; processing the vast volumes of data generated can no longer efficiently be done manually. Today, ICT is becoming central to the effective operation of health systems and services, although progress is uneven.

The first challenge to the measurement of Target 5 is the lack of globally accepted definitions for health system facilities, including hospitals and health centres. Facilities can vary within and between countries, thus making standardization of measurement difficult. Another important factor is that technology is in a constant state of development, therefore measurements made today may not be relevant in five years' time.

This chapter builds a picture of progress in health sector connectivity since 2003 by using the limited data available. Data from the ITU survey on the 2013 WSIS targets questionnaire (*Partnership*, 2013) show promising progress in connectivity trends for health centres and hospitals. Results show that almost 80 per cent of responding countries have connected 75–100 per cent of their hospitals. The connectivity figures are not quite as high for health centres, with 65 per cent of countries having connected 75–100 per cent. However, this is still an indication of good progress for those countries that responded. Patient information data are less conclusive.

This chapter explores alternative approaches to measuring Target 5, including the use of proxy data for the uptake of an online knowledge service providing scientific journals to health institutions (HINARI)[2] and the adoption of eHealth strategies by countries. The first approach is proposed as a reliable measurement of health facility connectivity as it is only available to health institutions with Internet access in developing countries. The data are collected by the World Health Organization (WHO) annually and show solid and linear growth over the period 2003–2013. The growth of the number of connected institutions has grown an impressive 600 per cent from an original baseline in 2003 of 792 connected institutions to 5 584 at the end of 2013. The monitoring of the adoption of eHealth strategies is proposed as another data source. An eHealth strategy can be a good indication of a government's view of the importance of eHealth and the role it will play in strengthening the health sector, including the building of connectivity. WHO actively supports the development of eHealth strategies in countries and reports on their adoption. The WHO Global Observatory for eHealth reports that the number of countries with eHealth strategies is showing a steady rise. In 2009, 55 countries indicated that they had eHealth strategies and in 2013 this number had grown to 85.

The limitations of relying on country connectivity data for measuring eHealth progress are highlighted. It is proposed that the eHealth domain is better understood through extending studies to include surveys. WHO, through its Global Observatory for eHealth (GOe), conducts global and thematic eHealth surveys. The Organisation for Economic Co-operation and Development (OECD) is spearheading the use in countries of a model survey, particularly in the area of electronic health records.

WSIS +10 is a catalyst for all stakeholders to review progress in health sector connectivity since 2003 and to plan for the way forward. This chapter recognises the strengths and limitations of the current approach and makes two recommendations for future monitoring:

- data on connectivity for Target 5, as well as the measurement of growth in access to the world's medical knowledge, be provided by the WHO Global Observatory for eHealth (GOe) through an analysis of enhanced WHO HINARI programme records
- data on the development and implementation of national eHealth strategies and their content be reported for Target 5 by the GOe as an indicator of eHealth uptake in countries.

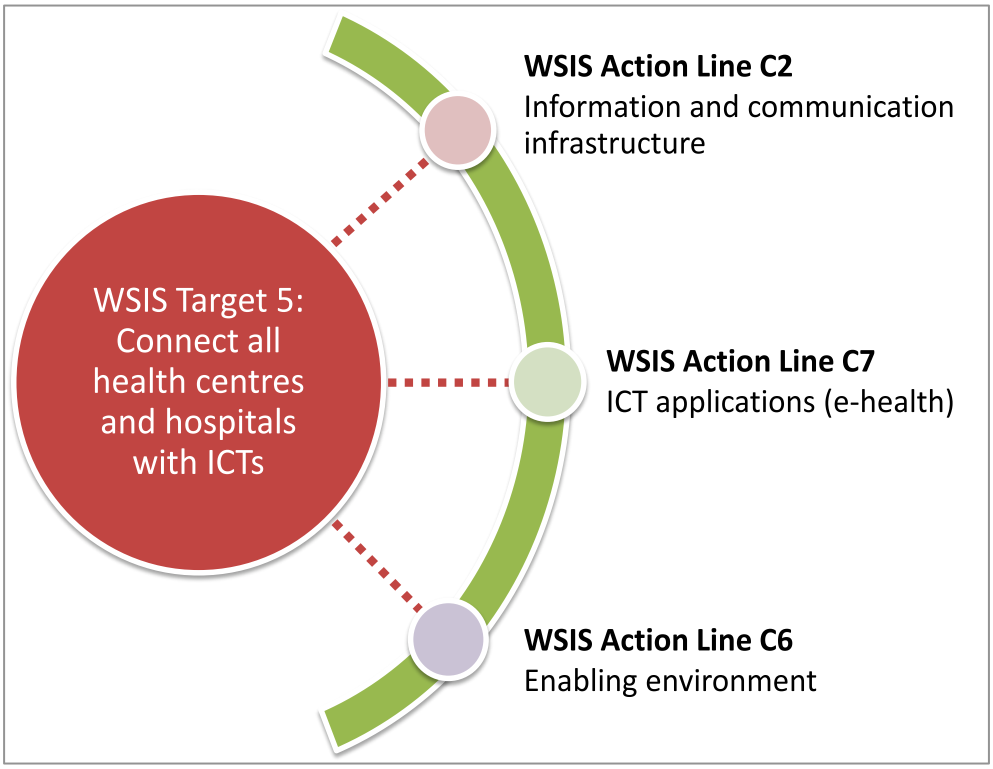
Introduction

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 deliberate over how ICTs) could play a central role in the development of a global information society. Ten targets were identified in the Geneva *Plan of Action* (ITU, 2005). The ultimate goal of the WSIS targets is to connect citizens and the institutions that serve them, to provide the ICT infrastructure to deliver the tools and services of the information age. The purpose of Target 5, in particular, is to encourage governments to provide the necessary connectivity to all health centres and hospitals. Note that "all" was added to the 2011 WSIS statistical framework document (*Partnership*, 2011) to address the measurability issues around the target.

In the Geneva *Declaration of Principles*, the first WSIS phase, stakeholders shared a vision of ICT opportunities for all. ICT applications were identified as beneficial for the health sector through improving the efficiency of health-care services and the provision of health information to the general public. In the *Tunis Agenda for the Information Society*, the second WSIS phase, stakeholders aligned WSIS Target 5 to fit more closely with the UN Millennium Development Goals (MDGs), demonstrating their commitment to improving access to global health knowledge and telemedicine (ITU, 2005). It was recommended that Target 5 and MDG Goal 8F, which promotes public-private partnerships, be strategically aligned in order to facilitate access to the benefits of ICT for all.

Target 5 needs to be considered within the context of complementary WSIS action lines: C2 states that countries should provide and improve ICT connectivity, including for health institutions; C6 addresses the need for an enabling environment; and C7 highlights the benefits of ICT applications, including eHealth applications in all aspects of life (ITU, 2005). Figure 5.1 shows the relationships between Target 5 and the WSIS action lines.

Figure 5.1: Relevance of Target 5 to WSIS action lines

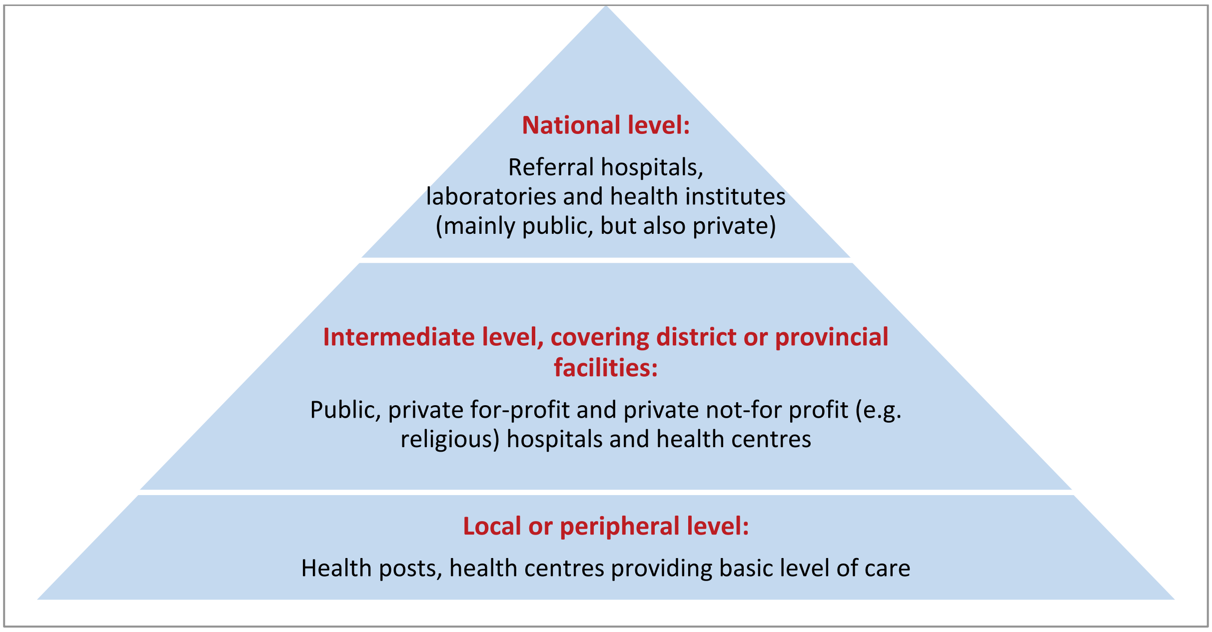


The World Health Organization (WHO) broadly defines eHealth as the “use of ICT for health” (WHO, 2009). The use of eHealth is an effective tool for supporting health-care service delivery and increasing health system efficiency. Public health services in countries are undergoing major transformation with the adoption of eHealth. Examples of some uses of eHealth include:

- **Telehealth:** The delivery of health care services where distance is a critical factor. This is done through the use of ICT for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers (WHO, 2008).
- **Mobile health (mHealth):** A medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs) and other wireless devices (WHO, 2011a).
- **Electronic Health Records (EHR):** Provider-centric electronic records used by healthcare professionals to store and manage patient health information and data, and include functionalities that directly support the care delivery process.
- **Decision-support systems (DSS):** The use of online information resources for clinical decision-making.
- **E-learning for health:** The use of ICT for educating and training health-care professionals and students.
- **E-journals:** The use of ICT to create and store electronic journals for widespread distribution across the Internet or through CDs/DVDs if online connectivity is unavailable.

A fundamental challenge to the measurement of Target 5 is the definition of health facilities. Hospitals and health centres need to be measured for connectivity; however, health systems and their facilities differ significantly within and between countries. There is currently no universal definition for health facilities. Another important factor is the lack of data concerning the total number of each type of facility (see Figure 5.2) by country. This makes estimating the degree of uptake of ICT connectivity by facility type a further challenge.

Figure 5.2: Types of health facilities by country administrative levels



Source: WHO/eHealth.

Figure 5.2 is a pyramid showing three geographic and administrative layers within most country healthcare systems including national, intermediate and local levels. At the national level, the health facilities usually include hospitals that provide tertiary care. This is health care provided by specialists after referral from primary or secondary care. These hospitals are generally public, although, some may be privately funded. Research institutes and diagnostic laboratories may also operate at the national level and sometimes at the intermediate level.

The intermediate level describes district or provincial services that offer health care through hospitals or health centres. Hospitals at this level generally offer secondary care or specialist care referred from a primary care centre. They can be public, private, or special hospitals founded by religious orders. The local level is where most people seek care first. It consists of primary health services in the local community, usually provided by a general practitioner or practice nurse. In rural areas, these services are often provided by health posts.

The pyramid shows the diversity and complexity of health systems and the numerous options for point of care where access to the Internet could be required. It illustrates that the number of health facilities is greatest at the local level, decreasing at the intermediate level and further at the national level.

Another aspect to consider regarding measurement is the technology itself. Technology, by its nature is in a state of constant evolution, therefore the measurement of one kind of ICT used for a specific function in one year may not be relevant in another year. The Organisation for Economic Co-operation and Development (OECD) proposes a practical way of dealing with this through its model survey approach. The OECD's model survey method is characterised by a series of discrete, self-contained modules that ensure flexibility and adaptability in rapidly changing environments. The approach focuses on developing indicators using a functionality-based method. Importantly, it supports technology-neutrality in that the questions neither require nor assume utilisation of a particular technology (OECD, 2010).

During the 2010 review of the WSIS targets, analysis of Target 5 highlighted that there were substantial efforts required in order to achieve the goals proposed by the WSIS stakeholders (ITU, 2010). Many countries were already in the process of introducing ICT in hospitals and health centres. However, as mentioned, there is no agreed international definition for the description, and therefore measurement, of 'health facilities'. The closest established indicator is the number of hospital beds per 10 000 population. This is published annually by WHO in the *World Statistics Database.*[3] Unfortunately, this indicator does not assist with the number and type of hospitals in a country.

In summary, the measurement of the number and type of healthcare facilities is problematic due to issues of definition as well as the difficulty in accessing accurate country records.

Availability of data and scope

ITU and the Partnership on Measuring ICT for Development sent out WSIS targets questionnaires in 2009 (ITU) and 2013 (*Partnership*) in an attempt to measure progress in achieving the WSIS targets, based on the following indicators identified in the 2011 WSIS statistical framework:

Indicator 5.1: Proportion of public hospitals with Internet access, by type of access

Indicator 5.2: Proportion of public health centres with Internet access, by type of access

Indicator 5.3: Level of use of computers and the Internet to manage individual patient information.

All three indicators present statistical challenges. In particular, for indicators 5.1 and 5.2, the definitions of public hospitals and public health centres, respectively, are unlikely to be comparable across countries. See *Partnership* (2011) for a more complete discussion of this issue.

The 2013 WSIS targets questionnaire was sent to 195 countries and 59 responded (30 per cent overall response rate). Of the responding countries, 33 (17 per cent) answered question 5.1, 23 (12 per cent) answered 5.2 and 13 (7 per cent) answered question 5.3. Regarding comparative data between the first and second surveys, there were insufficient numbers to make statistically valid comparisons (9 countries for 5.1, 4 for 5.2 and 3 for 5.3). However, general observations were made relating to 5.1.

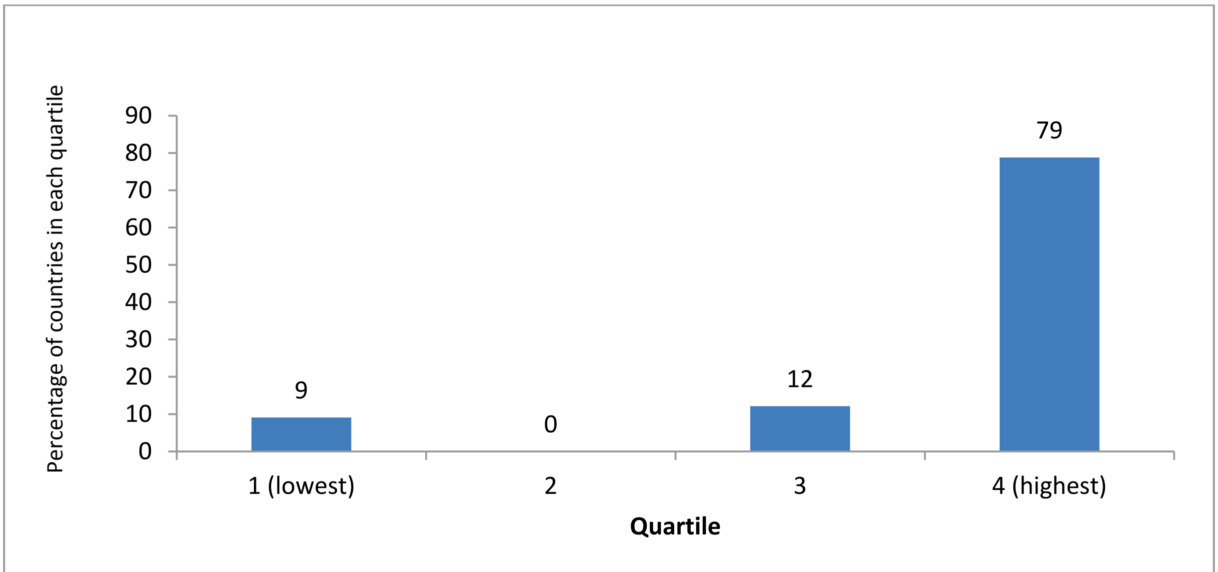
It should be noted that the WHO GOe does not compile indicators 5.1 to 5.3, nor does any other international organization.

Achievements against Target 5

Public hospitals Internet access

Chart 5.1 shows the breakdown of public hospital access to the Internet by responding countries. The percentage of hospitals with access was broken down into quartiles to facilitate analysis and visualization. Quartiles are as follows: 0–24 per cent of hospitals with Internet connectivity – quartile 1; 25–49 per cent – quartile 2; 50–74 per cent – quartile 3; 75–100 per cent – quartile 4. The question also asked countries to specify the type of Internet access, such as broadband, narrowband, mobile broadband etc. As only a few countries provided this information, without data to the contrary, it is assumed that the type of access is broadband. The chart shows that the majority of responding countries (79 per cent) have between 75–100 per cent of their public hospitals connected to the Internet. The figures are much lower for hospitals in the first and third quartiles, with only 9 per cent and 12 per cent of responding countries, respectively, offering Internet access.

Chart 5.1: Hospitals with Internet access, by quartile, 2013



Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013 (*Partnership*, 2013).

Table 5.1 shows public hospital connectivity data for individual countries between 2009/2010 and 2013. It shows that by the end of 2013, all public hospitals had Internet connectivity in two-thirds of responding countries. Growth patterns since the previous survey in 2009/2010 are not possible to ascertain as the sample size from the previous survey is too small. By individual country, there was particularly impressive growth in the examples of Georgia (from 20 to 100 per cent), Jordan (from 10 to 100 per cent) and Venezuela (from 2 to 73 per cent). The results from responding countries are encouraging, though it is not possible to determine whether this is a global trend. The sample is also possibly biased in that it may have attracted countries that had relatively positive results to report.

Table 5.1: Internet connectivity in public hospitals, by country

Country	2013 % of public hospitals connected to the Internet	2009/2010* % of public hospitals connected to the Internet
Azerbaijan	57	18*
Bhutan	100	
Bulgaria	65	
Burundi	0	
Colombia	100	
Congo	80	
Czech Republic	100	70
Denmark	100	
Dominican Republic	80	
El Salvador	100	
Estonia	100	
Finland	100	100
Georgia	100	20*
Iran, Islamic Rep.	100	
Japan	100	
Jordan	100	10*
Latvia	100	100*
Lebanon	100	
Lesotho	67	
Lithuania	100	100
Maldives	100	
Mexico	85	
Nauru	100	100*
Nigeria	10	
Portugal	100	98*
Spain	100	100*
Thailand	100	
Turkey	100	100*
United Arab Emirates	100	
Uruguay	100	
Venezuela, Bolivarian Republic of	73	2*
Viet Nam	98	
Yemen	24	

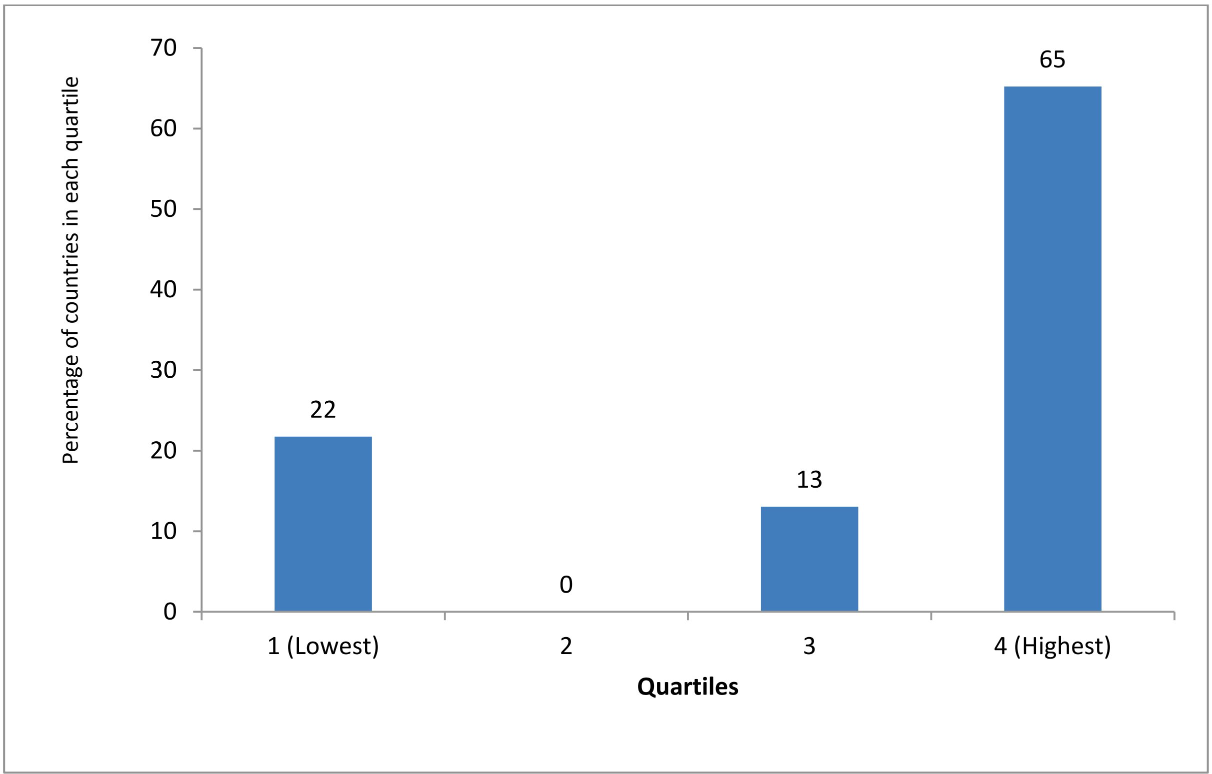
Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Note: * represents 2010 data provided in the 2013 survey.

Health centres Internet access

Chart 5.2 shows the breakdown of public health centre access to the Internet by responding countries. As with Indicator 5.1, without data to the contrary it is assumed that the type of Internet access provided to health centres is broadband. The chart shows that the majority of responding countries (65 per cent) have between 75–100 per cent of their health centres connected to the Internet. The figures are much lower for health centres in the first and third quartiles, with only 22 per cent and 13 per cent of countries, respectively, offering Internet access.

Chart 5.2: Public health centres with Internet access, by quartile, 2013



Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Table 5.2 shows that by the end of 2013, all public health centres had Internet connectivity in two-fifths of responding countries. Growth patterns since the previous survey in 2009/2010 are not possible to determine as the sample size from that survey is too small. Compared with hospital connectivity, there is a lower proportion of countries with all health centres connected. Additionally, in countries without universal coverage, the proportions tend to be lower than for hospitals. This is most probably due to operational differences between health centres and hospitals. Connecting hospitals is likely to be a higher priority for governments as there is generally a greater volume of data collection, processing and transmission in hospitals compared to health centres.

The results from responding countries are moderately encouraging but it is clear there is much work to be done before all public health centres are connected.

Table 5.2: Internet connectivity in public health centres, by country

Country	2013 % of health centres connected to the Internet	2009/2010 % of health centres connected to the Internet
Azerbaijan	100	100
Bhutan	8	
Bulgaria	35	
Congo	80	
Czech Republic	82	
Denmark	100	
Dominican Republic	68	
El Salvador	12	
Estonia	100	
Finland	100	
Georgia	100	
Iran, Islamic Rep.	90	
Jordan	70	
Lebanon	100	
Lesotho	1	
Lithuania	99	
Maldives	98	
Mexico	10	
Nauru	100	100
Thailand	100	
Turkey	100	
United Arab Emirates	58	
Venezuela, Bolivarian Republic of	20	1
Viet Nam	97	

Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Use of computers and the Internet to manage individual patient information

Indicator 5.3 is level of use of computers and the Internet to manage individual patient information. Unfortunately, there are no existing data sources to adequately measure this indicator. The 2011 WSIS statistical framework suggested the use of data from Global Observatory for eHealth survey. However, there are no relevant data available from that source.

Alternative approaches to measurement of Target 5

Indicators 5.1, 5.2 and 5.3 pose several challenges that make their collection and reporting difficult. It is clear that there is an overall lack of global data on these indicators, primarily because neither governments nor international agencies are collecting and reporting on these indicators. Secondly, there are also major issues concerning indicator definitions as there are no commonly agreed upon definitions for these indicators. This is a particular problem for defining statistical units, 'public hospitals' and 'public health centres' (see the 2011 WSIS statistical framework) for a fuller discussion). It is therefore suggested that other indicators be found which can reflect developments in connectivity as well as the uptake of eHealth by countries.

The following section discusses alternative approaches to measuring progress on Target 5. The monitoring of these indicators will be more achievable and the information gained likely to have broader value in the overall context of eHealth development in countries.

The proposed indicators are:

- the uptake of HINARI
- the adoption of eHealth strategies.

HINARI – connectivity driven by the need for content

A potential proxy indicator on connectivity of public sector health-related institutions is the uptake of an online knowledge service made available to health facilities in developing countries. This service is HINARI (Health InterNetwork Access to Research Initiative) and it can only be accessed if there is Internet connectivity within the institution. In collaboration with its publishing partners, WHO provides access to up to 13 000 online biomedical journals in hospitals, research institutions and health centres. HINARI is offered at no, or very low, cost depending on the country. Countries are assessed for eligibility based on four factors: total GNI (World Bank figures), GNI per capita (World Bank figures), United Nations least developed country (LDC) status and the Human Development Index (HDI).[4]

To gain access to HINARI, institutions must complete a subscription form and, if required, pay the annual fee. The subscription form does not ask the institution to specify whether it is a hospital, health centre or research institution, so analysis by these categories is currently not possible. It also does not ask the institution whether it has narrowband or broadband access.

The number of HINARI institutions in a country is a direct reflection of the number of health-related institutions with access to the service and therefore with Internet connectivity. It follows that an indicator based on HINARI would provide reliable information on country level connectivity.

More specifically, HINARI data could be used as a data source for indicators 5.1 and 5.2 if:

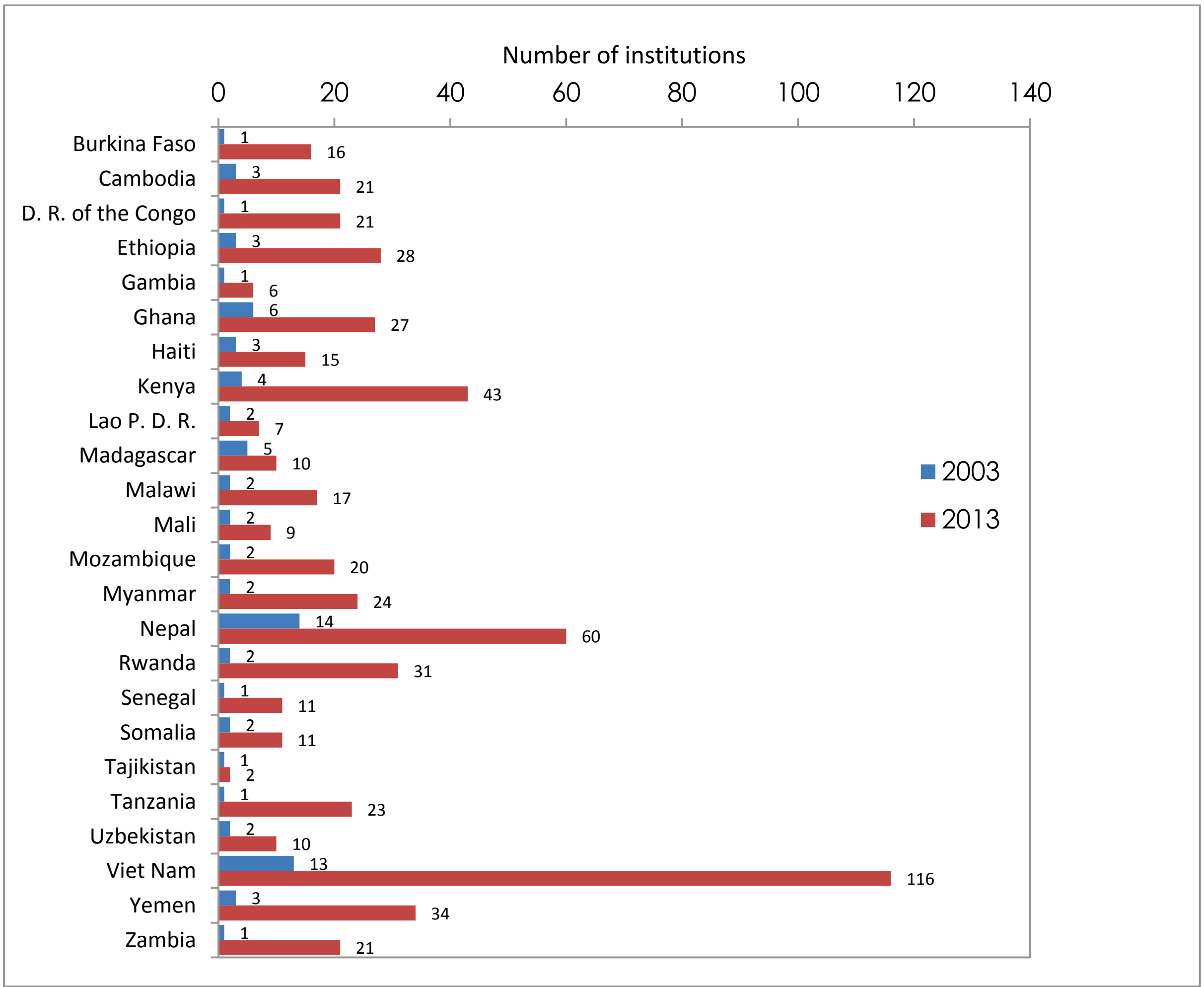
- data were split by type of institution and
- supplementary data on the number of public hospitals and health centres in countries were available.

In this case, the percentage of connected institutions, by type, could be calculated for countries participating in HINARI.

Access to HINARI would be only one of the Internet-based services that hospitals and other health-related institutions would use. Other benefits from Internet access would include communication by health professionals via e-mail as well as the possibility of using electronic health records (EHR) if available. Once connected to the Internet, hospitals could consider offering *Telehealth* services to isolated patients.

Chart 5.3 shows growth in the number of connected health-related institutions[5] in low-income countries from 2003 to 2013. Some countries show more growth than others, with particularly strong growth in Kenya, Nepal and Viet Nam.

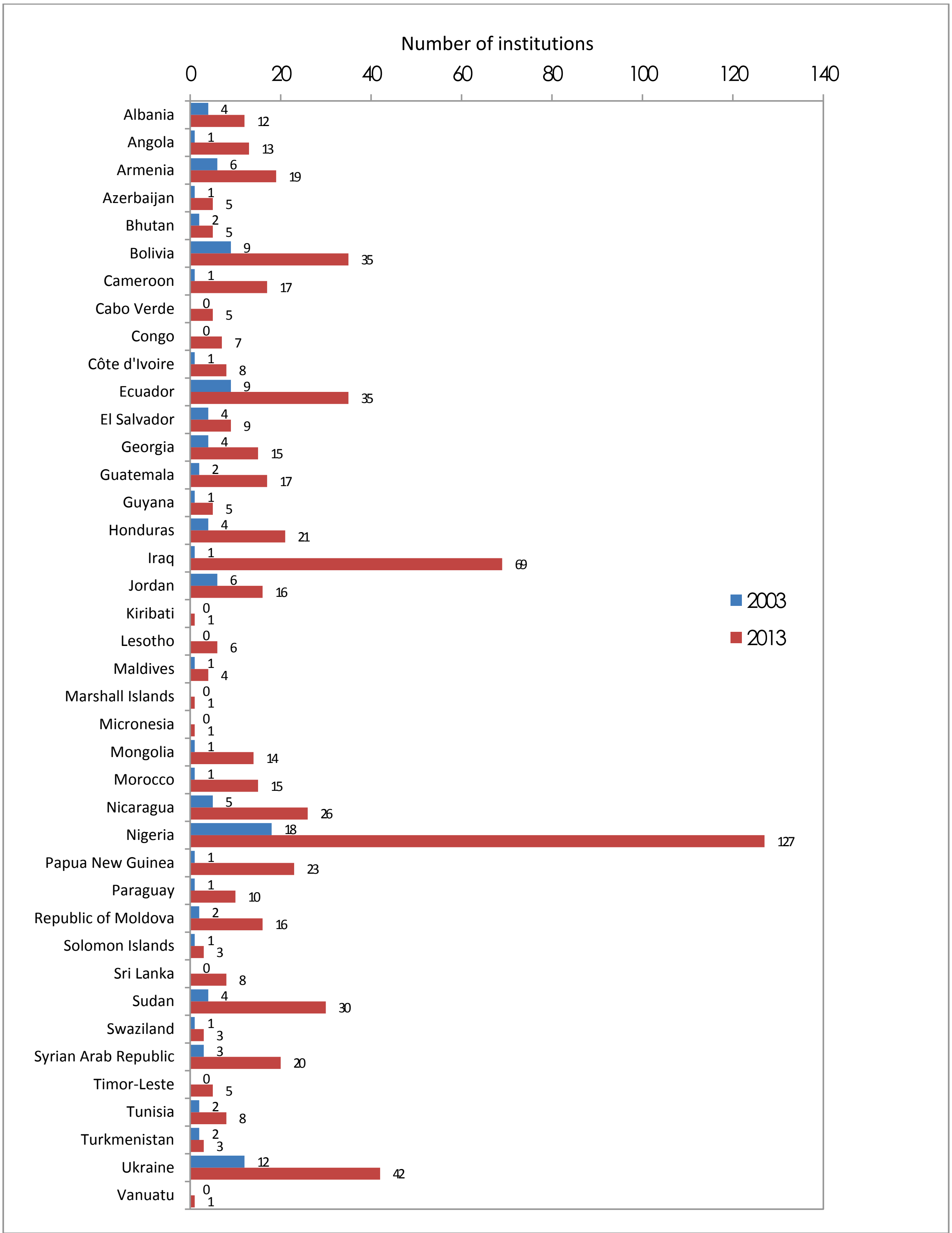
Chart 5.3: Health-related institutions, access to HINARI, low income countries



Source: HINARI project files, 2014.

Chart 5.4 shows that many low to middle income countries display substantial growth in the number of HINARI institutions. Of particular note is the growth in countries such as Bolivia, Ecuador, Iraq, Nigeria and Ukraine.

Chart 5.4: Health-related institutions, access to HINARI, low–middle income countries

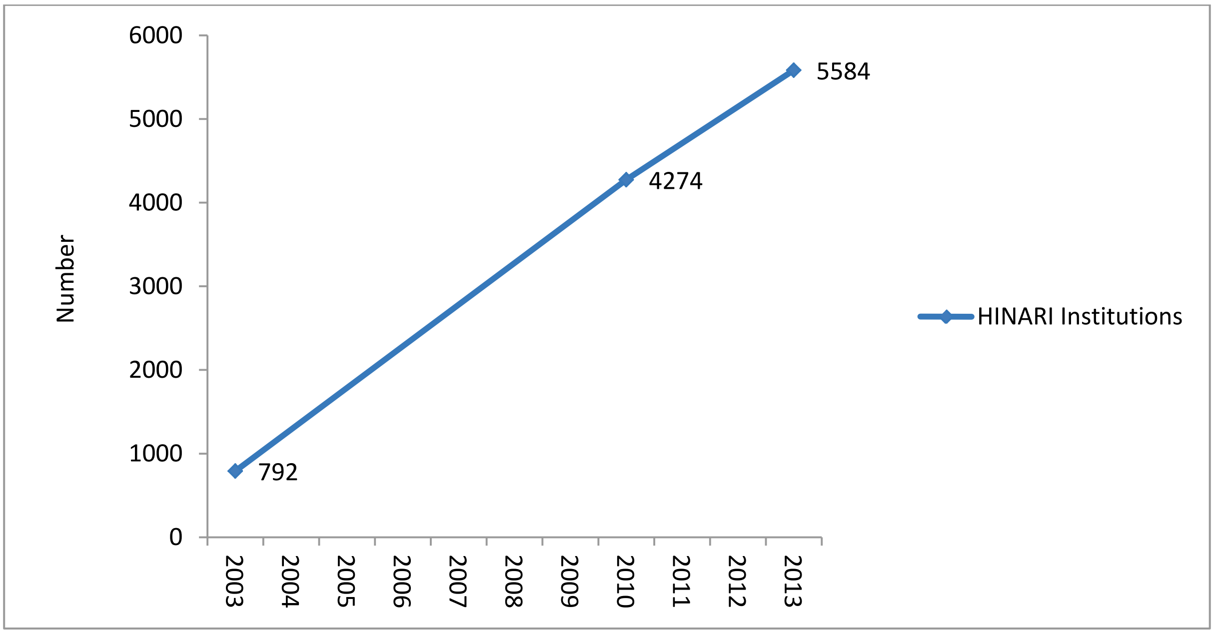


Source: HINARI project files, 2014.

Note: The country of Sudan split in 2011.

Chart 5.5 shows the strong growth in the number of HINARI institutions, from an original baseline in 2003 of 792 connected institutions. By 2010, the number had increased by 440 per cent to 4 274. At the end of 2013, the number of institutions reached 5 584, representing growth of over 600 per cent from 2003.

Chart 5.5: Growth in number of HINARI institutions, 2003–2013



Source: HINARI project files, 2014

Adoption of eHealth strategies

A current priority area for WHO, based on the expressed needs of many member states, is to offer support for the development of national eHealth strategies. The strategic introduction of ICT to support the health sector is complex and requires both careful planning and multi-sectoral collaboration. An effective eHealth strategy should present the strategic context for the introduction of eHealth and the eHealth components required to meet national eHealth objectives. Central to developing a sound eHealth strategy is the recognition that eHealth represents a collaborative effort between the health, information technology and telecommunications sectors, as well as requiring active involvement from both the public and private sectors.

The existence of an eHealth strategy can be a good indication that a national government recognises the significance and role that eHealth can play in the health sector. The proposed indicator for this measure is the percentage of countries with an eHealth strategy, with the target being 100 per cent of countries by 2020. This is currently one of the main indicators used by WHO to assess the extent of its work with member states in the eHealth domain.

The WHO Global Observatory for eHealth closely monitors the development and adoption of eHealth strategies by countries. A dedicated directory has been created on the Observatory's website[6] to list countries with national eHealth strategies, as well as making available the details of the strategy. The baseline for the number of national strategies in 2009 was 55; this had grown to 85 by the end of 2013 and represents growth from 28 per cent to 44 per cent of all WHO member states. However, the result shows that much remains to be done before all member states have an eHealth strategy to guide their eHealth implementation.

However, the existence of a strategy is not enough to make a broad assessment as to the state of eHealth in countries. Other factors should also be considered, such as the extent of its implementation and the scope of eHealth solutions proposed.

WHO is working with ITU to support countries in the development of eHealth strategies. For the first time, member states have access to a comprehensive and expert guide, the *National eHealth Strategy Toolkit* (WHO and ITU, 2012) as well as intensive training workshops for stakeholders. A national eHealth strategy supports the achievement of Target 5 through:

- planning for government funding and policy support for funding connectivity in healthcare facilities
- creating an enabling environment to support connectivity and eHealth approaches
- the collaboration of ministries of health, communications and finance for eHealth governance and strategic planning
- providing funding for its sustainability.

Extending our understanding of eHealth

In the previous section, two alternative methods were proposed for measuring progress in Target 5. This section explores the use of other relevant indicators to provide a more comprehensive overview of the uptake of eHealth in countries. All of these sources are complementary in that they study the use of ICT for health but in different ways. Together they give a richer view of the status of eHealth in countries.

Sources include:

- thematic surveys – topic specific and targeting a subset of member states
- comprehensive and high-level global surveys – covering key eHealth themes and targeted at all member states
- model surveys – flexible in design and approach.

Innovation and eHealth for women's and children's health

This is a good example of the use of a thematic survey concerning the application of eHealth for women's and children's health in developing countries. The 75 countries targeted were identified by the UN Commission on Information and Accountability for Women's and Children's Health.[7] The respondents were specialists in women's and children's health and ICT. In mid-2013, GOe conducted a survey of countries with the greatest need and least available resources (WHO, 2011) to establish a baseline for the use of ICT to support the health of women and children. Sixty-four countries responded, a response rate of 85 per cent, reflecting strong country interest. The survey investigated areas such as the use of ICT in health monitoring and surveillance, registration of vital events, monitoring indicators and electronic health information systems.

The results are reported in a joint WHO–ITU publication, *Innovation and eHealth for women's and children's health* (WHO, 2014) It shows the vital role played by ICT in helping achieve the MDGs and how innovations in eHealth are saving the lives of women and their children in some of the most vulnerable populations around the world.

Box 5.1: Use of ICT for women's and children's health – CoIA recommendations and key findings

Coordinated inter-sectoral planning: Well-coordinated inter-sectoral planning is fundamental to limiting the proliferation of pilot projects, recognizing the role of standards and interoperability, and building capacity of the health workforce.

- Recommendation: Ministries of health and their partner organizations should foster inter-sectoral collaboration in planning and implementing eHealth services and information systems.

Moving to electronic data collection: The current situation in most countries is a blend of paper and electronic systems. Moving to electronic formats is intended to improve reliability, accuracy, timeliness, cost-effectiveness and reporting.

- Recommendation: Coordinate the collection of indicators via electronic means as part of an integrated plan for implementing eHealth services for women's and children's health.
- Recommendation: Support the adoption of district web-based reporting initiatives with the goal of integrating health information systems for reproductive, maternal, newborn and child health (RMNC).
- Recommendation: Identify and adopt ICT-enabled RMNCH resource tracking systems in alignment with other public expenditure information management systems.

eHealth strategy: Most countries reported having a women's and children's health policy or strategy referring to eHealth, and a far lesser number refer to eHealth within their RMNCH strategies. These two policies should be complementary.

- Recommendation: RMNCH policies need to recognize the importance of eHealth to support their goals, and concurrently, national eHealth strategies should promote the use of eHealth for RMNCH.

eHealth initiatives knowledge base: A global inventory of eHealth initiatives (including mHealth and social media) is a valuable planning resource for countries to learn from each other's experiences.

- Recommendation: To promote knowledge sharing, countries are encouraged to regularly contribute their eHealth initiatives to the WHO global eHealth database.

Electronic RMNCH content: As Internet connectivity and services become more established, so do the opportunities for improving access to information for citizens and health-care professionals. Simultaneously, the use of social media, the development of websites providing RMNCH information, or decision support systems for health-care professionals are all contributing to eHealth services being provided.

- Recommendation: Improve the quality and scope of electronic RMNCH information for both citizens and health-care professionals for delivery in available and appropriate e-formats.

Enabling eHealth programmes

ICT training: The fundamental challenge of building human capacity for health is clear. While those with training may now have the skills to learn online, many professionals still do not know how to acquire the ICT capabilities they need to access knowledge and training online.

- Recommendation: Enable online learning for health-care professionals using affordable ICT solutions and training approaches appropriate to the local context.

Privacy: Governance and policy at the national level must strive to find the right balance between measures to safeguard privacy, confidentiality and security while enabling the management of data sources to support research and decision-making.

- Recommendation: National information policy should address the privacy and accountability implications of using eHealth, including in the provision of RMNCH services.

Source: WHO (2014) Global Observatory for eHealth, Innovation and eHealth for women's and children's health.

Global eHealth surveys

Global eHealth surveys are conducted periodically by the WHO GOe. The first two surveys in 2005 and 2009/2010 established baseline figures. The third survey will be conducted during 2014 and will focus on the role of eHealth in member states' efforts towards universal health coverage. The aim of universal health coverage is for all people to receive quality health services that meet their needs, without exposing them to financial hardship. The survey will explore how the following thematic areas can contribute to the goal of universal health coverage:

- uptake of eHealth foundation policies and strategies
- deployment of mHealth initiatives in countries
- application of telehealth solutions
- adoption of e-earning for health professionals and students
- legal and ethical frameworks for electronic patient information
- legislation and initiatives concerning online child safety, Internet pharmacies and health information on the Internet
- governance and organization of eHealth in countries.

The strength of global surveys is that they provide data from a large number of countries with varying economic situations and health priorities, thereby providing a comprehensive picture of the eHealth landscape. However, a disadvantage is that they are normally carried out at the national level and therefore only provide national data.

The OECD model survey

Model surveys offer flexibility while maintaining comparability. The OECD model survey functionality approach has been endorsed by the European Commission (EC) and WHO. One of the prime challenges of a model survey is to ensure that the terminology has comparable meaning across countries. This means that when changes to questions are made by individual countries, they are done in ways that maintain comparability. For example, for many countries, the terms electronic medical record (EMR) and electronic health record (EHR) have different meanings. These differences in interpretation and approaches across countries impede meaningful benchmarking. To avoid such issues, OECD has chosen to focus on developing a model survey using indicators that reflect functionality.

The model survey uses three broad categories of contextual indicators including:

- availability and use of electronic records and health information exchange
- availability and use of functionalities that support patient engagement with electronic records
- availability and use of telecommunications technologies to support health care delivery.

Importantly, this approach also supports technology-neutrality which means the questions neither require nor assume a particular technology. This is forward-looking in that it does not hinder the future use, or development, of technologies. The OECD approach was adopted by the European Commission in 2013 to benchmark deployment of eHealth among general practitioners in the European Union (EU) and more recently by Brazil.[8] The Working Group on ICT measurement of the Statistical Conference of the Americas, coordinated by the National Statistics Office of the Dominican Republic and Economic Commission for Latin America and the Caribbean is adapting the OECD model survey for use in Latin America.

Sample of international data sources

The number of international agencies currently contributing data to the pool of eHealth knowledge is limited and includes those shown in Table 5.3. What is clear from the table is that the nature and scope of data collected by these organizations is a distinct reflection of their mandates. The GOe of the World Health Organization, established in 2005, is the only observatory to specialise in the collection and analysis of data on trends and developments in eHealth worldwide.[9] The OECD collects selected health and ICT-related data; however, coverage is primarily of OECD member countries, with the exception of a few observer countries (Argentina, Brazil, China, Egypt and South Africa). The Health care Information and Management Systems Society (HIMSS) is a global not-for-profit organization that focuses on achieving better health through use of information technology. It is well established in North America and is now expanding in Europe, Asia and the Middle East.[10]

Table 5.3: Sample of international sources of ICT and health data

Key areas studied and indicators	Strengths	Limitations
World Health Organization, Global Observatory for eHealth (GOe)		
• global survey data on eHealth from over 110 countries every 4 years • data on the uptake of eHealth technologies and related policies	• all 194 WHO member states are invited to participate • data focusing on the adoption of eHealth policies and other supporting actions that provide an enabling environment for growth of eHealth in countries • eHealth country profiles for all participating WHO member states • data collected on a regular basis • special theme surveys conducted in addition to global surveys	• data collected at national level therefore information at regional or local level not available • survey results based on self-reporting by eHealth experts in country • expert informants often change from survey to survey
Organisation for Economic Co-operation and Development (OECD)		
• data on ICT and health at the country level • literature reviews and case studies of ICTs for health in OECD countries	• data available for the 34 OECD countries and now working with most BRIC countries • a range of ICT indicators as well as health-system indicators for OECD countries • case studies on eHealth in OECD countries	• selective data on ICT and health
Health care Information and Management Systems Society (HIMSS)		
• 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 • now expanding operations to Europe, Asia and Middle East • 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 for health facilities in the US and Canada, although coverage spreading

Source: WHO/eHealth.

Conclusions and recommendations

The results for Indicator 5.1 show that by the end of 2013 all public hospitals had Internet connectivity in two-thirds of responding countries. This is a good indication that solid progress is being made in those countries. Results for Indicator 5.2 show that there has been less progress in health centre connectivity; by the end of 2013, all public health centres had Internet connectivity in two-fifths of responding countries. HINARI data provide reliable information on the number of connected health-related institutions in low and low-middle income countries. In the ten years, 2003 to 2013, the number of connected institutions across all HINARI countries grew significantly, from 792 to 5 584. No results are shown for Indicator 5.3 as there were insufficient data for a meaningful analysis.

Measurement of progress against Target 5 has significant challenges due to the overall lack of systematically collected data. The *Partnership* surveys are currently the sole source of data for all three indicators. The WSIS + 10 review provides an ideal opportunity to reassess the existing WSIS targets and review what is being measured, by whom and for what purpose. This chapter has shown that the extent of connectivity of hospitals and health centres to the Internet is difficult to measure globally. Although having this data would indeed be useful for planning and funding purposes, there is more value in trying to understand how eHealth systems are emerging, what they do, and how they are transforming health care delivery. The Global Observatory for eHealth, through its periodic global surveys, attempts to study the uptake of eHealth based on quantitative and qualitative descriptions of eHealth systems and services, as well as important enabling factors such as the policy and legal environments. It is proposed that Target 5 connectivity indicators be revised with the aim of making the data more applicable in the broader global context of eHealth.

Country connectivity data broken down by hospitals and health centres is challenging for any agency to collect. However, similar data collected by the WHO HINARI programme is more readily available and could be collected and reported at regular intervals. Not only does it provide a reliable indication concerning connectivity of health facilities, but it also allows for reporting in another important WSIS area – enabling access to the world's medical knowledge. Data collected through HINARI could be enhanced by asking subscribing institutions additional questions, such as type of institution and level of connectivity. This information could be used in conjunction with data on the number of public hospitals/health centres in countries to derive data for indicators 5.1 and 5.2 for those countries participating in HINARI.

It is recommended that from 2015, data on connectivity for Target 5, as well as the measurement of growth in access to the world's medical knowledge, be provided through an analysis of enhanced WHO HINARI programme records. The target will be set to 100 per cent of countries to provide Internet connectivity to health facilities by 2020.

As part of its vision, WSIS recognises the vital importance for countries to develop and implement eHealth strategies that support the strategic use of ICT within the health sector. The existence of a national eHealth strategy that has been implemented is a good indicator of progress in the uptake of eHealth in countries. WHO considers this a priority area for its activities and is currently working with ITU to ensure that member states are given guidance and support in developing their national eHealth strategies.

WHO, through the GOe surveys, will continue to monitor and report on the progress of member states in the development and implementation of eHealth strategies. In addition to data already collected, it is proposed that the scope of the policy content be recorded so as to provide a more complete description of the trends in eHealth development.

It is recommended that from 2015, data on the development and implementation of national eHealth strategies and their content be reported for Target 5 as an indicator of eHealth uptake in countries. The target for the proposed indicator is to have 100 per cent of countries with an eHealth strategy by 2020.

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Endnotes

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[1] The original WSIS indicator was worded slightly differently "Connect health centres and hospitals with ICTs".

[2] Health InterNetwork Access to Research Initiative, http://www.who.int/hinari/en/.

[3] WHO (2013) World Statistics Database, 2013, http://www.who.int/gho/publications/world_health_statistics/en/.

[4] WHO HINARI access to research in health programme, 2014, http://www.who.int/hinari/en/.

[5] Although some health-related research institutions are included in the programme, the prime targets are health care institutions.

[6] See GOe website, www.who.int/goe.

[7] WHO (2012) Accountability for Women's and Children's Health, http://www.who.int/woman_child_accountability/countries/en/.

[8] Cristiano Codagnone & Francisco Lupiañez-Villanueva (2013) Benchmarking deployment of ehealth among general practitioners. European Commission DG Communications Network, http://www.nic.br/imprensa/.

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CONNET ALL CENTRAL GOVERNMENT DEPARTMENTS AND ESTABLISH WEBSITES

Target 6: Connect all central government departments and establish websites[1]

Executive summary

Target 6 reflects the growing importance of e-government in terms of connecting government departments and equipping them with a web presence. The Geneva *Plan of Action* (ITU, 2005) called for developing national e-government initiatives and services to achieve greater transparency and accountability at all levels of government for better service delivery. E-government as a tool for public sector reform and development enables better inter-organizational linkages and consolidation of government systems, improvements in service delivery and efficacy in government functioning.[2]

Governments are increasingly looking towards e-government to achieve maximum cost savings and improved service delivery, by focusing on the provision of services at the front end supported by integration, consolidation and innovation in back-end processes and systems. While many countries have initiated public administration reform through e-government by strengthening infrastructure and enhancing online service delivery in support of socio economic development goals, disparities remain in the use of ICT in government across countries, thus contributing to a global digital divide that is expected to diminish slowly over time.

Target 6 is assessed by seven indicators falling into two categories: use of technology by government employees and organizations, and e-services to citizens. A review of this target indicates that, for most of the indicators, progress is not uniform across regions and countries, with many countries still not utilizing the full potential of ICT in government.

Data on the use of ICT in government also remains scarce because either countries do not collect data on the use of ICT in government as a matter of routine, or because of rapid advances in technology, the type of data collected becomes obsolete. This makes quantitative assessment on the achievements of much of Target 6 challenging.

An assessment of the self-reported national level data, where available, indicates disparities between developed and developing countries. Whereas the majority of developed countries (75–100 per cent) indicated routine use of computers and the Internet by government employees, the same was at times less than 50 per cent in some developing countries. A similar pattern was observed in the availability of local area networks (LANs) and the Internet, with the majority of developed countries reporting 80–100 per cent availability and developing countries reporting much lower levels.

However, in terms of e-services, countries have addressed a wide array of issues in the last ten years. These include provision of more public services online and meeting the growing demands of citizens for e-participation in public policy decision-making. Considerable progress has been made globally on establishing government agencies' websites, with all countries having a government web presence in 2014. Countries also advanced further in interactive, transactional and connected services to citizens. These indicators assess different types of services including:

- online documents on laws, policies etc.

- public services such as taxes, fines, licences, which comprise transactional services
- e-participation information and services, which assess the level of inclusion by the government in public policy and are termed "connected services".

Online information and services on government website portals increased threefold in the last decade, with 70 per cent of countries providing a one-stop shop portal in 2012, compared to 26 per cent in 2003. By 2014, almost all of the countries of Europe, and the majority in the Americas and Asia, provided information on education, health, finance, social welfare, labour and environment. The proportion was less in other regions, such as countries in Africa, which ranged from 31 per cent in social welfare to much higher at 65 per cent in finance. In terms of transactional services in 2014, about half the countries of the world provided for creation of a personal online account and in 73 countries (38 per cent) income taxes could be paid online.

Notwithstanding progress, considerable disparities remain between developed and developing countries. It appears that governments that have benefited most from the opportunities offered by ICT are those that have successfully addressed the issues of development priorities, including resource availability, regulatory frameworks and human and technological infrastructure.

To adequately assess future progress, it is recommended that the target on e-government be retained, as most countries are far from fully utilizing the benefits of ICT in government. However there is a need to address the scarcity of global comparable data. In this context, there may be a need to revisit the indicators on access to, and use of, ICT in government for a post-WSIS target.

Some specific recommendations are:

- Governments need to address challenges in capturing data on use of ICT in government.
- Development of a secondary set of e-government indicators may help to broaden the scope of monitoring and feedback.
- Review the framework for supporting and monitoring e-government at the global level.

Develop a strategic framework for how ICT can be better utilized by governments.

Introduction

The use of ICT in government – e-government – is a key tool for effective functioning of government. Many countries are adopting a greater use of ICT in government as advances in technology and the changing world environment enable them to exploit synergies between e-government and public sector efficiency. Acceptance is gaining ground among policy-makers that e-government can effectively contribute to improving efficiency in government, along with greater public service delivery.

ICTs can enhance and streamline processes across government agencies, thereby improving public administration. Use of ICT in government also serves 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 the civil society.

Recognition of the important role of e-government has led many countries to reform, modernise and augment the use of ICT in public administration systems. This includes strengthening the ICT infrastructure that enables online service delivery in support of socio economic development goals, including the millennium development goals. Nevertheless, huge disparities remain in the use of ICT in government across countries, thus contributing to a global digital divide that is expected to diminish slowly over time.

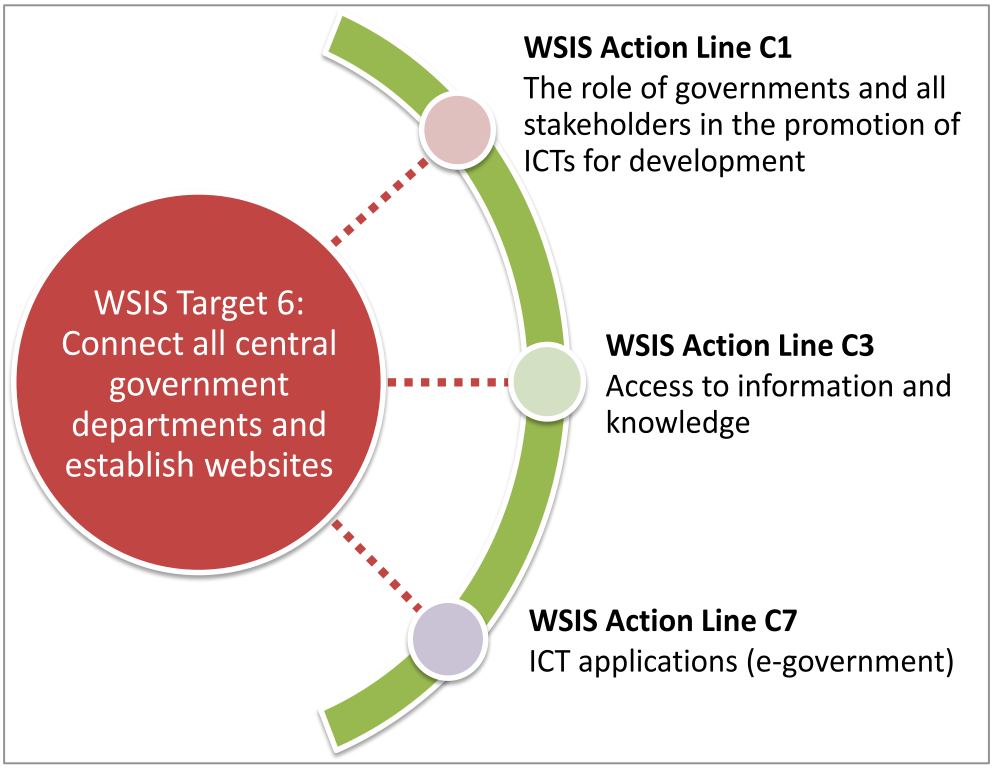
Governments can contribute to an open environment by sharing previously ‘locked-up’ data sets, a trend that is increasingly being adopted in both developed and developing countries. By opening up their information, government present opportunities for everyone (including scientific and research centres) to use the raw information, repurpose it, or integrate economic, social and environmental data to advance sustainable development (UNDESA, 2012).

The United Nations has been central in promoting multistakeholder cooperation and the development of e-government across regions – including, through lessons of experience in the use of ICT by governments and the development of global information repositories and databases. Discussions of concepts and good practices have contributed to the development of innovative solutions in many countries of the world and have advanced the vision and concrete agenda set by the WSIS.

The United Nations Department of Economic and Social Affairs (UNDESA) is the leading agency in international e-government benchmarking of e-government services. UNDESA has had an important role in implementation of the Geneva *Plan of Action* and the Agenda of the WSIS (ITU, 2005) as the focal point for implementation and follow-up of the following action lines:

- C1: The role of public governance authorities and all stakeholders in the promotion of ICTs for development
- C7: ICT applications: benefits in all aspects of life – focusing on e-Government
- C11: International and regional cooperation.

Figure 6.1: Relevance of Target 6 to WSIS action lines



WSIS Target 6: framework and scope of review

Policy-makers at the WSIS in 2003 had already recognized that the use of ICT in government is crucial for development. The WSIS Geneva *Plan of Action* stated that "ICT applications can support sustainable development, in the fields of public administration, business, education and training, health, employment, environment, agriculture and science within the framework of national e-strategies" and in respect of e-government called on governments to:

"(a) 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.

(b) 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.

(c) Support international cooperation initiatives in the field of e-government, in order to enhance transparency, accountability and efficiency at all levels of government." (Action Line C7, ITU, 2005)

Within this framework, the WSIS set targets to measure progress in the use of ICT by governments. For the advancement of e-government, the Geneva *Plan of Action* identified a target to "Connect all local and central government departments and establish websites and email addresses". In constituting the WSIS target for e-government, it was deemed important that national and local/municipal governments and departments be connected online.

Box 6.1: The Task Group on e-Government (TGEG)

The Task Group on E-government (TGEG) was established in 2006 by the Partnership on Measuring ICT for Development. The United Nations Statistical Commission (UNSC), at its 2007 meeting, asked the *Partnership* to extend the core list of ICT indicators to include indicators on ICT use in government (UNSC, 2007).

The TGEG has been working on the development of consistent, sound, relevant e-government development indicators for cross-country comparisons. It has developed a core list of e-government indicators, which were endorsed by the UN Statistical Commission in its forty-third session. For the work of TGEG, see the *World Telecommunication/ICT Development Report* (ITU, 2010) and the *Framework for a set of e-government core indicators* (*Partnership* and UNECA, 2012). A training manual on the use of the e-government indicators has also been developed (*Partnership* and UNECA, 2013) and will be translated from English to French for dissemination.

The members of the Task Group are UNECA (coordinator), UNECLAC, UNESCAP, UNESCWA, Eurostat, ITU, OECD, UNCTAD, UNDESA and the World Bank. Among its terms of reference were development and recommendation of a core set of statistical indicators which can be collected by countries.

In 2009, ITU, along with UNDESA, UIS and WHO, initiated a quantitative mid-term review of the WSIS targets to identify the challenges in measuring ICT, including e-government, and to ascertain whether a review of the scope of the WSIS targets was required in light of the rapid advancements in the adoption of ICT use. To ensure a globally consistent approach for review and assessment, the WSIS e-government target, "Connect all local and central government departments and establish websites and email addresses", was clarified and interpreted as comprising three distinct goals:

1. Connect central and local government departments.
2. Establish websites for central and local government departments.
3. Establish e-mail addresses for central and local government departments.

The wording of the target was changed for measurability purposes in the 2011 WSIS statistical framework (*Partnership*, 2011). The scope was changed from the original "local and central government" to "central government" and the reference to "e-mail addresses" was dropped. Notwithstanding the revisions to the target in 2011, it still poses considerable measurement challenges. The WTDR 2010 noted that the term “connect” in reference to governments or “establish a website” could be open to interpretation as government offices could have Internet access and/or an established website of varying degrees of sophistication. Access to the Internet or availability of computers does not automatically imply that all offices and staff in the departments are fully equipped with ICTs, or that links have been established between different government entities. The lack of effective and integrated use of ICT by government departments and entities would have implications for the effectiveness of public administration and public sector service delivery. Other measurement challenges include the heterogeneity of government departments; this is further discussed below.

In response to a UNSC request to extend the core list of ICT indicators to include indicators on ICT use in government (see Box 6.1), the *Partnership*, through its Task Group on e-Government (TGEG), prepared a set of measurable e-government indicators to help monitor progress towards achieving Target 6. These were presented in the publications: *Monitoring the WSIS Targets, A mid-term review* (ITU, 2010) and *Measuring the WSIS Targets. A statistical framework* (*Partnership*, 2011). They were subsequently elaborated in *Framework for a set of e-government core indicators* (*Partnership* and UNECA, 2012), which proposes a set of seven globally comparative e-government core indicators, along with their associated statistical standards and definitions. The set of indicators was endorsed by the UNSC in its forty-third session in 2012 (UNSC, 2012).

Significant challenges were encountered in the development of the e-government indicators in terms of statistical feasibility, cross-country comparability, data collection costs and burden on countries. The scope and statistical units for the indicators, that is, what units of government they encompass and how these are to be defined, pose a particular challenge – as government statistical units are heterogeneous and are therefore not easily defined in a way that can be applied uniformly across all countries. In addition, the functions of central government will vary across countries, thus compounding comparability problems. For example, in some countries, schools, hospitals, health centres, museums, police stations or post offices could be under the control of central government, while in others these may be controlled by provincial/state, or even local, authorities. To overcome these challenges, the E-government framework recommends that indicators be classified and weighted by size of central government organization, thus enabling comparison of similarly sized units across countries.

The detailed measurement framework served the purpose of defining the parameters of the quantitative assessment of the progress made on e-government for the WSIS +10 review and has formed the basis for national and international data collection with respect to the monitoring of the WSIS targets.

Progress against Target 6 is tracked by the seven indicators, which are presented in Box 6.2. All but one of them (6.7) are core e-government indicators of the *Partnership*.

Box 6.2: Developing indicators for the WSIS target on e-government

Target 6

WSIS Target 6 (2003): Connect all local and central government departments and establish websites and e-mail addresses.

WSIS Target 6 (revised, 2011): Connect all central government departments and establish websites.

A set of e-government indicators to measure the revised target:

EG1[3]–6.1 Proportion of persons employed in central government organizations routinely using computers

EG2–6.2 Proportion of persons employed in central government organizations routinely using the Internet

EG3–6.3 Proportion of central government organizations with a local area network (LAN)

EG4–6.4 Proportion of central government organizations with an intranet

EG5–6.5 Proportion of central government organizations with Internet access, by type of access

EG6–6.6 Proportion of central government organizations with a web presence

6.7 Level of development of online service delivery by national governments

(EG7 is Selected Internet-based services available to citizens, by level of sophistication of service.)

The WSIS Geneva *Plan of Action* stated in Action Line C7 that "ICT applications can support sustainable development, in the fields of public administration …". Box 6.3 describes research on electronic governance for sustainable development.

Box 6.3: Electronic governance for sustainable development research

Governments formulate and implement public policies that provide security, generate economic growth, deliver public services and generally advance socio-economic development. Given this role, the use of ICT by governments is not only a matter of improving their internal performance, but also determining the effectiveness of development policies in general. Governments have diverse objectives in using ICTs, including: improving internal government operations and delivering better public services; supporting institutional and administrative reforms; engaging citizens and other non-state actors in government decision-making processes; and directly contributing to policy and development goals in areas such as health, education, economy and the environment. The use of ICT by government has evolved over time and four phases are recognized: technology in government, electronic government, electronic governance and policy-driven electronic governance. Each phase is characterized by three binary variables: whether ICT development is accompanied by government transformation; whether this transformation is internal to government or also affects its relationships with citizens, businesses and other non-state actors; and whether this transformation is context-independent or dependent on different locations or sectors.

The following table (Janowski, 2014) depicts the incremental nature of these phases and how they are characterized:

Phases		**Variables**		
		Transformation of government?	Includes non-state actors?	Location- and sector-specific?
1	Technology in government	no	no	no
2	Electronic government	yes	no	no
3	Electronic governance (EGOV)	yes	yes	no
4	Policy-driven electronic governance	yes	yes	yes

In particular, electronic governance for sustainable development (EGOV4SD) is an instance of policy-driven electronic governance, which entails transformational use of ICT by governments to improve internally and in relation to citizens and the public, while ensuring and advancing sustainable development goals. The EGOV4SD domain can be defined at the non-symmetric intersection of the electronic governance (EGOV) and sustainable development (SD) domains. The assessment of 417 research papers published during 2011 and 2012, including EGOV papers contributing to SD goals or SD papers applying EGOV to further such goals, found that:

- EGOV4SD research problems are distributed across the social (33 percent), institutional (28 percent), economic (20 percent) and environmental (19 percent) dimensions of SD.
- Under half (41 per cent) of the papers address internal government issues and 41 per cent address its relationships with society.
- Many papers (42 percent) lack theoretical foundations and the remaining ones rely on models (16 percent), frameworks (12 percent), concepts (12 percent), categories (12 percent) or theories (5 percent).
- Most of the papers (62 percent) have no theoretical contribution while 15 per cent contribute to theory through models.
- Nearly half of the papers (49 percent) contribute to practice through capacity-building and nearly one-third (31 percent) through policy recommendations.

Typical areas for EGOV4SD research include: policy, planning, monitoring, urban and community issues, governance, services, agreements, geographic information systems, value, access, inclusion, development, taxes, emissions, waste reductions, and prevention and protection measures. Typical problems addressed by such research include: delivering public services, particularly to vulnerable groups; delivering basic services like water, electricity, housing and waste management; providing access and reducing digital divide; developing infrastructure; promoting governance at the local, regional, national and international levels; assessing community needs to determine areas for policy intervention; prioritizing and raising awareness about environmental issues; promoting innovation; planning urban systems; creating value; and monitoring and enforcing regulations.

Source: Janowski (2014), Estevez & Janowski (2013).**There are no sources in the current document.**

Data availability and scope

Data on the use of ICT in government remains sparse, with most countries not routinely collecting these data. This makes quantitative assessment of Target 6 particularly challenging.

For the current review, the *Partnership* sent out the *Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013* (*Partnership*, 2013) to 195 countries requesting information on each of the WSIS target indicators, including the seven e-government indicators identified by the 2011 WSIS statistical framework. A total of 30 countries responded to the questions on e-government, which is about 13 per cent of all UN regional commission member states. Table 6.1 shows the composition of responses received.

Table 6.1: Data availability on use of ICT in government

Countries in the region	Regional commission[4]	Countries responding to survey	Countries responding with e-govt data	% response with e-govt data	% of total regional commission countries
44	UNECLAC	10	5	50	11
53	UNECA	5	3	60	6
53	UNESCAP	10	8	80	15
17	UNESCWA	5	2	40	12
56	UNECE	22	12	55	21
223*		**52**	**30**	**58**	**13**

Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013 (*Partnership*, 2013).

Note: * The total exceeds 193 countries as a few countries are not UN member states (for example, Palestinian Territories), while some may belong to more than one regional commission. Sri Lanka is not included as its data were obtained from external sources.

Not all of countries shown in Table 6.1 provided information on all seven e-government indicators. An analysis of the results of the questionnaire indicates that the number of replies per e-government indicator 6.1 to 6.5 varied from between 3 in UNECA to 12 in the UNECE. In particular, the majority of countries either did not respond on indicator 6.5 'Proportion of central government organizations with Internet access, by type of access', or did not provide the appropriate breakdown by type of access, that is, fixed broadband, narrowband, mobile broadband etc. No country in the *Partnership* survey reported on 6.6 and 6.7, which have therefore been compiled using data from the UNDESA E-Government Survey.

In addition, the latest year of data provided by countries ranged from 2004 to 2013, making direct comparability difficult. Caution should therefore be exercised when using the data presented in this report.

One of the reasons for the low response rate on e-government is that not many countries are measuring it. There are various reasons for this but they include the fact that the field of e-government measurement is young compared to established socio-economic indicators, and that rapid advances in the field of ICT, and the adoption of new technologies by governments, have rendered some of the indicators obsolete.

Finally, it is important to note that the data are self-reported by countries. It is not clear whether definitions, scope and the suggested parameters of each indicator were followed. For example, for some countries it is not clear if the data refer to the reporting agency or were being reported by the agency for the entire central government (for example, Sudan). In the case of others (for example, Nigeria) only state level data are reported. As such, data on indicators 6.1 to 6.5 may not be statistically consistent and comparable across countries.

For measurement of e-government services, the United Nations Department of Economic and Social Affairs (UNDESA) is the lead agency in international e-government benchmarking. In this report, UN E-Government Survey data, from 2003 to 2014, are used for analysis of indicator 6.6 'proportion of central government organizations with a web presence' and 6.7 'level of development of online service delivery by national governments'. Since 2003, UNDESA has tracked and monitored e-government development through the United Nations E-Government Survey, now in its 7th edition (UNDESA, 2014). The survey covers all United Nations member states and is carried out by the UNDESA Division for Public Administration and Development Management (DPADM).

The E-Government Survey assesses government websites based on a quantitative multi-stage model of a country's online presence. For countries that have established an online presence, the model defines stages of e-government development according to a scale of progressively sophisticated public services.

Achievements against Target 6

A review of the WSIS targets on the use of ICT in government shows that much progress has been made since 2003. However, progress is not uniform across regions and countries, with many still not utilizing the full potential of ICT in government.

Persons employed in central government organizations routinely using computers

One of the most important areas of e-government has been to utilize ICTs to improve the internal workings of the public sector. Benefits include reduction of costs and transaction time, and better management of work flows and processes. Access by government employees to computers has spread in recent years, thus improving institutional linkages between government agencies and enabling efficiency in public administration. Some countries in the vanguard of e-government adopted practices for public administration streamlining early on. For example, by the year 2000, in the Republic of Korea, more than 80 per cent of the central Government's documents had been computerized and 55 per cent of the government's documents were handled electronically.[5]

Because of lack of data, there is very limited information on the extent to which countries have deployed computers to public sector employees. The self-reported data available for the few countries shown in Table 6.2 indicate a disparity among countries, with persons employed in central government in the developed countries having 80 to 100 per cent access, compared to less than 50 per cent in some developing countries. Access in Europe was the highest, with Estonia and Moldova, along with some developing countries, such as Azerbaijan, reporting full access. The proportion was much less in the Americas and Africa, with El Salvador, Burundi and Gambia at 35, 40 and 45 per cent respectively.

Table 6.2: Persons employed in central government routinely using computers, 2013 or LYA[6]

Asia	%	Americas	%	Africa	%	Arab States	%	Europe	%
Azerbaijan	99	Colombia	50	Burundi	40	Oman	51	Estonia	100
Bhutan	87	El Salvador	35	Gambia	45			Lithuania	80
Iran, Islamic Rep.	> 73	Uruguay	43					Moldova	100
Japan	100							Spain	80
Nauru	95								
Thailand	49								

Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Access to computers by government employees does not guarantee their effective use. In addition to access to computers, an appropriate level of skill in using the equipment is a critical requirement. Further, while e-literacy will enable employees to use computers, it will not ensure optimal use.

In many developing countries, effective use may be a function of several factors including access, skills, level of the person, job description, culture and attitudes. For example, one survey conducted in 2007 in Sri Lanka, before it undertook a program of modernizing ICT use in government, indicated that despite adequate e-literacy, there was a significant difference in the provision as well as the use of ICT facilities between the executive and non-executive ranks of government employees. Two-thirds of executive officers had access to ICT facilities compared to only around one-fifth of non-executives. However, the pattern of use of ICT was the opposite – with around one-fifth of the executives using the available facilities compared to three-fifths of non-executives (ICTA, 2008).

Persons employed in central government organizations routinely using the Internet

A similar picture merges with respect to the use of Internet by government employees. Table 6.3 presents the percentage of government employees routinely using the Internet in 2013 (or latest year available). The developed countries that provided data indicated that 70 to 100 per cent of employees in the central government routinely used the Internet in the reference year. Among the regions, Europe had the highest proportion, while the Americas had the lowest. In Asia, Singapore had 100 per cent of government employees routinely using the Internet, followed by Nauru, Azerbaijan and Bhutan. Lowest in Asia was the Philippines, reporting only 15 per cent.

Table 6.3: Persons employed in central government routinely using Internet, 2013 or LYA[6]

Asia	%	Americas	%	Africa	%	Arab States	%	Europe	%
Azerbaijan	91	Colombia	39	Burundi	70	Oman	29	Bulgaria	100
Bhutan	87	El Salvador	22	Gambia	53			Estonia	100
Iran, Islamic Rep.	> 60	Uruguay	43					Lithuania	71
Japan	100							Moldova	100
Nauru	95							Spain	70
Philippines	15								
Singapore	100								
Thailand	51								

Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Central government organizations with a local area network (LAN)

A local area network was defined in the 2011 WSIS statistical framework as "… a network connecting computers within a localized area such as a single building, department or site; it may be wireless."

Table 6.4 indicates that the majority of countries reported high usage of LANs in central government agencies. In Europe, Portugal was lowest at 85 per cent. The results were similar in Asia, with only the Philippines and Sri Lanka not reporting almost universal access to LANs. However, for Sri Lanka some progress should be noted; under the *e-Sri Lanka Development Project* the Information and Communication Technology Agency of Sri Lanka (ICTA) has undertaken programs to increase the use of ICT in government. As a result, the proportion of government institutions with corporate networks (LAN, intranet, extranet) went from 24 per cent in 2007 to 69 per cent in 2010 (ICTA, 2011).

Table 6.4: Central government organizations with a LAN, 2013 or LYA[6]

Asia	%	Americas	%	Africa	%	Europe	%
Azerbaijan	100	Chile	100	Burundi	90	Bulgaria	99
Bhutan	100	Colombia	98	Gambia	86	Cyprus	100
Iran, Islamic Rep.	100	El Salvador	100	Sudan	100	Czech Republic	99
Japan	100	Uruguay	100			Estonia	100
Nauru	100					Moldova	100
Philippines	85					Poland	100
Singapore	100					Portugal	85
Sri Lanka	69						
Thailand	96						

Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013; Sri Lanka data, ICTA (2011).

Central government organizations with an intranet

Access to an intranet by central government employees is reflective of the ability of government organizations to share information, operational systems or computing services within the organization.

Intranet was defined in the 2011 WSIS statistical framework as "... an internal communications network using Internet protocols and allowing communication within an organization (and to other authorized persons). It is typically set up behind a firewall to control access."

As shown in Table 6.5, access to an intranet was low among some developing countries, in particular Gambia at 20 per cent and Yemen at under 1 per cent.

In most of the countries of Europe that provided data, the proportion of central government organizations with an intranet in the reference year was 100 per cent, the exceptions being Portugal (83 per cent), the Czech Republic (82 per cent) and Poland (80 per cent). Of the Asian countries reporting data, all had 100 per cent access, except for Nauru, the Philippines and Thailand.

Table 6.5: Central government organizations with an intranet, 2013 or LYA[6]

Asia	%	Americas	%	Africa	%	Arab States	%	Europe	%
Azerbaijan	100	Chile	98	Burundi	90	Oman	85	Cyprus	100
Bhutan	100	Colombia	79	Gambia	20	Yemen	< 1	Czech	82
Iran, Islamic Rep.	100	El Salvador	71	Sudan				Estonia	100
Japan	100							Moldova	100
Nauru	50							Poland	80
Philippines	55							Portugal	83
Singapore	100							Spain	100
Thailand	85								
Viet Nam	100								

Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Central government organizations with Internet access

Internationally comparable data on the type of government connection (broadband or other) is particularly scarce. Table 6.6 presents the percentage of government entities with Internet access in 2013 for those countries that responded to the survey. Most of these reported close to 100 per cent of government entities with Internet access. This held true across all regions of the world.

However, the majority did not provide a breakdown by type of Internet access. It is likely that most developed countries, including those shown in Table 6.6, have broadband access in most or all of their government organizations. In the developing world, Bhutan, Colombia and Uruguay have a high level of broadband connectivity.

The provision of high speed Internet by the developing countries is evidence of the recognition of the role of ICT by government in improving efficiency and effectiveness. Some have made considerable progress in the last few years, perhaps partly due to a drop in broadband prices. Analysis of trends in broadband pricing in more than 160 countries shows that, in the four years between 2008 and 2012, fixed-broadband prices fell by 82 per cent overall, from 115 per cent of average monthly income per capita (GNI p.c.) in 2008 to 22 per cent in 2012, with the biggest drop occurring in developing countries, where fixed-broadband prices fell by an average of 30 per cent each year between 2008 and 2011.[7]

Many developing countries have taken advantage of this price fall. In Sri Lanka by 2010, 93 per cent of all ministries and 92 per cent of all departments were utilizing some form of broadband connectivity and the per cent of government institutions with different types of access to the Internet had gone up from ADSL (at 512 kbit/s 29 per cent; 2 Mbit/s 29 per cent) in 2007 to ADSL

(512 kbit/s 36 per cent; 2 Mbit/s 27 per cent; 62 kbit/s 3 per cent) by 2010 (ICTA, 2011). Despite a drop in price, provision of the Internet via fixed broadband was a challenge for other developing countries in the reference year, including Yemen (22 per cent).

Table 6.6: Central government organizations with Internet access, by type, 2013 or LYA[6]

Asia	%	Americas	%	Africa	%	Arab States	%	Europe	%
Azerbaijan	100	Chile	100	Burundi	90	Yemen	22	Cyprus	100
Bhutan(1)	100	Colombia(2)	Note(2)	Gambia	100			Czech Republic(3)	100
Iran, Islamic Rep.	100	El Salvador	81	Sudan	100			Denmark	100
Japan	100	Uruguay(4)	100					Estonia	100
Nauru	100							Lithuania(5)	100
Philippines	99							Moldova	100
Singapore	100							Poland(6)	100
Sri Lanka(7)	Note(7)							Portugal(8)	99
Thailand	96							Romania	100
Viet Nam	100							Spain	100

Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Notes:

1. 100% fixed broadband.
2. < 1 Mbit/s 10%; >= 1 Mbit/s 91%; mobile broadband 19%.
3. 98% broadband (>= 256 kbit/s).
4. 100% broadband.
5. Narrowband 12%; fixed broadband 91%; wireless broadband 39%.
6. 100% broadband (>= 2 Mbit/s).
7. ADSL (512 Kbit/s 36%; 2 Mbit/s 27%; 62 Kbit/s 3%). Data for Sri Lanka are from ICTA (2011).
8. Narrowband 34%; fixed broadband 95%; mobile broadband 62%.

Central government organizations with a web presence

The WSIS target indicator to '... establish websites' for central government departments was reformulated as 6.6, 'proportion of central government organizations with a web presence'.

The capabilities of governments are changing with the adoption and use of ICT. Many countries of the world have found that increasing use of ICT to provide timely and relevant public services has led to a growing interest by citizens for governments to provide online services across sectors such as education, health and finance. In the advanced countries, where access to networks is more widely diffused, there is a growing number of experiments with ICT applications to support government activities.

The UN E-Government Survey tracks web presence on a range of services, including a national portal or an official home page; links to regional/local governments; current and archived information, such as policies, laws and regulation, and newsletters; and more sophisticated interactive, transactional services and networked services. As such, the UN E-Government Survey provides key benchmarking data for the current review (see tables 6.7 and 6.8).

Table 6.7: Central government web presence 2003–2014

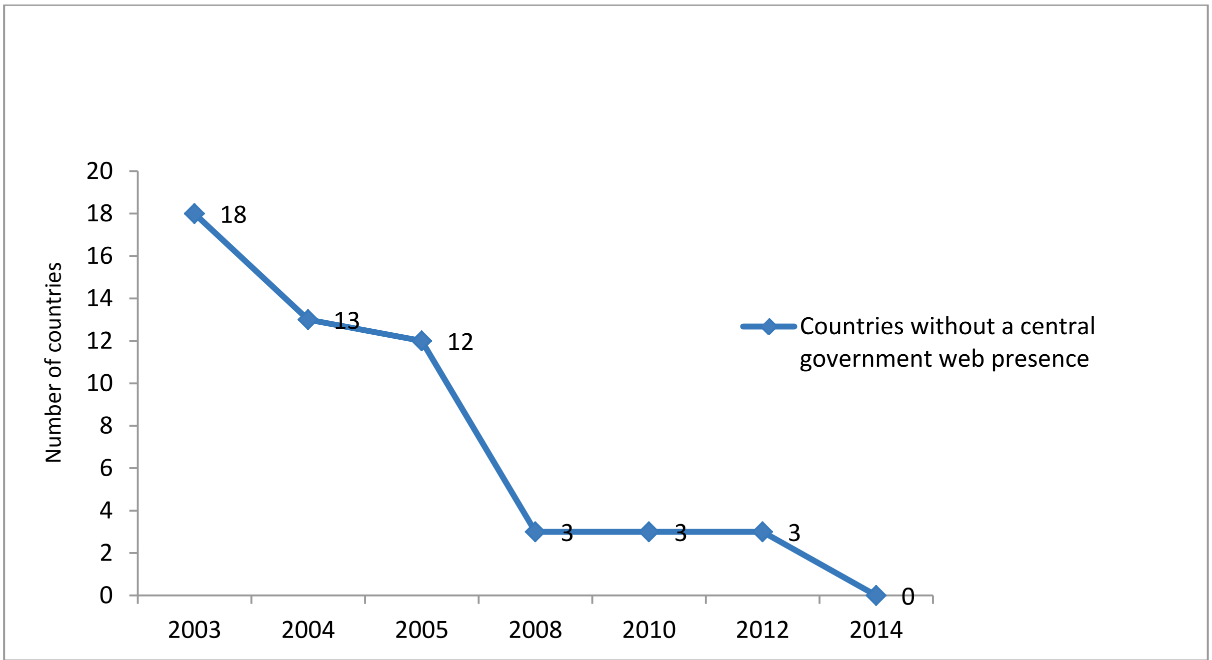
	2003	2004	2005	2008	2010	2012	2014
				Number			
Countries with an established central government web presence	173	178	179	189	189	190	193
Countries without an established central government web presence	18	13	12	3	3	3	0
Total UN member states	**191**	**191**	**191**	**192***	**192**	**193***	**193**

Source: UNDESA, based on UN E-Government Survey data, various editions.

Note: * On 28 June 2006, Montenegro was accepted as a United Nations member state; in 2011, South Sudan became the 193rd UN member state.

During the last decade, member states have made steady progress in establishing a web presence. In 2003, when the UN began tracking online government service provision, 18 countries did not have a central government web presence. By 2010, nine more countries had established a central government web presence and by 2012, only three countries – the Central African Republic, Guinea and Libya – did not have a web presence (see Chart 6.1).

Chart 6.1: Countries without a central government web presence, 2003–2014



Source: UNDESA, based on UN E-Government Survey data, various editions.

Increasingly, central governments are linking to lower administrative tiers of government. In 2014, 105 countries (54 per cent) provided links to regional and/or local governments on their national website. This compared with 97 countries in 2012 (Table 6.8). The 105 countries that offered such links comprised around three-quarters of all countries in Europe, three-quarters of Asian countries, nearly half of the countries in the Americas, and about one-third of countries in Africa and Oceania.

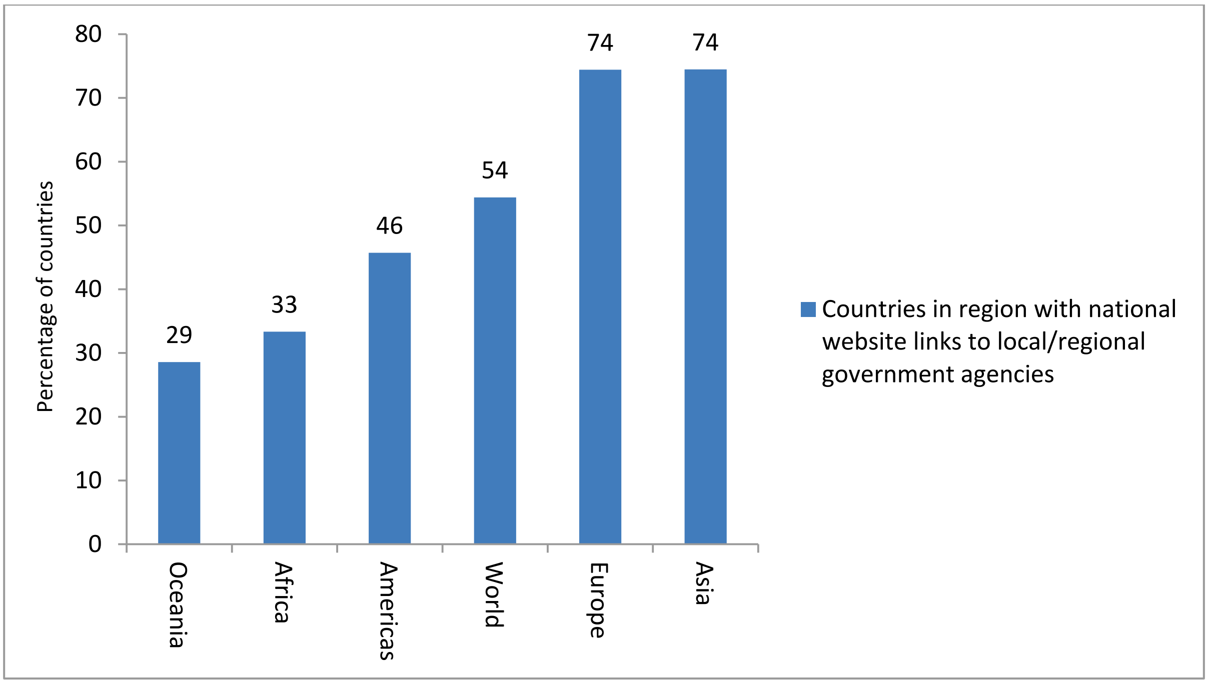
Table 6.8: National website links to local/regional government agencies

	2014	2012
No of countries	105	97
% of countries	54	50

Source: UNDESA, UN E-Government Survey data 2012 and 2014, forthcoming.

Chart 6.2 shows the proportion of countries in each region where the national website links to regional and/or local governments. The lowest proportion of countries in 2014 was in Oceania (29 per cent) and the highest in Asia and Europe (both 74 per cent).

Chart 6.2: National website links to regional/local governments, by region, 2014



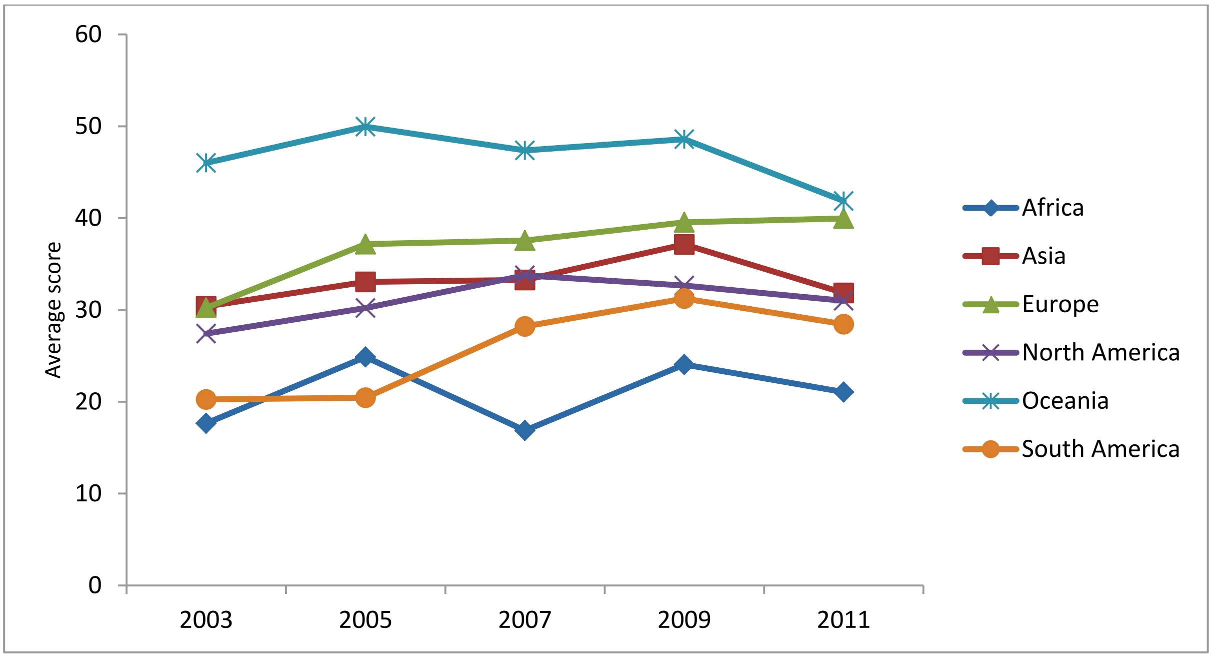
Source: UNDESA. Data from United Nations E-Government Survey 2014, forthcoming.

By 2014, the specific target of WSIS on establishing central government websites can be largely considered met. However progress on connecting the lower administrative tier to central government lags behind.

Lower levels of government

While levels of government below central government are out of scope of the revised Target 6, they were included in the original WSIS target. A few studies exist at the regional or local administrative level assessing some aspects of ICT use. The Digital Governance in Municipalities Worldwide Survey (Holzer and Manoharan, 2012) assessed the official websites of the largest city (by population) of the top 100 "most wired" countries as at 2011 (Chart 6.3). They analysed: privacy/security, usability, content of websites, the type of online services offered, and citizen response and participation. The overall score of a city level government is the weighted average of scores in the above five categories. To date, there have been five surveys – in 2003, 2005, 2007, 2009 and 2011. In 2011, of the 100 cities selected, 92 were found to have official websites (Table 6.9). Based on the 2011 evaluation, the top city level services were offered by Seoul, Republic of Korea (score 82) followed by Toronto, Canada (score 64); Madrid, Spain (score 64); Prague, Czech Republic (score 62) and China, Hong Kong (score 61). By comparison, in 2005, 81 of the largest cities belonging to the top 100 most wired countries had their own websites.

Chart 6.3: Official website scores, largest city, top 100 most wired countries, 2003–2011



Source: Holzer and Manoharan (2012).

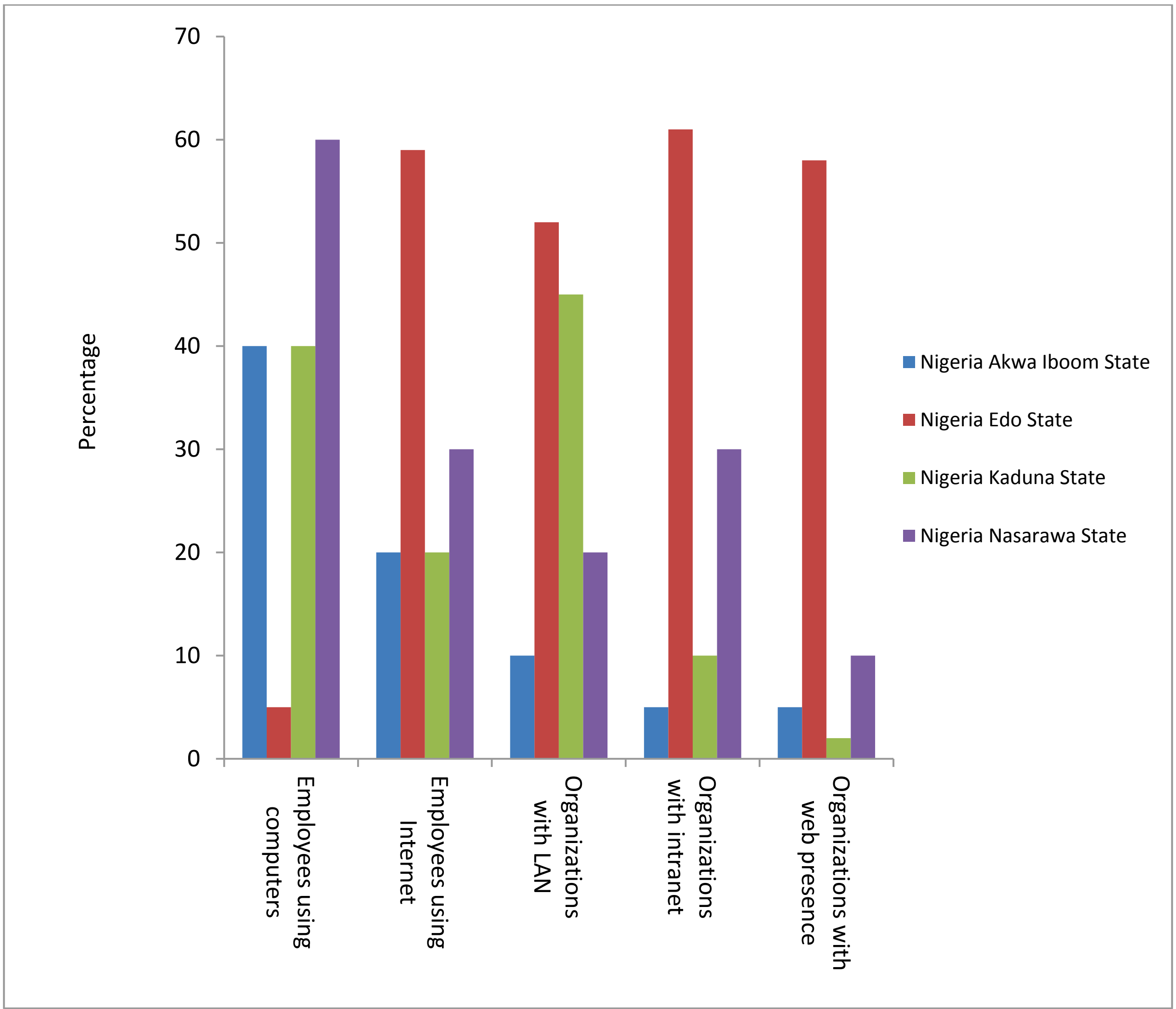
Table 6.9: Cities offering official websites 2005–2011

Number			
2005	2007	2009	2011
81	86	87	92

Source: Holzer and Manoharan (2012).

While there appears to be progress in putting local governments online, much of this progress is limited to developed countries and large cities in developing countries. Smaller cities or lower tier administrations are likely to have fewer resources or a lack of integration with central government, both of which lead to with slow adoption. The disparity at the regional level within one country is illustrated by varying rates of utilization of ICT in the four states of Nigeria. As Chart 6.4 shows, Nigeria Edo State was more advanced in the provision of Internet, and connection of state organisations with LAN and intranet, than other regions in the country.

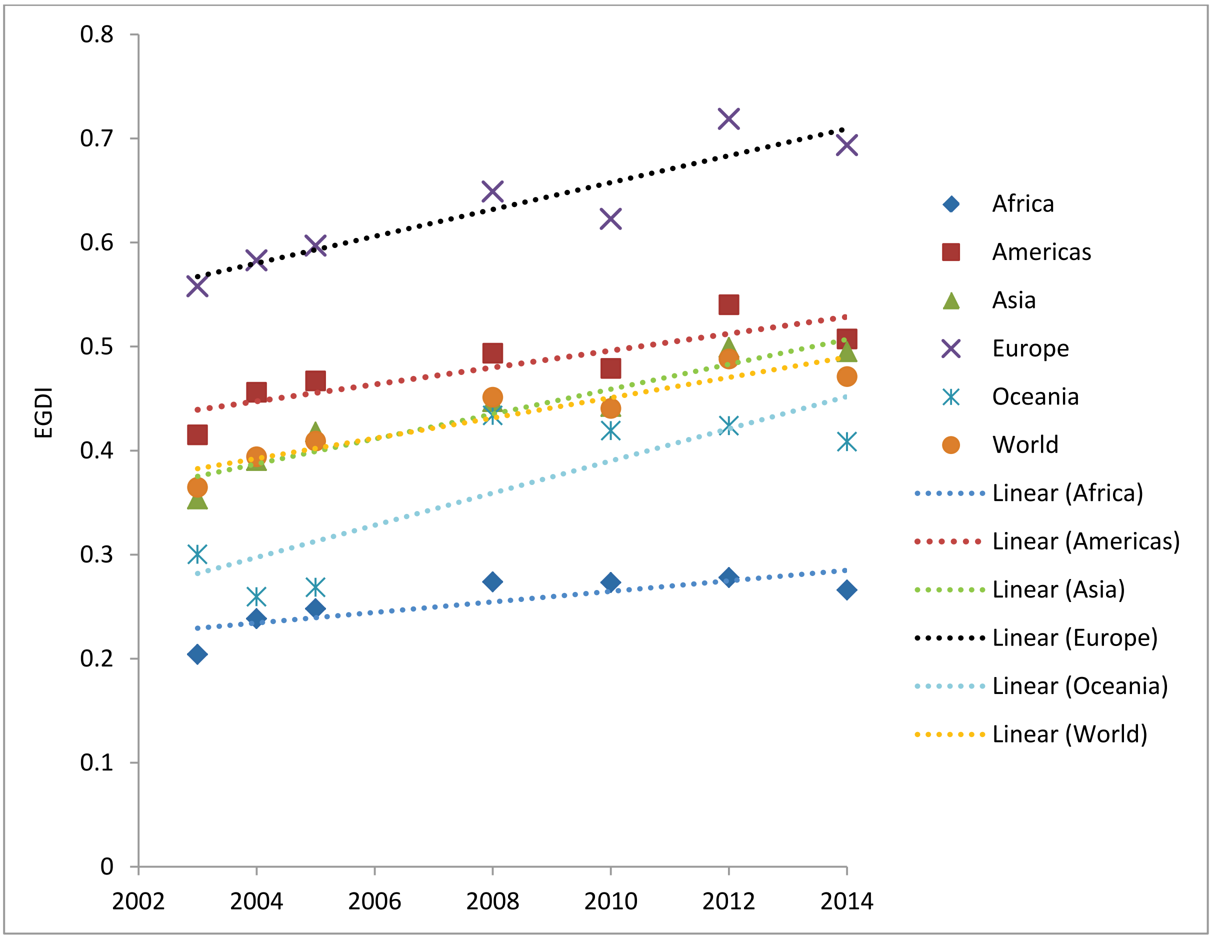
Chart 6.4: Nigeria, e-government at the state level, 2013



Source: Nigeria Government response to the *Partnership* survey, data are in respect of 2013.

Notwithstanding challenges at the local level, the overall assessment of how e-government has fared in the last decade indicates progress. UNDESA tracks overall e-government development through its E-government Development Index (EGDI), which is a composite benchmarking indicator based on a direct assessment of the state of national online services, telecommunications infrastructure and human capital. Progress in e-government development for the period 2003 to 2014 can be gauged by the upward trend in the EGDI as shown in Chart 6.5. E-government development as a whole is highest in Europe, followed by the Americas. Asia, which started out below the world average in 2003, achieved higher than world average growth in e-government development and was closer to the Americas by 2014. Progress in Africa has been relatively slow.

Chart 6.5: Trends in progress in e-government development, 2003–2014



Source: UNDESA. Data from United Nations E-Government Survey, forthcoming.

Level of development of online service delivery by national governments

Indicator 6.7 has been reformulated to encompass several aspects of e-service delivery as follows:

- interactive services
- transactional services
- connected services.

The UN E-Government Survey provides consistent data for a comparative assessment on the provision of e-services by government. It monitors the progress of countries in a four-stage model as they move towards higher levels of service delivery.

The model is ascending in nature and builds upon the previous level of sophistication of a country's online presence. For countries that have established an online presence, the model defines stages of e readiness according to a scale of progressively sophisticated citizen services. Countries are ranked according to what they provide online, as described in Box 6.4.

Box 6.4: Stages of e-government in the UN E-Government Readiness Survey

Stage 1. Emerging information services: Government websites provide information on public policy, governance, laws, regulations, relevant documentation and types of government services provided. They have links to ministries, departments and other branches of government. Citizens are easily able to obtain information on what is new in the national government and ministries and can follow links to archived information.

Stage 2. Enhanced information services: Government websites deliver enhanced one-way or simple two-way e-communication between government and citizen, such as downloadable forms for government services and applications. The sites have audio and video capabilities and are multi-lingual, among others.

Stage 3. Transactional services: Government websites engage in two-way communication with their citizens, including requesting and receiving inputs on government policies, programmes, regulations, etc. Some form of electronic authentication of the citizen's identity is required to successfully complete the exchange. Government websites process non-financial transactions, for example, e-voting, downloading and uploading forms, filing taxes online or applying for certificates, licenses and permits. They also handle financial transactions, that is, where money is transferred on a secure network to government.

Stage 4. Connected services: Government websites have changed the way governments communicate with their citizens. They are proactive in requesting information and opinions from the citizens using Web 2.0 and other interactive tools. E-services and e-solutions cut across the departments and ministries in a seamless manner. Information, data and knowledge are transferred from government agencies through integrated applications. Governments have moved from a government-centric to a citizen-centric approach, where e-services are targeted to citizens through life cycle events and segmented groups to provide tailor-made services. Governments create an environment that empowers citizens to be more involved with government activities so as to have a voice in decision-making.

Source: UNDESA. UN E-Government Survey, 2012, pp 123–124, http://www.un.org/en/development/desa/publications/connecting-governments-to-citizens.html.

Within the four stages, the UN E-Government Survey assesses different types of services, including:

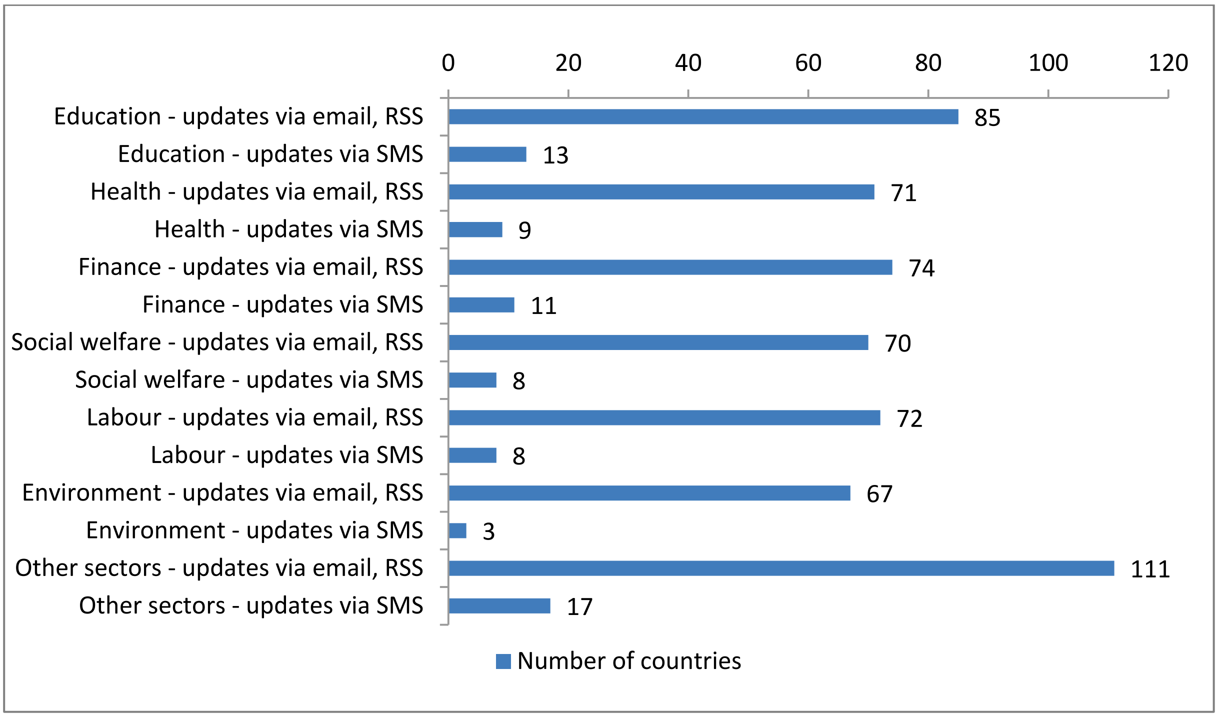
- Information such as documents on laws, policies etc. across sectors of education, health, finance, social welfare and labour, which together, would be of relevance to the citizen. These fall under interactive services for the purposes of this chapter.
- Public services such as taxes, fines, licenses, which comprise transactional services.
- E-participation services, which assess the level of inclusion by the government in public policy and are grouped under stage 4 (connected services).
- Technical features (audio, video, RSS, etc.), which provide a conduit for free flow of information and services between the government and the citizen.

An assessment of these services is grouped into interactive, transactional and connected services.

Interactive e-services offered by governments

It is notable that many countries have not only established websites, but have advanced further in providing interactive services for citizens. These comprise provision of information and a few services but remain one-way, that is, largely 'G-to-C' services. As seen in Chart 6.6, governments were fairly advanced in providing information via e-mail and RSS on education, health, finance, social welfare labour and environment – but considerably less advanced in providing information via SMS.

Chart 6.6: Countries providing information by e-mail or RSS, and SMS, 2014

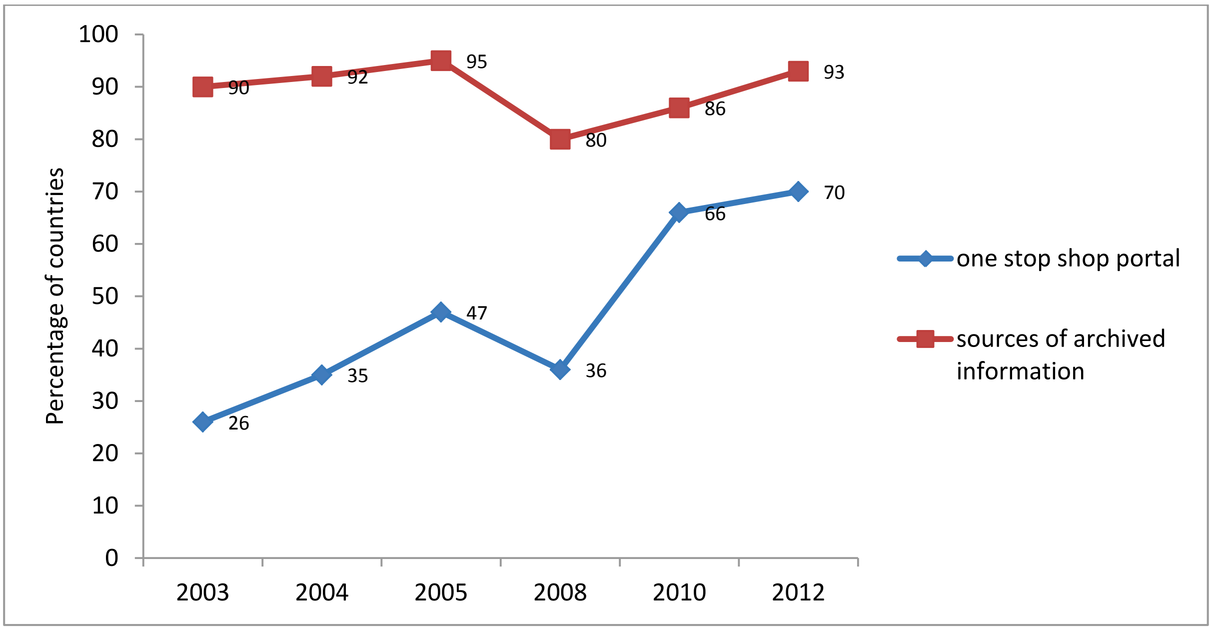


Source: UNDESA. Data from United Nations E-Government Survey, forthcoming.

Advancement in the concept of interactive services was witnessed in the form of integration of government websites providing information. By 2014, many countries had moved from a decentralized single-purpose organizational model towards connecting departments and divisions in a centralized single portal, where citizens could access all government-supplied services irrespective of which government authority provided them (see Chart 6.7). Integration of online information and services on portals increased threefold between 2003 and 2012, with 70 per cent of countries providing a one-stop shop portal in 2012, compared with 26 per cent in 2003. Among the developed and developing countries which had integrated portals were: Australia, Belize, Bhutan, Egypt, El Salvador, Greece, Grenada, Portugal, Qatar, Republic of Korea and Mongolia.

This whole-of-government approach is based on a philosophy of interconnected departments and divisions to improve efficiency and effectiveness. For example, the official gateway of Qatar Hukoomi (http://portal.www.gov.qa/wps/portal/frontpage) integrates government services, programs and initiatives to improve efficiency, responsiveness to users and accessibility. It also integrates back-office processes to allow easy access to over a 100 topics and articles with detailed information about Qatari law and society (UNDESA, 2012). Other examples are the U.S. FirstGov portal (http://www.usa.gov/) and Singapore (http://www.gov.sg/); they provide an integrated portal as the main gateway, with links to other service delivery portals aimed at different users.

Chart 6.7: Integrated approaches in e-government, 2003–2012



Source: UNDESA. Based on UN E-Government Survey data, various editions.

Note: The decline in aggregate values in 2008 is attributable to the slight change in the types of services as more innovative services were brought into the assessment methodology. The catch-up by 2012 is notable.

Recent advances in technology, coupled with the need to devise innovative ways to meet the development challenges facing national governments, are affecting the ICT models in government. In many countries, these have led to governments putting information online, simplifying administrative procedures, streamlining bureaucratic functions and increasingly providing open government data.

In 2014, some countries took this further and were providing various types of archival information via links to the central government website (see Table 6.10). Around three-quarters of all governments provided information on education and health; 82 per cent provided information on finance and about two-thirds on each of social welfare, labour and environment.

Almost all of the countries of Europe and the majority in the Americas and Asia provided information in respect of all these sectors. Examples of developing countries that offered archived information on education and/or health are: Bangladesh, Bosnia and Herzegovina, China, Colombia, Gambia, India, Lebanon, Mozambique, Suriname, Togo and Uruguay. Among those offering information on finance were Botswana, Comoros, Djibouti, Lithuania, Mali, Senegal, Serbia, Viet Nam and Zambia.

Table 6.10: Provision of archived information by region, 2014

	Education	Health	Finance	Social welfare	Labour	Environment
	Percentage of countries in the region					
World	76	78	82	64	68	67
Africa	52	61	65	31	41	43
Americas	86	86	89	69	77	69
Asia	87	85	94	77	74	79
Europe	98	95	95	95	98	98
Oceania	36	50	57	36	43	29

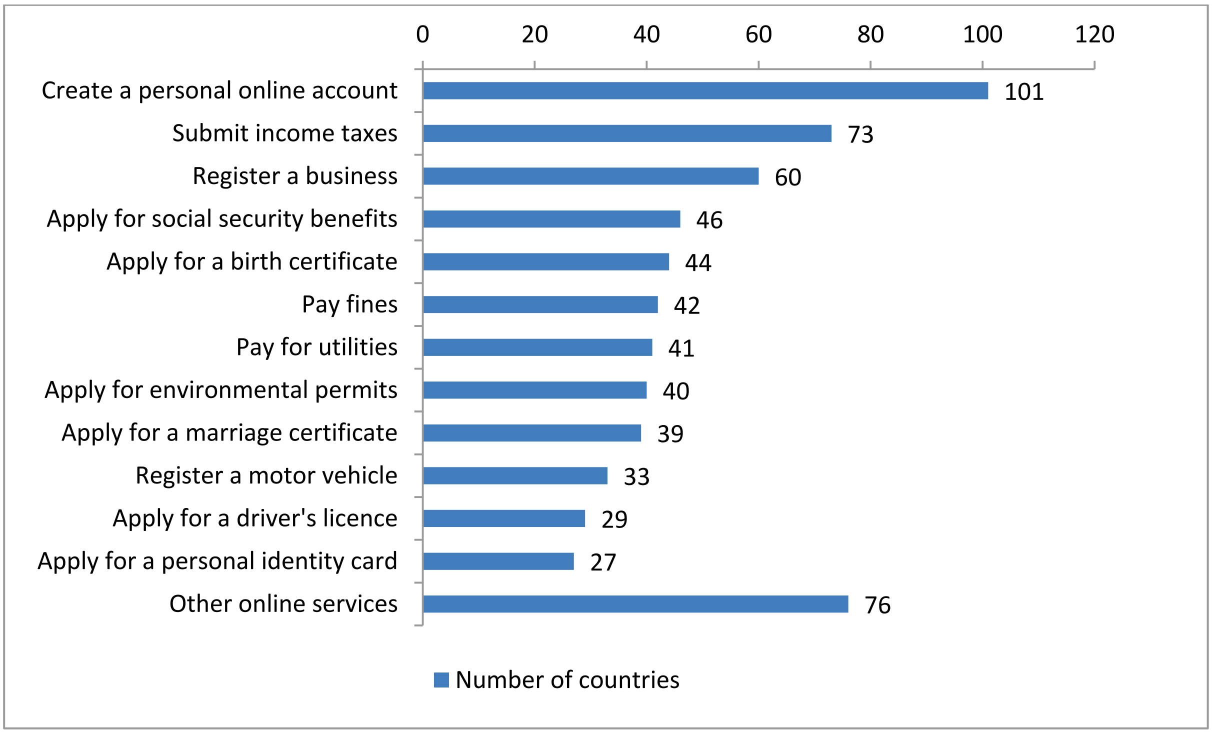
Source: UNDESA. Data from United Nation E-Government Survey 2014, forthcoming.

Transactional e-services offered by governments

In order to make governing more effective, inclusive and service-oriented, governments are providing an increasing number of public services online. Previously, mature services were mostly limited to developed countries; however, more and more developing countries are now putting basic transactional services online.

In 2004, transactional services were limited to those few countries where financial and banking systems were developed enough to allow for basic transactions, including payments, to be made online. Since then, considerable progress has been made in all regions of the world. In 2014, about half of the countries in the world provided for the creation of a personal online account and in 73 countries (38 per cent) income taxes could be paid online. Sixty countries allowed for online business registration and in 40 countries environmental permits could be sought over the Internet (see Chart 6.8). Countries of Europe are in the vanguard in providing transactional services. Among those countries that allow online income tax payments are: Belgium, Denmark, Estonia, Finland, Germany, Hungary, Iceland, Italy and the United Kingdom.

Chart 6.8: Countries providing transactional e-services, 2014



Source: UNDESA. Data from United Nation E-Government Survey 2014, forthcoming.

Developing countries have not been left out of these advances. In Kazakhstan, for instance, the use of ICT for the reform of administrative systems has led to more than 1 300 codes, laws, decrees, orders etc. being integrated into the national portal. Each e-service has several icons stating whether this service can be paid online/or can be obtained through electronic signature.[8]

Part of the progress in this area can be attributed to other technology advances, especially in mobile banking, which has allowed many developing countries to overcome the barriers of security and financial system development. This is evidenced in initiatives such as *M-Pesa*, a mobile phone based money transfer service operating in Kenya and Tanzania, which provides e-services involving payments to government agencies or receipt of social welfare entitlements (UNDESA, 2014).

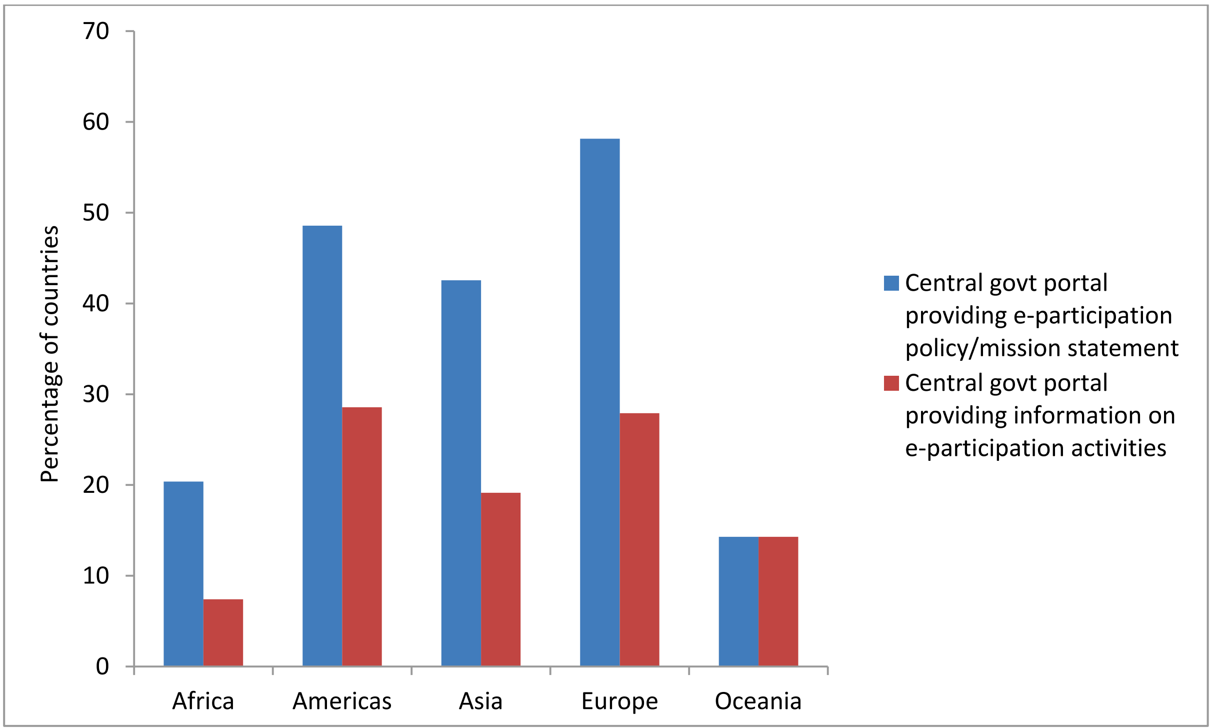
Connected e-services offered by governments

It is not so long ago that new technologies, notably the Internet, enabled e-participation by providing citizens with the opportunity to make decisions that were otherwise the domain of their representatives.

National governments around the world have been increasingly reaching out and giving people access to information on how their government operates and how they can participate in government – to improve their own lives and take part in change processes.

Provision of connected e-services is steadily increasing. In 2014, around one-fifth of member states provided information on e-participation activities on their websites, including how to participate (Chart 6.9). In addition, 39 per cent of member states worldwide had an official e-participation policy on the central government website (or a link to it).

Chart 6.9: Connected e-services, 2014



Source: UNDESA. Data from United Nation E-Government Survey 2014, forthcoming.

Conclusions and recommendations

The ten-year review of the WSIS *Plan of Action* and implementation on e-government indicates that much progress has been made since 2003. Countries have moved far beyond the WSIS original e-government target of 'Connect all local and central government departments and establish websites and e-mail addresses' to wider applications of e-government. However, progress has been uneven.

Data are lacking for indicators 6.1 to 6.5, on access to, and use of, ICT in government by persons and organizations. Very few countries are tracking these e-government indicators and data that are available are generally not statistically consistent for cross-country monitoring. Based on the data that are available, it appears that progress is uneven across countries. Many of the advanced countries could be considered to have met the WSIS targets; however, for most developing countries, use of ICT by government employees and organizations may be low or restricted to basic functions.

The specific target of WSIS as revised 'Connect all central government departments and establish websites' is considered to be met inasmuch as all countries had a functioning central government website by 2014 (Indicator 6.6). However, progress on connecting the lower administrative tiers of government lags behind.

Service delivery (Indicator 6.7) has seen significant progress, with most governments offering information and transactional services online. Central government websites indicate innovative models encompassing varied services across sectors in most countries, including developing countries. However, wide differences remain in the extent of such offerings and target achievement cannot be considered complete.

To adequately assess future progress, it is recommended that a target on e-government be retained post-WSIS – as most countries are far from fully utilizing the benefits of ICT in government. However, there is a need to address the scarcity of globally comparable data. It is recommended that governments identify and address challenges in monitoring the use of ICT in governments more energetically. The UN Statistical Commission has endorsed a set of seven core e-government indicators developed by the Partnership on Measuring ICT for Development. These correspond with the indicators used in this report and are obvious candidates for international benchmarking (*Partnership* and UNECA, 2012 and 2013).

Parallel efforts are required to extend the initial set of seven core e-government indicators. As governments move from deployment of basic technology to more complex e-government solutions, a secondary set of e-government indicators may help to improve the relevance of monitoring efforts.

Though much progress is observed in e-government since WSIS Geneva and Tunis laid out a plan of vision for the use of ICT, much still remains to be done. Some broad conclusions emerge from the current review.

First, use of ICT has come to dominate the government sector in the last decade. It is no longer a question of whether to use ICT to further government functioning and operations, but a question of which is the most effective way for ICTs to help in the delivery of development objectives. Progress on the use of ICT in government is evident in all regions of the world and across all countries.

Second, under the banner of e-government, in the last ten years, countries have addressed a wide array of issues. These include promoting accessibility of ICT for government employees, but have gone beyond this to address increasing efficiency and effectiveness of departmental operations, provision of more public services online and meeting the growing demand of citizens for e-participation in public policy decision-making. Innovative models of the use of ICT in government have emerged, with the aim of addressing national and local challenges. A particular development is the use of ICT by government for greater service delivery and public value.

Third, despite this progress, wide disparities remain across, and between, countries of the world. It appears that governments that have benefited most from the opportunities offered by ICT for development are generally the early adopters of ICT. A major global challenge in the utilization of e-government for economic and social development is the inequitable access to, and use of, ICT. In some cases, the digital divide between those who have fully benefited from the use of ICT in government and those who have not, remains wide and is perhaps increasing, in many parts of the world.

A large part of the divergent pattern of the use of ICT in governments can be explained by varying levels of investment in the sector. However, a closer look reveals that the models of e-government reflect, among other things, economic and social systems, resource availability, institutional frameworks, political ideologies and cultural attitudes.

Given the global disparity in use of ICT by governments, it is imperative that the UN and the international community continue to support country efforts to enhance ICT use by governments. It is suggested that the international community focuses on developing a strategic framework for how ICT can be better utilized by governments in the context of the forthcoming post-2015 development agenda. Countries may look to holistic approaches to integrating ICT to support sectors, such as education, health, commerce, industry, law enforcement and security.

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Endnotes

[1] The original WSIS indicator was worded somewhat differently “Connect all local and central government departments and establish websites and email addresses”.

[2] World Summit on the Information Society. The Geneva *Declaration of Principles* and *Plan of Action*. December 2003, https://www.itu.int/wsis/docs/promotional/brochure-dop-poa.pdf.

[3] The EG indicators refer to the *Partnership*'s names for the core e-government indicators.

[4] United Nations Economic Commission for Africa (UNECA); United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP); United Nations Economic Commission for Europe (UNECE); United Nations Economic Commission for Latin America and the Caribbean (UNECLAC); United Nations Economic and Social Commission for Western Asia (UNESCWA).

[5] See http://www.itu.int/ITU-D/ict_stories/themes/e-government.html.

[6] Latest year available. All data refer to 2013 except for the following countries for which data are for the year cited: Philippines 2004; Nauru 2013 estimate; Thailand 2012; Viet Nam 2011; Lithuania 2012; Portugal 2012; Bulgaria 2012; Romania 2011; Poland 2008, 2010 and 2011.

[7] See http://www.itu.int/net/pressoffice/press_releases/2013/41.aspx#.UsjBlE2A1Dw.

[8] There are other convenient sites, such as http://www.epay.gov.kz and http://www.elicense.kz, where one can access specific services, payments (UNDESA, 2012, 2014).

ADAPT ALL PRIMARY AND SECONDARY SCHOOL CURRICULA TO MEET THE CHALLENGES OF THE INFORMATION SOCIETY, TAKING INTO ACCOUNT NATIONAL CIRCUMSTANCES

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

Executive summary

Moving beyond connecting schools with ICT, Target 7 reflects the need for countries to invest in human resources and provide adequate training to ensure that teachers have an appropriate skill set to adapt national curricula to ICT-assisted instruction. It also reflects the general shift amongst both developed and developing countries from using older forms of ICT-assisted instruction (for example, radio and television broadcasts) to newer more interactive forms of ICT-assisted instruction that rely on computers and the Internet. As the second target (besides Target2) to focus on schools, Target 7 highlights the importance of teachers and educational institutions to ensure educational quality as well as broadening equal opportunities for all, including traditionally underserved or marginalized groups.

The first two indicators – 'proportion of ICT-qualified teachers in schools' and 'proportion of teachers trained to teach subjects using ICT' – show varying levels of achievement amongst countries. Although developed countries typically have greater proportions of trained teachers than developing countries, most countries, regardless of economic position, have trained 10 per cent or fewer teachers to be ICT-qualified for delivering basic computer skills or computing courses. However, considering the overall proportion of time spent in specific computer skills classes, this may be sufficient in a number of countries. Rather, given the emphasis in many countries to integrate ICT skills learning into other subjects, measuring the proportions of teachers trained to teach other subjects using ICT in the classroom is equally if not more important. The proportion of teachers trained to teach using ICT varies much more widely. In developed countries, which have a relatively strong policy environment regarding ICT in education and the essential school infrastructure, there are relatively high proportions of teachers trained to teach subjects using ICT. In comparison, many low income countries, particularly least developed countries (LDCs),[1] are particularly challenged in guaranteeing an adequate supply of trained teachers. In both developed and developing countries, a lack of trained teachers presents significant challenges in terms of adapting national curricula to meet the challenges of the information society.

Given many countries' shift towards more advanced forms of ICT-assisted instruction in the classroom, the third indicator, 'proportion of schools with computer-assisted instruction (CAI)' is important to demonstrate the general availability of computers for teaching and learning in schools. Results show substantial disparity amongst developed and developing countries. For example, while several high income and OECD countries in Europe, Eastern Asia and the Caribbean have integrated CAI adapted curricula in all schools, fewer schools have done so in developing countries in Latin America and Asia. Data are largely unavailable for most countries in Africa and Oceania.

Typically, countries that have strong policies and plans that set targets for ICT in education have also shown the most rapid change amongst developing countries. This is true for a number of countries including Chile, Colombia and Uruguay in Latin America, as well as Oman, Jordan, Thailand and Georgia in Asia.

The fourth indicator, 'proportion of schools with Internet-assisted instruction (IAI)', shows that in general the level of IAI is somewhat lower than the level of CAI, suggesting that access to the Internet, which requires the availability of at least basic telecommunications/ICT infrastructure, may be a barrier. Moreover, the data show that in some countries the Internet is not fully exploited by all schools – in many it may be reserved for administrative purposes. In terms of disparities, OECD and other high income countries are more likely to have IAI than developing countries, particularly for a number of countries in Asia and Africa.

Countries that have adopted full scale implementation of CAI and IAI in their schools also typically have a relatively high proportion of trained teachers, compared to those that are still in the early stages of implementation. Looking at the gap observed, albeit across the limited number of countries with available data, countries that are in the earlier stages of e-readiness can propel their progress by seizing opportunities to determine what activities or conditions are necessary. It is hoped that they can learn from more advanced countries that have employed effective models and policies for integrating ICTs into their curricula.

While progress has been achieved adapting primary and secondary school curricula to meet the challenges of the information society in the last ten years, the level of progress has varied across countries. Since adapting all curricula for primary and secondary schools to meet the challenges of the information society has not been achieved in many countries, particularly middle and low income economies, a post-2015 ICT monitoring framework should continue to track Target 7. Based on current analysis, and considering the rapidly evolving policy-driven data needs, some additional indicators for effectively monitoring the adaptation of curriculum during the post-2015 agenda may be needed. For example, calculating new indicators on proportions of schools with computers in laboratories versus classrooms and other locations sheds light on ICT usage and reflect evolving information requirements as countries move from a phase of building infrastructure for ICT in education (e-readiness) to more focused usage of different ICTs (e-intensity). Another possible inclusion may be enrolment rates (by sex) in programmes offering CAI and/or IAI in order to get more insight into the participation of pupils in such programmes. In addition to illuminating the digital divide between the sexes, this indicator, which is currently collected by the UIS, would also provide information on usage in schools.

In order to improve international comparability of teacher training indicators, the UIS should consider an alternative measure, given the wide variety in the nature of how teachers are prepared. For example, insight into the educational level of the training and/or the length would shed additional light on the quality of training that teachers acquire.

Finally, this report offers some policy recommendations for adapting curricula to meet the challenges of the information society:

- To adapt school curricula to meet the challenges of the information society, policies must go beyond mere capital investments in ICT-related infrastructure. It is imperative that initiatives also develop ICT-skills amongst the teaching force, so that the knowledge and skills can be effectively transferred to students.

  - As courses in basic computer skills and more advanced courses in computing require teachers with specific ICT qualifications, countries need to ensure they train an adequate number of teachers to effectively deliver these courses in all schools.
  - Because ICT plays a role in the instruction of various curricular subjects, an adequate number of teachers should be trained to teach subjects using ICT in order to effectively adapt curriculum to ICT-assisted instruction.

- Where resources permit, countries should increase the number of devices per school and connect them to the Internet to ensure a critical mass of ICT is available to provide sufficient access to computer-assisted and Internet-assisted instruction.
- Where resources permit, countries should allocate desktops, laptops tablets and other computer devices to classrooms, computer laboratories, libraries and other locations around the school to provide pupils multiple access points.
- Increase access to online free and open-source software (FOSS) as well as other open educational resources (OER), to improve the quality of CAI and IAI, at relatively low cost.
- Recognise the role of community media centres, to play a role in extending the reach of computer-assisted and Internet-assisted instruction to pupils when ICT is not available in schools.

Introduction

The direction in which information societies are evolving reveals a picture of education moving rapidly away from traditional practices. Information and communication technology (ICT) has had a significant impact on education in recent years – in terms both of the pressure on decision-makers to acquire new technologies, and for effective content development, management and delivery. In order to make informed decisions, a critical examination of national policies, past and present, as well as of national circumstances is critical to successfully integrate ICT in education. In the simplest terms, a review of what education is aiming to achieve is required prior to articulating how ICT may best be utilized.

School connectivity[2] is a crucial precursor to the uptake of ICT in education; however, it is insufficient to ensure that ICTs are used effectively in schools, classrooms, or in education in general. Policy-makers in many countries previously believed that simply equipping schools with PCs would prepare pupils for the demands of the 21st century. However, they are increasingly aware that simply providing access to ICT will not necessarily result in improvements to the education system. Instead, thoughtful planning and effective execution are required to reap the benefits of ICT in education. More specifically, policies are needed that will enable pupils, through the acquisition of appropriate skills, to effectively participate in a globally competitive workplace.

The action lines in the WSIS Geneva *Plan of Action* (ITU, 2005) express a clear need for capacity building and skills development in order to reap the full benefits of the information society. Teachers who are formally trained in the fields of ICT literacy and computing are best positioned to deliver ICT-adapted curricula that build on the development of basic computer skills in preparation for advanced studies and the labour market. As illustrated in Figure 7.1, WSIS Target 7 is closely related to three specific WSIS action lines. As stated in WSIS Action Line C4, capacity building through e-learning initiatives (that is, WSIS Action Line C7) 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.”
> (ITU, 2005)

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."
- "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."

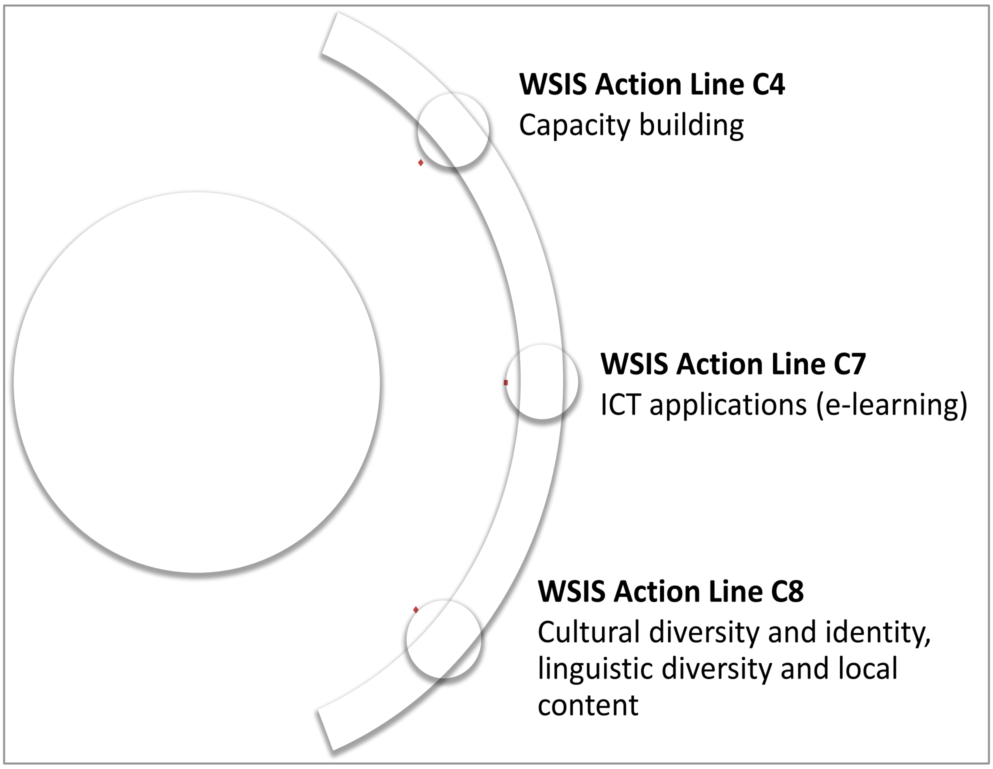
- "Design specific training programmes in the use of ICTs in order to meet the educational needs of information professionals, such as archivists, librarians, museum professionals, scientists, teachers, journalists, postal workers and other relevant professional groups. Training of information professionals 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." (ITU, 2005)

Action line 7 (ICT applications: benefits in all aspects of life), particularly the subcomponent e-learning, also has direct relevance for Target 7. Content for the e-learning subcomponent is elucidated above within Action Line C4 (Capacity building).

More indirectly, Action Line C8 (Cultural diversity and identity, linguistic diversity and local content) also has relevance to Target 7, particularly to build girls' and women's ICT capacity.

> "Strengthen programmes focused on gender-sensitive curricula in formal and non-formal education for all and enhancing communication and media literacy for women with a view to building the capacity of girls and women to understand and to develop ICT content." (ITU, 2005)

Figure 7.1: Relevance of Target 7 to WSIS action lines



Relating WSIS action lines to other international frameworks

Apart from the WSIS Geneva *Plan of Action*, two other global movements calling for equal educational opportunities are the Millennium Development Goals (MDGs) and the Education for All (EFA) goals. The eight MDGs, which were agreed upon in 2000, form a developmental blueprint for all the world's countries and leading development institutions. In particular, the MDGs have galvanized efforts to meet the education, health, gender equality, environmental, economic and other developmental needs of the world's poorest. Meanwhile, the Education for All (EFA) goals, which were also agreed to in 2000, include six education-specific targets to increase participation in education by broadening access and eliminating exclusion; to improve equity and quality in schooling and lifelong learning for all; and to diversify youth's skill set to match the demands of the information society (see Box 7.1).

While it is important that all MDGs and EFA goals be achieved, the emphasis on the universalisation of education stated in WSIS action lines 4, 7 and 8 also have relevance for MDG Target 2.A and Target 3A, respectively:

> "Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling", and
>
> "Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015". (United Nations, 2012)

The substance of MDG targets 2.A and 3.A are reflected in EFA goals 2 and 5, respectively (see Box 7.1), nonetheless, WSIS action lines 4 and 7 also are also related to EFA Goal 3, which aims to enhance skills, and to EFA Goal 6, which aims to enhance the quality of education, particularly through teacher training on ICTs and the incorporation of ICT-assisted instruction (UNESCO, 2000).

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 in 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: The Dakar Framework for Action (UNESCO, 2000).

The notion that adapting school curricula can help expand educational opportunities as well as enhance quality towards meeting the challenges of the information society, is an important stepping stone towards achieving Target 7 of the WSIS *Plan of Action* as well as the education-related MDGs and EFA goals. However, in view of the challenges faced, the sole reliance on conventional delivery mechanisms will be inadequate to provide affordable and sustainable education opportunities for all by 2015. For example, one of the greatest challenges for many education systems is to be able to offer learning, training and general educational 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 schools 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 made significant progress beyond connecting schools, particularly when countries set specific targets and have high government and sector-wide level support (see Chapter 2). Developed countries also face challenges integrating ICT in education; however, unlike developing countries, policy development focuses less on connectivity and more on how to enhance educational quality through the use of ICT, thus ensuring that sound pedagogy is central to the adaptation of school curriculum. Given ever-evolving technologies and pedagogies, exemplary policy initiatives are being taken by governments that address the multi-faceted challenges of adapting curricula in primary and secondary schools to meet the challenges of the information society (see Box 7.2).

Box 7.2: Singapore's Third Masterplan for ICT in Education (MP3)

In 2008, Singapore's *Third Masterplan for ICT in Education* (MP3) was launched to work towards the vision of "Harnessing ICT for Future Learning." MP3 follows two previous masterplans, the first (MP1) running from 1997 to 2002, focusing on equipping schools with basic ICT infrastructure and in training teachers, while the second (MP2), which ran from 2003 to 2008, focused on effective and pervasive use of ICT in education by sowing innovation in schools. MP3 continues the vision of MP1 and MP2 to enrich and transform the learning environments of students and equip them with the critical competencies to succeed in the information society.

The four MP3 goals are:

(1) Students possess competencies for self-directed and collaborative learning through the effective use of ICT.

(2) Teachers have the capacity to tailor and deliver ICT-enabled learning experiences for students to develop these competencies.

(3) School leaders provide the direction and create the conditions to harness ICT for teaching and learning.

(4) ICT infrastructure supports teaching and learning anywhere, anytime.

The key focus of MP3 is on self-directed learning (SDL) and collaborative learning (CoL) with ICT. It is believed that engaging students in SDL and CoL with ICT could better prepare Singaporean students to meet the challenges of the 21st century. The Ministry of Education (MoE) considers students to be engaged in SDL if there is some demonstration of ownership of learning, management and monitoring of one's own learning, and/or extension of this learning. Collaborative learning is where students work in pairs or groups to solve a problem or to achieve a common learning objective. Students engaged in collaborative learning are expected to develop effective group processes, and individual and group accountability of learning.

MoE supports schools to be innovative in the use of ICT and facilitates the sharing of good practices among schools through several programmes, including the FutureSchools@Singapore and LEAD ICT@Schools. Working closely with the MoE and the Infocomm Development Authority (IDA), the FutureSchools@Singapore initiative was launched in 2007 to support a small number of schools to become technology-enabled by focusing on innovative teaching approaches that fully leverage ICT and innovative infrastructure designs to bring about more engaged learning for students.

Source: Ministry of Education, 2014, http://ictconnection.moe.edu.sg/masterplan-3/mp3-vision-and-goals.

Data availability and scope

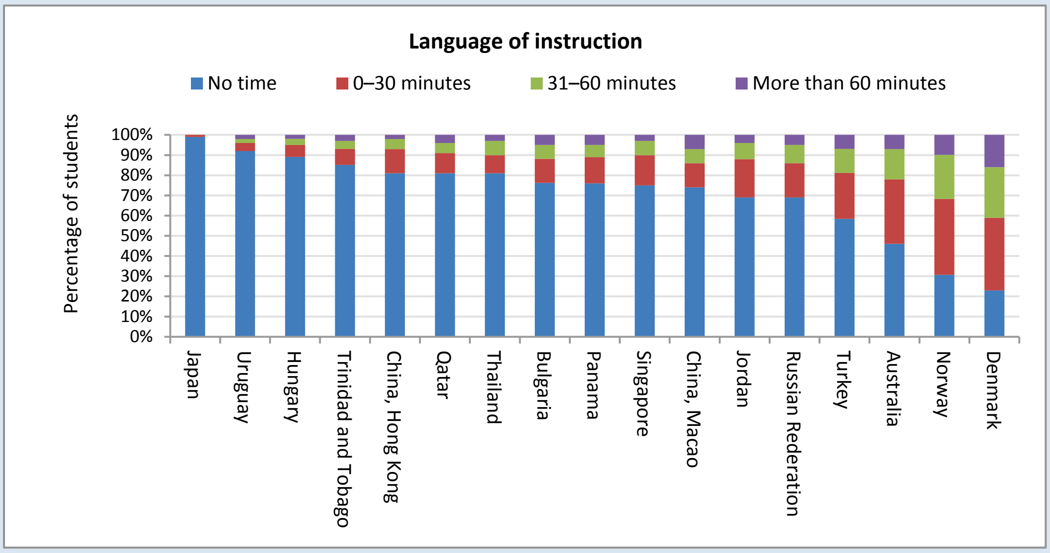
Monitoring the adaptation of curricula at the international level in relation to Target 7 can be understood from two distinct perspectives. On the one hand, monitoring Target 7 could include tracking outputs of ICT-adapted curricula. Currently, the greatest source of existing internationally comparable data on outputs derives from sample-based international assessments that rely on direct measurement of ICT use and curricula. The most commonly known examples include the International Association for the Evaluation of Educational Achievement (IEA) assessments, which focus on measuring student achievement in mathematics, science and reading. Respectively known as *Progress in International Reading Literacy* (PIRLS) and *Trends in International Mathematics and Science Study* (TIMSS), both studies include modules on ICT use by students and teachers as part of the curriculum. Another well-known assessment is the Organisation for Economic Co-operation and Development (OECD) *Programme for International Student Assessment* (PISA), which is a standardized international study targeting the performance of 15-year old pupils (see Box 7.3).

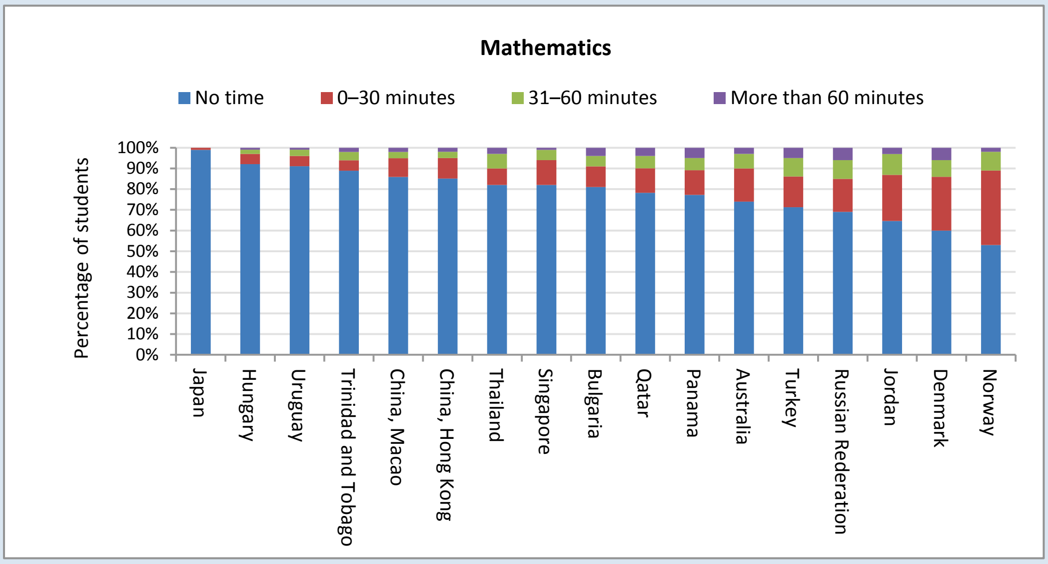
Box 7.3: The disconnection between ICT policy, infrastructure and use – evidence from PISA, 2009[3]

International survey data from the Programme for International Student Assessment (PISA) shed light on the use of ICT by 15-year old pupils in both OECD and participating non-OECD countries. Box Chart 7.3 shows the proportion of pupils using computers during school lessons by level of duration: high (>60 min per week), moderate (31–60 min per week), low (<30 min per week) or no time using computers, in 19 selected developed and developing countries.[4] Separate data are available for three subjects: language of instruction,[5] mathematics and science. Based on available data, there is evidence of an ongoing disconnection between national policy, existing infrastructure available to support ICT-assisted instruction, and use, by pupils. Box Chart 7.3 shows that in all countries represented, more than half of all 15-year old pupils do not use a computer during a typical week in mathematics lessons, while this is also true of the vast majority of countries in language of instruction lessons (16 of 19) and science lessons (18 of 19).

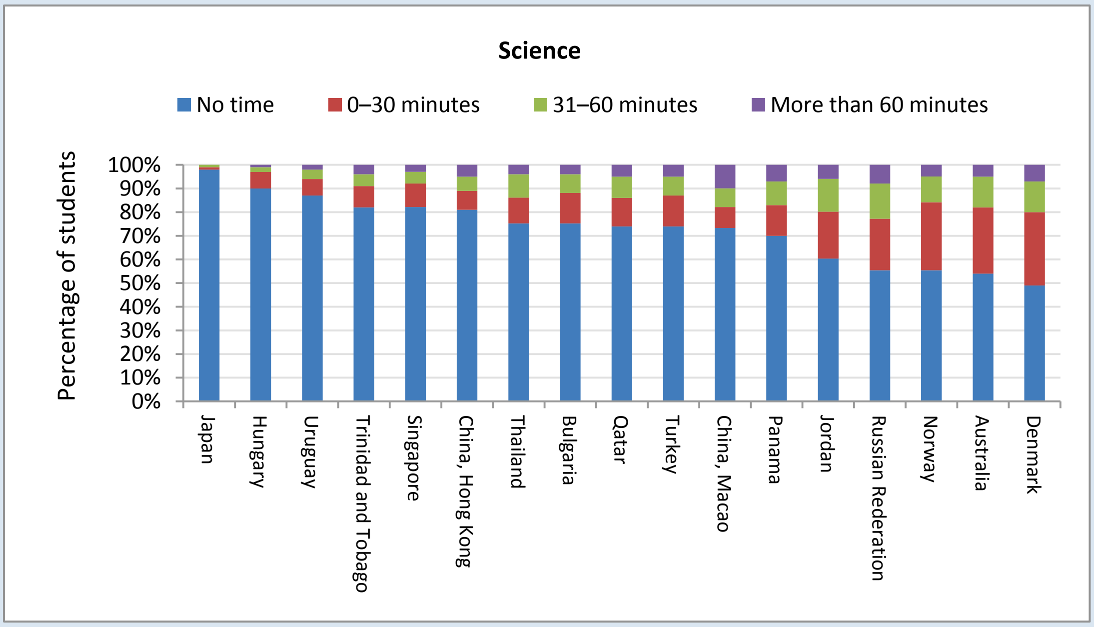
Weekly computer usage is lowest in Japan (below 5 per cent) for all three subjects even though the country has an ICT in education policy and supporting infrastructure providing access (that is, learner-to-computer ratio is 9:1) (see Chapter 2). Also in Asia, usage is higher and approximating the OECD average in Singapore, which implemented its third consecutive ICT in education policy in 2008 to progressively strengthen and reaffirm the use of technology in teaching and learning and where there is also a relatively low learner-computer ratio of 4:1.

Box Chart 7.3: Computer usage in language of instruction, mathematics and science, by frequency, 2009





Box 7.3: The disconnection between ICT policy, infrastructure and use – evidence from PISA, 2009 (cont.)



Computer use is highest in the Scandinavian countries Denmark and Sweden in all three subjects: around 70 per cent of 15-year old pupils or more use a computer during a typical week in language of instruction classes, compared to 40 to 50 per cent in mathematics and science classes. Somewhat less frequently, but higher than the OECD average, slightly more than half of pupils (54 per cent) also use a computer in language of instruction in Australia, compared to 26 per cent and 46 per cent in mathematics and science lessons.

While computer use is low to absent in some developed countries that have ICT in education policy and strong infrastructure, use is found to be higher than the OECD average in others, including Turkey and Jordan, which both actively promote educational reform that makes significant use of ICT in education. In Jordan, for instance, 31 per cent, 36 per cent and 40 per cent of pupils use a computer in language of instruction, mathematics and science classes, respectively, on a weekly basis. As per mathematics education, not only is Jordan becoming a pioneer in the region in the use of e-content under the Jordan Education Initiative, but compared to OECD countries, only Denmark and Norway surpass it for computer use.

Source: OECD, 2011.

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, as well as effectively linking ICT usage to sound pedagogy, are essential since these constitute the foundation for curricula that meet the changing needs of the information society.

The Partnership on Measuring ICT for Development is mandated to establish international standards, indicators and benchmarks for statistical monitoring of the WSIS global policy goals. Under the auspices of the *Partnership*, the UNESCO Institute for Statistics (UIS), in 2009, led a process for the development and pilot testing of internationally comparable core indicators on ICT in education leading to an international framework.

A set of core ICT in education indicators that measure inputs of e-readiness and access to ICT in education systems was 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 established the international Working Group for ICT Statistics in Education (WISE). The purpose of the working group was 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 identified to monitor Target 7 in the following sections are the result of this initiative (UNESCO-UIS, 2009a).

While the results of the UIS survey presented in this chapter provide important insights into the status of ICT in education in both developed and developing countries, the survey has not yet been disseminated globally and this chapter is therefore limited to 80 countries from various data collections. Initially, data were collected from 25 countries using the pilot questionnaire; these were analysed and included in the *World Telecommunication/ICT Development Report 2010: Monitoring the WSIS Targets, A mid-term review* (WTDR) (ITU, 2010). Since then, UIS has conducted regional data collections and released reports for Latin America and the Caribbean (UNESCO-UIS, 2012), Arab States (UNESCO-UIS, 2013) and Asia (UNESCO-UIS, 2014). UIS began collecting ICT in education statistics in sub-Saharan Africa in late 2013. As several countries have yet to complete the UIS survey, data in this chapter are complemented with information collected using the 2013 WSIS targets questionnaire (*Partnership*, 2013) as well as from other regional or national sources.

Indicators to track WSIS Target 7

While Target 7 promotes adapting all primary and secondary school curricula to meet the challenges of the information society, it does not specifically provide information on how this will be accomplished (*Partnership*, 2011). Adapting curricula effectively to meet the challenges of the information society requires two key elements. Firstly, teachers need to be trained not only how to teach students to use ICT, but teachers themselves need to be trained in effective use of ICT in the classroom. Secondly, integrating ICT-assisted instructional environments using the latest technologies (for example, computers, tablets, broadband Internet) provides schools with the optimal context for adapting curriculum to meet the challenges of the information society and thus help pupils to acquire the knowledge and skills to successfully compete in an ever more globalized economy.

The following four indicators were defined in the 2011 WSIS statistical framework (*Partnership*, 2011) to track Target 7:[6]

Indicator 7.1: Proportion of ICT-qualified teachers[7] in schools

Indicator 7.2: Proportion of teachers trained to teach subjects using ICT

Indicator 7.3: Proportion of schools with computer-assisted instruction

Indicator 7:4: Proportion of schools with Internet-assisted instruction

Indicator 7.1 refers to the percentage of primary and secondary teachers trained to teach basic computer skills (or computing) in schools. It the only one of the four indicators that is in the *Partnership*'s core list of ICT indicators (Indicator ED8). The indicator measures the magnitude of the teaching workforce qualified to deliver curriculum related to basic computer training and computing. It does not measure the proportion of teachers actually teaching computing, nor does it measure quality – as training modalities vary substantially between countries.

Indicator 7.2 refers to the percentage of primary and secondary teachers trained to effectively use ICT to enhance their teaching of different subjects within the official curriculum. The indicator does not measure the proportion of teachers actually using ICT in their teaching, nor does it measure quality – as training modalities vary substantially between countries.

Indicator 7.3 refers to the percentage of primary and secondary schools offering computer-assisted instruction (CAI). In other words, it measures the availability of computers allocated for pedagogical purposes amongst educational institutions. The indicator does not measure the intensity or quality of use.

Indicator 7.4 refers to the percentage of primary and secondary schools offering Internet-assisted instruction (IAI). In other words, it measures the availability of the Internet allocated for pedagogical purposes amongst educational institutions. The indicator does not measure the intensity or quality of use.

All four indicators are collected and published at the international level by UIS. While relatively few have done so, a number of countries have set specific targets on adapting school curricula to meet the challenges of the information society (see Box 7.4), which can be monitored by these four indicators.

Box 7.4: Monitoring targets for adapting school curricula to the information society – Asia

While target 7 does not specify the percentage of teachers that should be trained in relation to ICTs, nor the percentage of schools that should offer advanced forms of ICT-assisted instruction including CAI and IAI, countries can monitor progress against a backdrop of significant ICT in education initiatives.

- In Thailand, where education authorities are systematically implementing a one learner to one tablet computer model annually for all Grade 1 and Grade 7 pupils, training teachers in advance to use these devices effectively will play a vital role not only to ensure better educational outcomes (Viriyapong and Harfield, 2013), but more fundamentally to ensure that teachers feel confident in their use.
- Consistent with its considerable reliance on the use of e-materials, Kazakhstan intends to supply 48 per cent of schools (4 120) with interactive whiteboards by 2014. To meet the challenges of adapting existing curricula, Kazakhstan has a cross-curricular ICT policy, which states that all teachers will require some level of ICT competence (ADB, 2012).
- Azerbaijan, where computer-assisted instruction (CAI) was available in 84 per cent of schools in 2012, aims to provide a computer classroom to every school (that is, CAI in 100 per cent of schools). In addition, each class is to be supplied with uninterruptible power supply, networking equipment (switch, cables and connectors) and a laser printer (ADB, 2012).
- In Turkey, the *Movement of Enhancing Opportunities and Improving Technology*, known as Fatih, is among Turkey's most significant educational investments and advocates the establishment of a *Smart Class* in all schools. Turkey aims to equip 42 000 schools and 570 000 classes with the latest ICTs (that is, computers, tablets and LCD interactive boards) (Fatih, 2013). Between 2003 and 2010, over 844 000 computers had been allocated to schools and by 2013, more than 97 per cent of schools were connected to the Internet (World Bank, 2013).

These indicators 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 enhanced forms of ICT-assisted instruction; they serve as the foundation for the integration of ICT in education systems. The indicators that monitor these inputs are statistically comparable internationally, and aim to track progress towards Target 7 and the corresponding WSIS action lines identified above.

Achievements against Target 7

Training teachers for ICT in education

The stock of available human resources for teaching is seen as the hallmark for the effective delivery of any curriculum, including those that use ICT-assisted instruction. The latter may include any combination of the following: radio, television, computer and Internet-assisted instruction. Teachers are frequently considered the most important influence on classroom learning and therefore play an invaluable role in ensuring that pupils use ICT effectively, both inside and outside of school. However, to date, consensus is limited on how much teacher training is required to build a teaching workforce that is motivated to use ICT in the classroom in the context of new pedagogical frameworks and curricula. Other considerations for teacher training are: how often it should take place, what kind of training is most effective and what the training content should be.

Complicating matters, the integration of ICT into education is frequently resisted by teachers and their unions, particularly in countries with an ageing, underpaid teaching workforce, and where there has been inadequate training and preparation. In such circumstances, a lack of motivation to learn new skills, and teaching and learning methodologies, can occur and can even be compounded if teachers feel threatened by newer forms of ICT that students might understand better than them. For example, because of the high proportion of older teachers in the last quartile of their teaching career in Kazakhstan, concerns about a general lack of efficiency in the use of e-curriculum – an important focus of their education system – has been officially recognised by the Ministry of Education (ADB, 2012).

Proportion of ICT-qualified teachers

One useful measure in monitoring the stock of human capital for Target 7 is Indicator 7.1, 'Proportion of ICT-qualified teachers in schools' (that is, teachers trained to teach basic computer skills or computing). The qualification is based on a nationally defined qualification in the core disciplines of ICT or a qualification to teach basic computer skills or computing (in secondary education). Where a country has a high percentage of ICT-qualified teachers among the overall teaching staff in primary and secondary schools, this suggests that the country is aiming to provide learners with basic ICT skills and to meet emerging and evolving skills requirements in the information society. This does not necessarily mean that those basic ICT skills are taught by teaching staff who have received the requisite formal training.

Besides its use for international comparison, Indicator 7.1 can also be calculated and analysed at national and subnational levels (by education level and grade, geographical region, urban/rural area and public/private school) in order to design tailored policies and help implement training initiatives and deploy adequate numbers of ICT-qualified teachers in schools.

Proportion of teachers trained to teach subjects using ICT

A second approach to measuring the available human capital stock is via Indicator 7.2, 'Proportion of teachers trained to teach subjects using ICT'. The indicator refers to teachers who have received a nationally defined minimum formal training to teach one or more subjects at the relevant level(s) using ICT to support instruction. Where a country has a high percentage of teachers that are trained to teach subject(s) using ICT, this can be interpreted as an appropriate measure of e-readiness. When calculated by education level, geographical region, urban/rural area and individual educational institution, and analysed in conjunction with other indicators (for example ‘proportion of schools with computer-assisted instruction’), this indicator can highlight discrepancies. Appropriate policy decisions can then be taken to reassign trained teachers more effectively and to provide additional training.

Training required to become ICT-qualified or to teach subjects using ICT may be completed either in a preservice teacher training programme, or during in-service professional development courses. Furthermore, it is possible that recurring training in a variety of formats may be required to match evolving technologies and related skills. At secondary education levels, teachers trained to teach computer skills or computing would typically have an accredited academic qualification in an ICT-related field such as computer science.

Chart 7.1 shows the proportion of ICT-qualified teachers (teachers trained to teach basic computer skills or computing) versus the proportion of teachers trained to teach subject(s) using ICT in combined primary and secondary education amongst the 33 countries for which data are available. The most apparent trend is that for the majority of countries, there appears to be more emphasis on training teachers to teach using ICT than on training teachers to teach basic computer skills or computing (that is, ICT-qualified). This finding is consistent with contemporary situated learning theory, which, at its simplest, stresses that learning that takes place in the same context in which it is applied. Lave and Wenger (1991), for example, have argued that learning should not be viewed as simply the transmission of abstract and decontextualized knowledge from one individual to another, but a social process whereby knowledge is co-constructed in a specific context and embedded within a particular social and physical environment. Extending this theoretical model to teacher training leads to the conclusion that teachers who have been trained how to integrate ICT into various learning contexts are more pertinent for overall learning than those specifically trained to pass along decontextualized computer skills.[8]

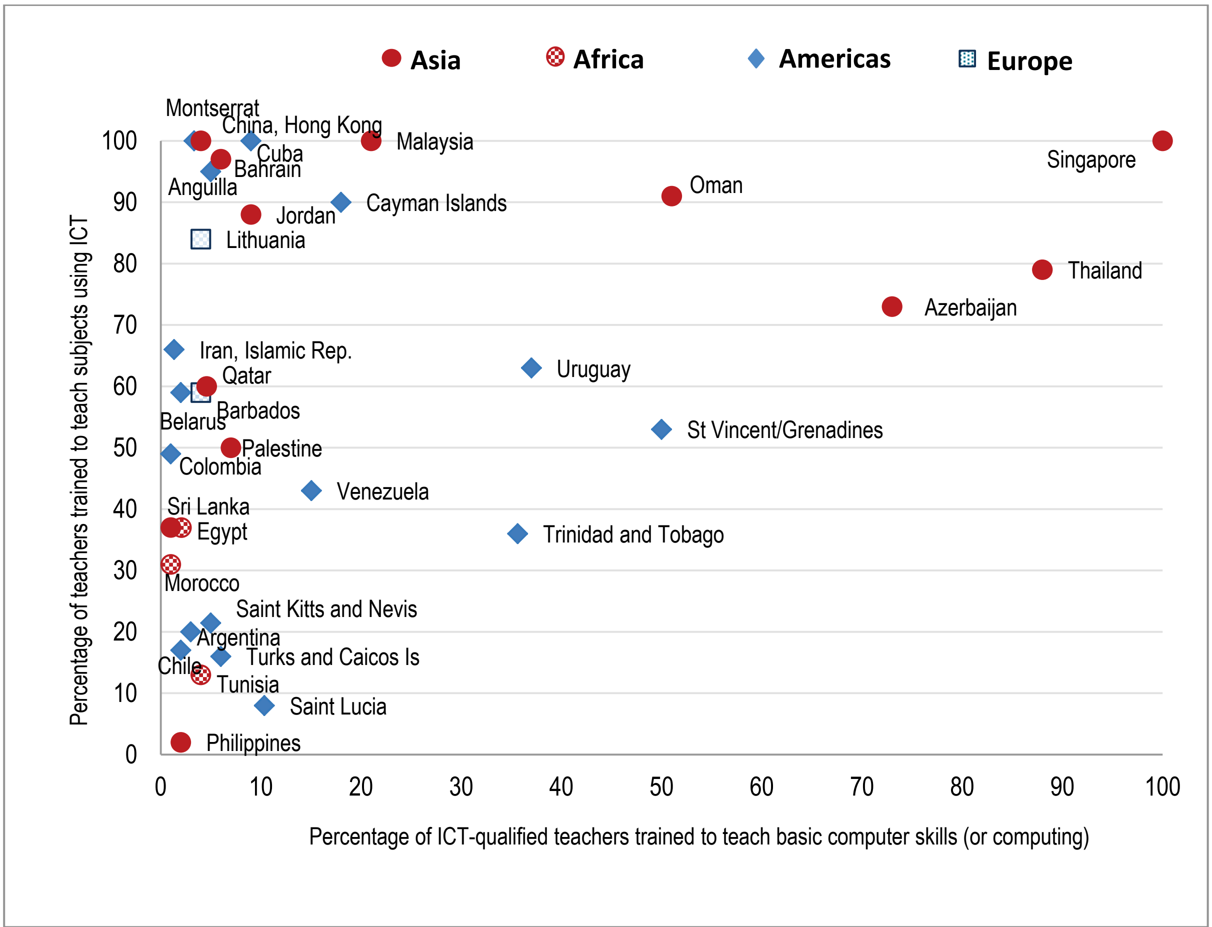
Representing different regions and national income levels, less than 10 per cent of the national teaching workforce was trained to teach basic computer skills or computing (ICT-qualified) in 2011/2012 in the vast majority of countries represented in Chart 7.1. In contrast, approximately 50 per cent of teachers or more were ICT-qualified in Oman (51 per cent), Azerbaijan (73 per cent), Thailand (88 per cent) and Singapore (100 per cent). This wide range can partly be explained by the fact that nationally defined standards to be ICT-qualified vary. In Jordan, for example, where 9 per cent of teachers are considered ICT-qualified, the training standard in the public education system is a tertiary level qualification in computer science (Ministry of Education, 2010). Meanwhile, the standard in many countries is likely to be lower, requiring only a single course during an entire teaching course or covered during short intensive in-service programmes. In Singapore, where 100 per cent of teachers are ICT-qualified, the same course requirements as teachers trained to teach subjects using ICT apply. Additional metadata on teacher training programmes would be required to make firmer statements about the quality of training between countries.

Compared with ICT-qualified teachers, the range of the proportion of teachers trained to teach using ICT was much wider. For example, 20 per cent or fewer teachers were trained to teach using ICT in Argentina (20 per cent) and Tunisia (13 per cent) in 2009, Saint Lucia (8 per cent) and Turks and Caicos Islands (16 per cent) in 2010, Philippines (2 per cent) in 2012 and Chile (17 per cent) in 2013. In contrast, between 80 and 100 per cent of teachers were trained to teach using ICT in Bahrain (97 per cent) in 2008, Anguilla (95 per cent) and Cayman Islands (90 per cent) in 2010, Jordan (88 per cent) in 2011 and Lithuania (84 per cent) in 2012. Extending training even further, 100 per cent of teachers were trained to teach other subjects using ICT in Singapore by 2009, Cuba and Montserrat by 2010, and China, Hong Kong by 2012.

Teacher capacity to effectively deliver ICT-assisted instruction is expected to be most effective in countries where high proportions of teachers are both ICT-qualified and trained to teach subjects using ICT. In Singapore, where all preservice teachers have had to undertake a module on the instructional uses of technology since the 1990s – complemented by additional professional development for in-service teachers – 100 per cent of teachers are both ICT-qualified and trained to teach using ICT. Relatively high proportions of teachers are also ICT-qualified and trained to teach using ICT in Azerbaijan, Thailand and Oman (see Box 7.5).

Concurrent to the implementation of Thailand's *One Tablet per Child*, the proportion of teachers trained to teach using ICT increased from 66 per cent in 2008 to 79 per cent in 2012. Uruguay has also successfully increased the proportion teachers that are ICT-qualified and trained to teach using ICT to 37 per cent and 63 per cent, respectively by 2009.

Chart 7.1: ICT-qualified teachers versus those trained to teach using ICT, 2012 or LYA[9]



Source: UIS database, Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013 (*Partnership*, 2013).

Notes:

1. Reference years range from2008 to 2013 (2008 to 2010 for Africa; 2008 to 2013 for the Americas; 2008 to 2013 for Asia; and 2008 to 2013 for Europe). Full details can be found on the UIS website, http://www.uis.unesco.org/Communication/Documents/wsis-tables-2014.pdf.
2. All data for Montserrat and Saint Lucia refer to secondary only. Data for Philippines refer to primary and lower secondary only. Data for teachers trained to teach using ICT for Venezuela refer to primary only. All data for Anguilla, Azerbaijan, Barbados, Jordan, Singapore, Trinidad and Tobago, Uruguay, Philippines and Sri Lanka refer to public schools only. For Egypt, data on teachers trained to teach subjects using ICT refer to public schools. Data for Palestine refer to West Bank schools only.

Box 7.5: Increasing ICT skills among teachers in Oman to match evolving curricula

The development of Oman's education system mirrors its rapid emergence, both economically and socially. From only one all boys' school in 1970, Oman today has about 1 043 schools catering to both girls and boys. Responding to the global knowledge revolution and emerging information society, the education system of Oman is evolving rapidly to ensure that young Omanis are prepared to compete in a global economy by creating a skilled work force.

Information Technology (IT) is now taught in all schools as a separate subject from Grade 1 to Grade 10, while in Grade 11, the ICDL (International Computer Driving License) is a required course. Additionally, there are units in several other subjects that require the application of IT throughout. In 2007, the Ministry of Education (MoE) launched the Education Portal, which is an umbrella initiative to collate all IT initiatives and services within the MoE IT Master Plan. This web-based application is tied to a centralized database, which enables a single entry point for users within the MoE. The Education Portal provides users with the following applications:

- **Learning Management System (LMS)**, which handles all educational aspects publishing e-learning content like digital text, e-books, audio and video materials to present the subject in an appealing way for teachers and students;
- **Documents Management System (DMS)**, which tracks and archives electronic documents sent by users; and
- **School Management System (SMS)**, which transforms all administrative work in schools into electronic form.

As of late 2013, usage of the portal had increased to include 43 000 teachers, 27 000 administrators and 550 000 students in 1 040 schools. Close to 400 000 parents connect to the system to carry out daily transactions.

With the rapid evolution of ICT in education in Oman, the MoE recognized the importance of training to enhance teacher capacity through the acquisition of new skills and reduce internal resistance. Supported by influential private sector partners, and a training budget that was tripled from the 2010 level, the MoE embarked upon several initiatives to train teachers in the effective use of ICT in the classroom. In particular, in-service training was identified as an effective solution to bridge the skills gap occurring from rapid development of curriculum and the introduction of ICTs. Moreover, there is effective coordination between educational colleges in Oman and the MoE to ensure preservice and in-service training are aligned so that teachers are prepared and trained when programmes are implemented. Based on available statistics, Oman has been particularly successful in delivering training to its teacher workforce. Between 2010 and 2013, Oman increased the proportion of ICT-qualified teachers and those trained to teach subjects using ICT from 15 per cent and 37 per cent, respectively, to 51 per cent and 91 per cent.

Source: Information Technology Authority & Ministry of Education, 2014.

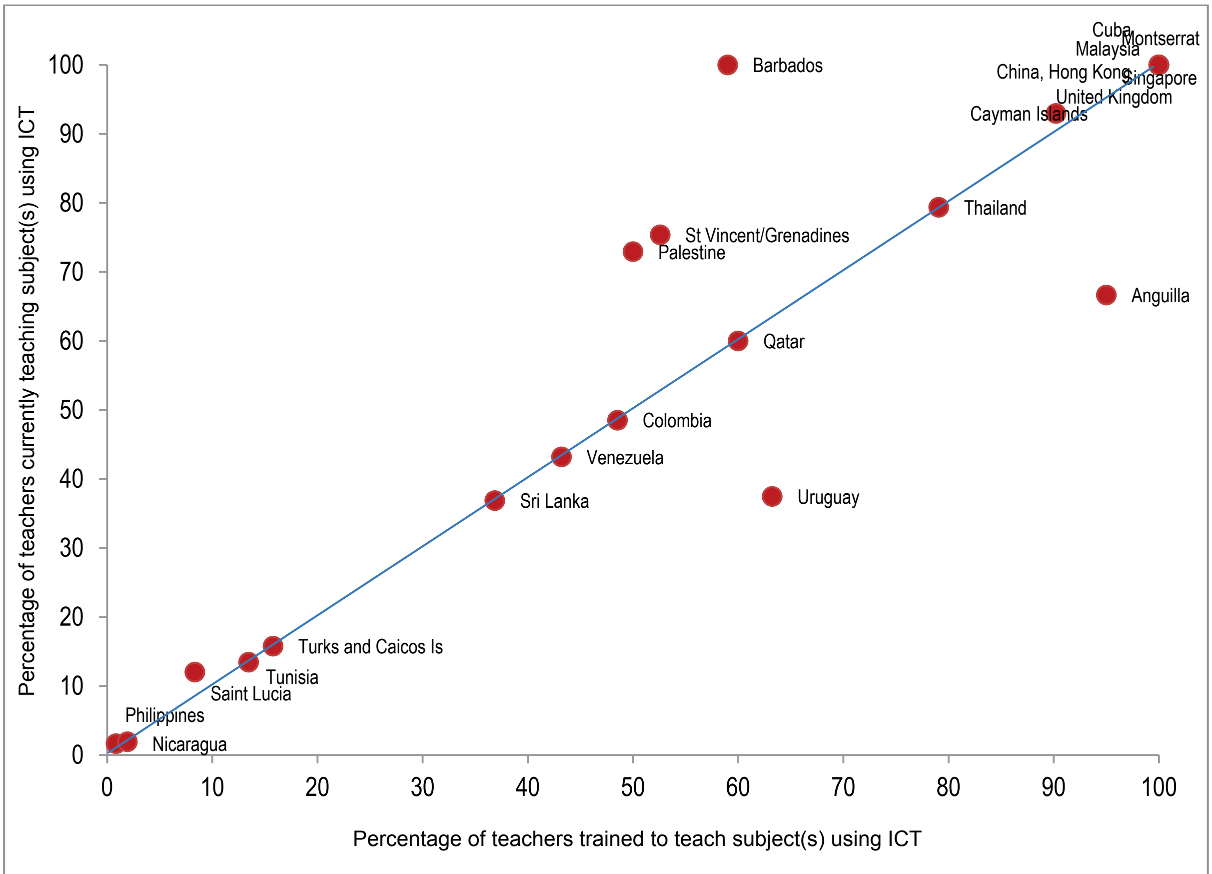
It is difficult to identify an ideal proportion of teachers who should be ICT-qualified or trained to teach subjects using ICT. Much will depend on the level of integration of ICT into the curriculum as well as how many children are enrolled in programmes that use various ICTs. Having ascertained the stock of teachers that are ICT-qualified or are trained to teach subjects using ICT according to national standards, it would also be useful to determine the proportion of teachers who actually use the relevant training in their teaching. One hypothesis is that there would be a one-to-one relationship between the two groups.

In terms of teachers trained to teach subject(s) using ICTs, Chart 7.2 shows that there is evidence of a perfect match in many countries. Countries such as Tunisia in 2009, Sri Lanka, Colombia and Qatar in 2011 and Thailand in 2012 displayed perfect proportionality (that is, a one-to-one ratio) between those trained to teach using ICTs and those engaged in teaching using ICTs. Moreover, there was significant variation amongst countries ranging from 1 per cent in Nicaragua in 2010 and 2 per cent in Philippines in 2012 to 100 per cent in China, Hong Kong in 2012; Malaysia and Singapore in 2011;

Cuba and Montserrat in 2010; and the United Kingdom in 2008. The high levels in these countries reflect active policies to fully integrate ICT into curricula and training programmes (see Box 7.6).

In contrast, Uruguay had a relatively high proportion of teachers trained to teach subjects using ICT (63 per cent) as against a smaller proportion of teachers actually teaching using ICTs (37 per cent) in 2009. This high level of trained teachers can likely be attributed to the El Ceibal project that is implementing one-to-one computing for all children (particularly in primary schools) and which was responsible for the training of 17 000 teachers. More recently, data show that by 2012, 100 per cent of primary teachers were trained to teach using ICT. Palestine, on the other hand, displayed a different type of gap between teacher resources and current practice, where as many as 73 per cent of teachers were teaching subjects using ICTs in 2012 compared to just 50 per cent who were trained.

Chart 7.2: Teachers trained to teach using ICT versus those teaching using ICT, 2012 or LYA[9]



Source: UIS database, Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Notes:

1. Reference years range from2008 to 2013 (2008 to 2010 for Africa; 2008 to 2013 for the Americas; 2008 to 2013 for Asia; and 2008 to 2013 for Europe). Full details can be found on the UIS website, http://www.uis.unesco.org/Communication/Documents/wsis-tables-2014.pdf.
2. Data for Montserrat and Saint Lucia refer to secondary. Data for Philippines refer to primary and lower secondary only. Data for Nicaragua and Venezuela refer to primary. Data for Philippines, Sri Lanka, Palestine, Barbados, Uruguay, Anguilla, Singapore and the United Kingdom refer to public schools. Data for Palestine refer to West Bank schools only.

Box 7.6: Training teachers to be effective change agents – the VLE in Malaysian schools

Experienced in the implementation of computer- and Internet-assisted instruction educational solutions, Malaysia is currently implementing the *Frog Virtual Learning Environment* (VLE) as a platform for teaching and learning in all primary and secondary schools. Part of the broader 1BestariNet initiative under the Malaysia Education Blueprint, 2013 –2025, VLE is geared towards ensuring that students learn how to use ICT as well as how to leverage it to enhance other areas of knowledge. To achieve this, all 10 013 schools in Malaysia will be provided with broadband access through either a 4–10 Mbit/s bandwidth using wireless 4G technology, or 2–4 Mbit/s bandwidth in rural and remote schools, requiring the use of Very Small Aperture Terminals (VSAT).

Nevertheless, several challenges confront the nationwide implementation of VLE including: adequate supporting infrastructure, universal access among stakeholders, availability of quality VLE resources, and continuous monitoring and evaluation. However, the most significant challenge has been undertaking the training of principals, Malaysia’s 450 000 teachers and pupils. To ensure that all teachers are trained, a cascading model, whereby at least one teacher per school receives formal training, which they in turn disseminate to other teachers in their respective schools, has been employed. Since its implementation in 2012, approximately 17 000 school principals and teachers have been trained on the use of VLE in teaching and learning, while a substantial number of students have also been trained.

To facilitate implementation, the Ministry of Education (MOE) also created 451 *Champion Schools* throughout Malaysia to serve as test schools; these schools offer three levels of teacher training to progressively develop basic to advanced skills in the use of VLE. Training is geared towards the development of *Communities of Practice*, whereby school teachers are encouraged to develop instructional materials in the form of learning sites for their own use and to be shared with other teachers and students. Currently, a total of 4 000 learning sites have been developed by teachers. To ensure consistency in the quality of these learning sites, a special committee comprising inter-divisional members was created.

To further support teacher training, 367 district level *Teacher Activity Centres* (TACs) across Malaysia are actively involved in providing training and support services to schools. These TACs are in turn monitored by the 15 State Education Technology Centres and the Educational Technology Division of the Ministry of Education. A recent evaluation of teachers’ skills based on a sample revealed that about 70 per cent have moderate to high levels of skills in using the VLE, while 55 per cent were of the opinion that the VLE motivated teachers in teaching and learning. Similarly, about 77 per cent of the students were of the opinion that the VLE increased students’ interest in learning.

Source: Ministry of Education, Educational Technology Division, 2014.

Adapting curricula to computer and Internet-assisted instructional environments

Developing an informed assessment of primary and secondary curricula to meet the changing needs of the information society entails multiple dimensions. While policies for the recommended use of ICT in curricula and for human capital formation (that is, of teachers) are vital to this assessment, other dimensions are required in order to monitor progress towards achieving WSIS Target 7. In tandem with teacher training, indicators that measure the actual proportion of primary and secondary schools that offer computer-assisted instruction (CAI) and/or Internet-assisted instruction (IAI) provide policy-makers with a sense of the magnitude of advanced forms of ICT use across schools. Indicators 7.3 and 7.4 are 'Proportion of schools with computer-assisted instruction' and 'Proportion of schools with Internet-assisted instruction' respectively. It should be noted that these indicators do not provide insight on quantitative or qualitative aspects of usage – that is, frequency and types of activities that pupils are engaged in.

The history of computer-assisted instruction (CAI) and Internet-assisted instruction (IAI) is much more recent than the use of radio and television for pedagogical purposes. However, their evolution and diversification have been exponential and they are increasingly merging with older ICTs to create new platforms for teaching and learning. In the 1970s, the approach of CAI was based on programmed learning or 'drill and practice' software, whereas both the software and hardware have since evolved. Various devices are well suited to this form of instruction (for example, desktops, laptops and tablets) or even specifically designed for learning and teaching (for example, interactive whiteboards). IAI, in comparison, can be defined as an interactive learning method using content from the World Wide Web (WWW) for pedagogical purposes. While IAI may often be thought of as CAI with the addition of Internet access, new models of instruction using tablets and mobile phones, especially smart phones, have introduced new and diverging forms of IAI.

One of the hallmarks of both CAI and IAI is the increased opportunity for interactivity with teachers and other learners, compared with older forms of one-way broadcasts delivered by radio or television. On the other hand, because of the increased level of technical sophistication of CAI and IAI, their start-up and maintenance costs are substantially higher than for older technologies. More recently low cost laptops and tablets are helping to reduce these costs; moreover some countries have been successful in negotiating preferential Internet rates for schools to ensure that IAI is sustainable.

Proportion of schools with computer-assisted instruction

Computer-assisted instruction (CAI) is defined as an interactive learning model in which a computer is used by teachers or pupils to present instructional material, perform learning-oriented tasks and help in selecting and accessing pedagogical content (UNESCO-UIS, 2009b). However, for CAI to be delivered effectively in schools, a critical mass of computers is needed to provide sufficient access. The learner-to-computer ratio (LCR) is one indicator that can play an important role in assessing this critical mass (see Target 2). In a number of countries, one-to-one computing models, where students are given their own laptop or tablet computer, represent an ideal for educational planners. One-to-one computing has become policy in Uruguay (see Box 7.8) (Martínez, Díaz and Alonso, 2009), Thailand (Ministry of Education, 2013) and Turkey (World Bank, 2013). In contrast, the current inadequacy of school budgets in most developing countries hinders CAI provision beyond a limited number of devices.

To be delivered effectively, CAI requires more than a simple haphazard system for distributing computers across schools. CAI policies focus on a variety of options as the most effective way to deliver CAI, including the establishment and maintenance of computer laboratories, as well as promoting ICT in classrooms, libraries and other designated locations. While the installation of computer laboratories is considered an important upgrade compared to one desktop computer placed at the back of the classroom, labs have been the subject of increasing criticism. Educational technologists argue that computer laboratories are becoming obsolete for delivering CAI and may in fact provide a disservice. Given the multitude of both school- and personally-owned devices (including laptops, tablets and mobile devices), detractors argue that labs imply a separation between computing as a subject and the general curriculum. Instead, they argue that computers and other devices should be primarily located in classrooms, to help build stronger links between ICT and curriculum, thus facilitating the development of ‘higher order’ skills (Pedro, 2012; Trucano, 2005; UNESCO, 2011a).

Chart 7.3 shows the proportion of schools that offer computer-assisted instruction (CAI). While the available data demonstrate the availability of CAI, they do not shed light on the intensity or type of usage by students or teachers. Given the increasing attention on where computers are located in schools in the support of curriculum, Chart 7.3 also shows data on the proportion of schools with computer laboratories. For countries where the proportion of schools offering CAI is greater than those with computer laboratories, CAI is thus also delivered in alternative locations including classrooms, libraries and other locations.

In several countries in Asia, CAI and computer labs were offered in 100 per cent of schools in Oman in 2013, China, Hong Kong and Georgia in 2012, and Singapore in 2011. In contrast, the provision of CAI was uncommon in some developing countries in Asia, including Nepal, Cambodia and Myanmar, representing 5 per cent or fewer of all primary and secondary institutions in 2012. The proportion of schools in Bangladesh with CAI is not known; however, due in part to newly emerging programmes such as multi-media classrooms, 14 per cent of schools had a computer lab in 2013 (see Box 7.7). Bangladesh struggles with basic infrastructure including electrification; therefore to further support the introduction of CAI, 17 mobile ICT labs containing laptop computers, wireless Internet modems, digital cameras, multimedia projectors, webcams and other e-learning facilities were introduced. Mobile labs move around and cover more than 1 000 schools in remote areas, with support from the non-governmental development organisation BRAC (World Bank, 2010). While data for CAI are unavailable for Bangladesh, computer labs are now present in 14 per cent of primary and secondary schools, where newly emerging programmes are under development (see Box 7.7).

In many developing countries, CAI frequently tends to be concentrated through the establishment of computer laboratories, due to limited computer resources (World Bank, 2010; ADB, 2012). In Armenia and Mongolia, where CAI is universally available, 91 and 92 per cent of schools respectively centralised CAI through computer laboratories in 2012. Similarly, CAI tended to be delivered through laboratories in Kyrgyzstan (86 per cent), Azerbaijan (84 per cent) and Maldives (40 per cent).

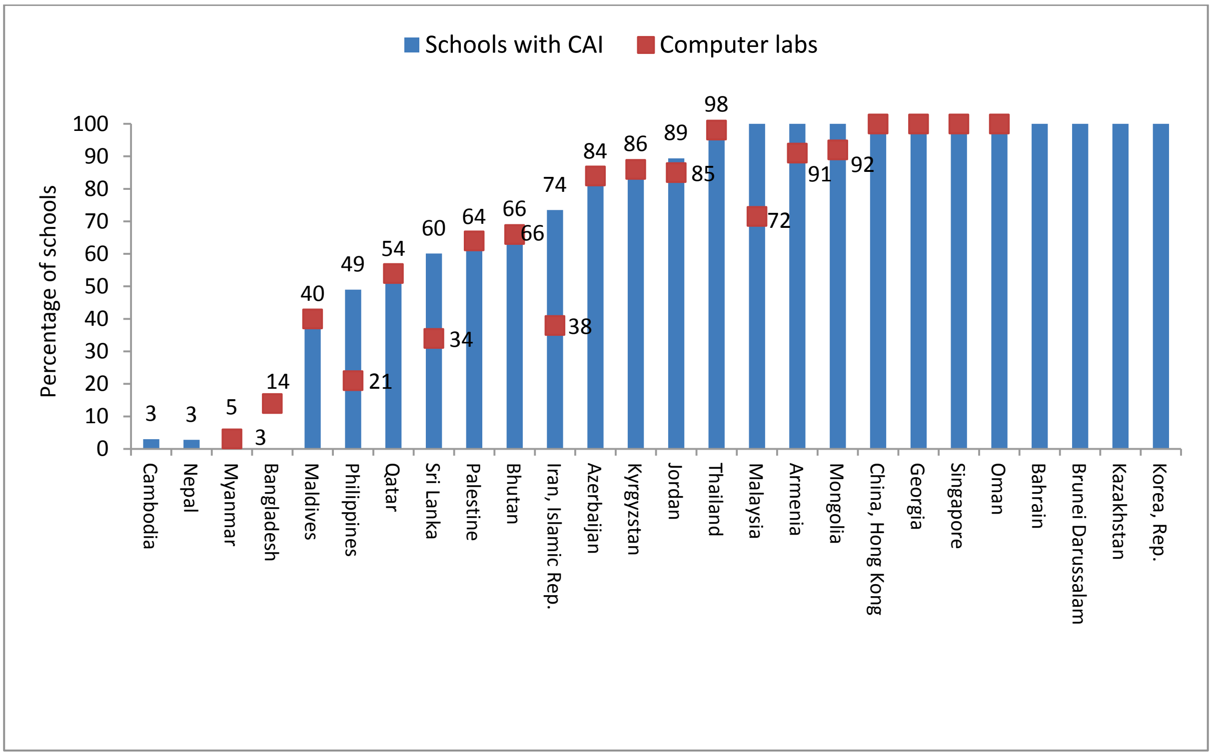
Countries where the proportion of schools with CAI is much greater than those with computer labs demonstrate greater capacity to provide a mixed model for delivering CAI in multiple locations. In Asia, a mixed model was present in Iran (Islamic Republic of) in 2012, where 74 per cent of schools offered CAI, compared to 38 per cent of schools with computer laboratories. Similarly, CAI was present in 100 per cent and 60 per cent of schools in Malaysia and Sri Lanka, respectively, in 2011, and computer laboratories were present in 72 per cent and 34 per cent of schools In Latin America and the Caribbean, considerable disparity in the availability of CAI is also present between countries. CAI was integrated in all primary and secondary education institutions in many Caribbean countries by 2010, as well as in Uruguay (see Box 7.8) by 2009 where national policies, with strong Presidential support, played a significant role in ensuring widespread availability of computers through the One Laptop per Child (OLPC) initiative under the aegis of *El Ceibal* (Martínez, Díaz and Alonso, 2009). Similarly, Chile under its *Enlaces* initiative, has increased the availability of CAI amongst schools during a relatively short time period, being available in approximately 58 per cent of schools in 2010 to 82 per cent by 2013. In contrast, CAI was present in less than one-quarter of schools in countries with relatively weaker electrical infrastructure including Guyana (15 per cent), Nicaragua (10 per cent) and Paraguay (16 per cent) in 2010, and Dominican Republic (18 per cent) in 2013.

The proportion of schools offering CAI in Colombia increased substantially to 88 per cent by 2011, partly due to the consolidation of existing schools and the closure of schools where ICT infrastructure was scarce. Beginning in 2003, Colombia had decreased the total number of schools from over 56 000 to less than 23 000 by 2013 – a decrease of approximately 60 per cent of all schools over the decade (Ministerio de Educación Nacional, 2014). In Colombia, computer labs are present in the vast majority of schools offering CAI (that is 85 per cent), suggesting they play an important role in the delivery of CAI. Labs are very common in the majority of countries in the region for which data are available. Irrespective of the proportion of schools offering CAI in countries in Latin America and the Caribbean, those demonstrating a mixed delivery model of CAI include El Salvador, Grenada, Turks and Caicos Islands, and Saint Vincent and the Grenadines.

Data on the proportion of schools with CAI are currently unavailable for most African countries.[10] Amongst those countries with data, CAI was offered in 98 per cent of schools in Egypt in 2010 and in 99 per cent of schools in Mauritius in 2008. It is noteworthy that this indicator sheds little light neither on the quality of CAI, nor on the intensity of its use. For example, the number of computers available in Egyptian schools was not keeping pace with enrolment since 48 pupils on average shared a single computer. In contrast, time using CAI in Mauritius is likely greater because there were approximately 20 students on average sharing a single computer.[11] CAI was available in less than a third of schools in South Africa (30 per cent) in 2012 and in just 11 per cent of schools in both Zambia in 2012 and Sao Tome and Principe in 2013.

CAI is relatively common in Europe and has been universally available in Andorra and Croatia since 2009, and Finland, Sweden, and the United Kingdom since 2008. However, the availability of CAI in schools has lagged in some Eastern Europe countries. For instance, while almost all schools in Lithuania (97 per cent) have had CAI from 2009, CAI was available in only 69 per cent of schools in Poland in 2008 and 86 per cent in Albania in 2009.

Chart 7.3: Schools with computer-assisted instruction (CAI) and computer labs, 2012 or LYA[9]



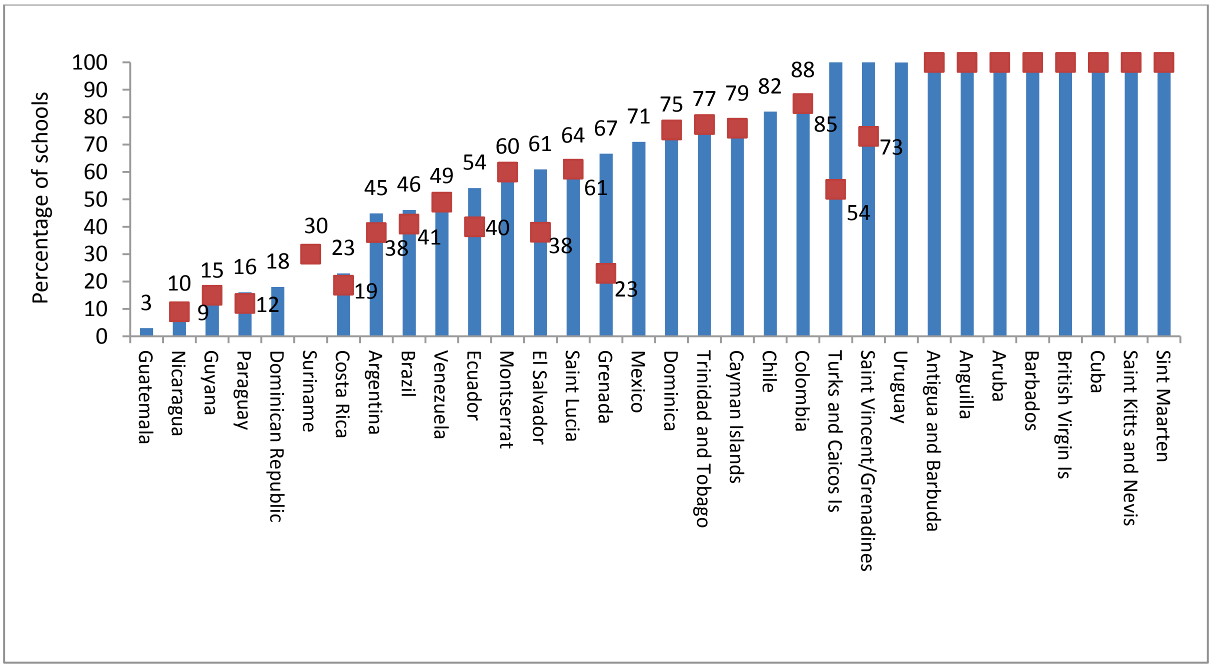
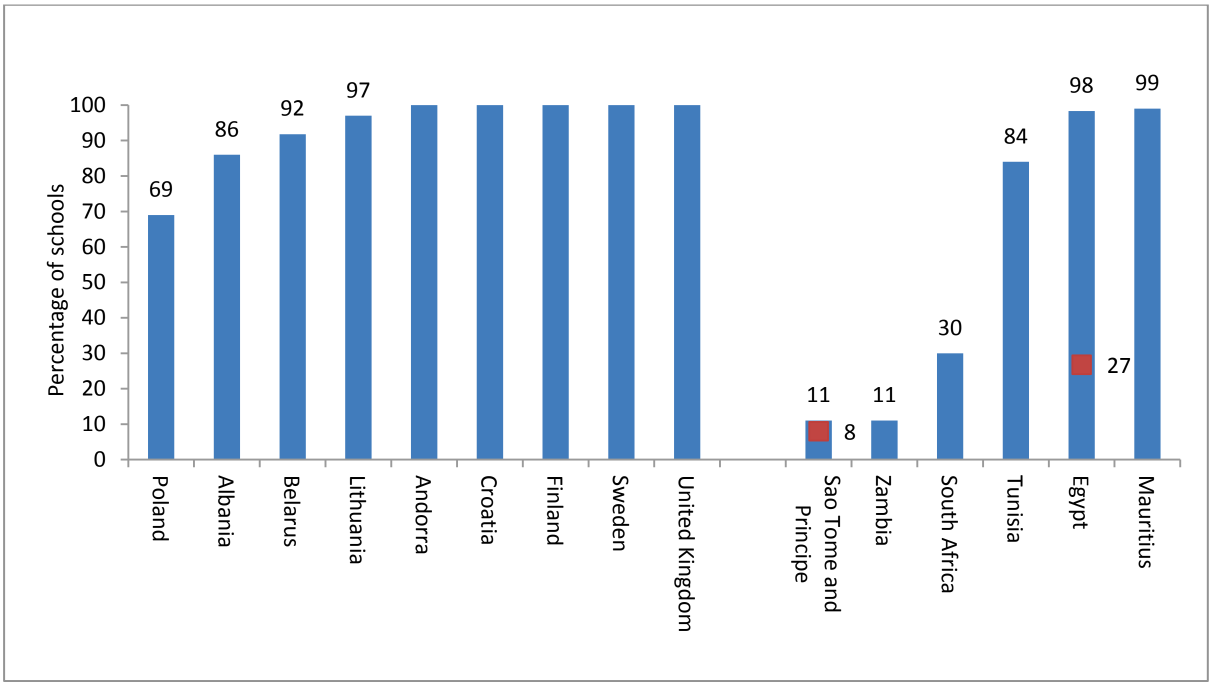


Chart 7.3: Schools with computer-assisted instruction (CAI) and computer labs, 2012 or LYA (cont.)



Source: UIS database, Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Notes:

1. The first chart shows countries in Asia, the second in the Americas and the third in Europe and Africa.
2. Reference years range from2008 to 2013 (2008 to 2013 for Africa; 2008 to 2013 for the Americas; 2008 to 2013 for Asia; and 2008 to 2012 for Europe). Full details can be found on the UIS website, http://www.uis.unesco.org/Communication/Documents/wsis-tables-2014.pdf.
3. CAI data for Colombia refer to 2011 and for Chile to 2013, while computer lab data refer to 2010 and 2009 respectively. Data for Bhutan and Saint Vincent and the Grenadines refer to secondary schools. Data for Philippines and Nicaragua do not include upper secondary. Data for Costa Rica refer to primary school. Data for Cambodia, Maldives, Philippines, Sri Lanka, Bhutan, Azerbaijan, Iran (Islamic Republic of), Kyrgyzstan, Malaysia, Singapore, Guyana, Dominican Republic, Costa Rica, Saint Lucia, Trinidad and Tobago, Chile, Colombia, Antigua and Barbuda, Anguilla, Barbados, Sint Maarten and Belarus refer to public schools. In Suriname, there are no private schools in upper secondary. Data for Palestine refer to West Bank schools only.

Box 7.7: Enhancing teaching and learning using computer-assisted instruction in Bangladesh

Considering ICT as a driving tool for socio-economic development, Bangladesh is undertaking a series of measures to promote expansion of ICT across society. BRAC, formerly known as the Bangladesh Rural Advancement Committee, is one of the largest non-governmental development organisations in the world and works in collaboration with the Directorate of Secondary and Higher Education of the Bangladesh Ministry of Education to improve quality in education and attain *Education for All*. Supporting 3 989 secondary schools in rural areas, BRAC is increasingly playing a significant role in broadening the reach of ICT in education including support to the 20 500 and 1 503 multimedia classrooms established in secondary schools and primary schools, respectively (Ministry of Education, 2014). For girls and children from lower socio-economic levels who are generally deprived of access to ICT due to social barriers, the provision of CAI in the school environment plays a significant role in reducing the digital divide.

While teaching and learning in rural schools in Bangladesh has been based on a traditional didactic paradigm where teachers are active and students are passive, BRAC advocates for the augmentation of ICT in the classroom to make teaching and learning more effective. As part of its efforts, BRAC introduced a CAI programme in 2005 with the objective to make classes more enjoyable for the students, as well as rewarding and motivating for teachers. The programme concentrated on the development of interactive educational software, based on national curriculum, using animated content and games for English, mathematics, and science that require practice, in pairs, groups and individually. The CAI contents are disseminated in the form of CDs and through a website[12] at no cost to users.

Anecdotal experience suggests that CAI has brought far-reaching changes to pilot schools. Teachers remark that students' attendance has increased and that they seem more motivated and engaged. Moreover, internal monitoring shows that not only have drop-out rates declined in pilot schools, but the *Secondary School Certificate* (SSC) examination results have also improved since the programme began. Some also suggest that CAI has been particularly useful as the content helps compensate for the shortage of expert teachers, while others note that CAI allows teachers to use their time more efficiently, particularly in the management of large class sizes.

While some challenges regarding teacher training and professional development in the use of unfamiliar technology were encountered, teachers increasingly accept the use of computers in classrooms. Moreover, the success of this CAI programme inspired BRAC to expand ICT to other components of its secondary intervention. BRAC has extended the reach of ICT services not only at school level but also at the community level through multipurpose community learning centres, which offer low cost computer training to people of different age groups. Students can also access the Internet in *Gonokendros*, of which 250 were newly established in 2014.

Source: BRAC, 2014.

Proportion of schools with Internet-assisted instruction (IAI)

Internet-assisted instruction (IAI) refers to an interactive learning method using content from the Internet and the WWW for pedagogical purposes. It can be argued that instruction employing the seemingly infinite resources of the Internet should have a profound impact on the nature of education by facilitating its transformation from a teacher-centred to student-centred process. Programmes that employ mobile forms of IAI (for example, assisted by laptops, tablets and mobile phones) increasingly facilitate student access to various learning platforms throughout, as well as outside, the physical school environment. In countries where Internet access has traditionally been limited, mobile learning forms of IAI may ultimately have a multiplier effect throughout the family and community (see Box 7.8).

In most countries, the pace of integration of IAI typically lags behind CAI, as some schools have computers, which are not connected to the Internet. While Internet connectivity is essential to provide IAI, its mere existence is insufficient. In order for IAI to be viable, the following are required:

- formal commitments for integrating ICT in education (for example, policy)

- curricula adapted to using the Internet
- supporting infrastructure (for example, an adequate number of devices, adequate connectivity)
- effective teacher training.

Chart 7.4 shows the proportion of primary and secondary schools that have IAI in 49 countries across Asia, Europe, Latin America and the Caribbean, and Africa. While the data provide insight on the availability of IAI amongst schools, they do not shed light on intensity of use or the ways that students engage with IAI. Chart 7.4 also provides data on proportions of schools with an Internet connection, to show the differences between the availability of Internet connectivity and the provision of IAI.

IAI was universally available in a number of Eastern Asian and South-Eastern Asian countries including China, Hong Kong and Republic of Korea in 2012, Singapore in 2011, Brunei Darussalam in 2009, and the majority of schools in Thailand (98 per cent) in 2012, and Malaysia (91 per cent) in 2011. In Western Asia, Georgia, Jordan (see Box 7.9) and Oman have made significant strides increasing the availability of IAI in schools. IAI was universal amongst schools in Georgia, whereas 73 per cent of primary and secondary schools combined offered IAI by 2011 in Jordan. Similarly, Oman has increased the proportion of schools with IAI from 62 per cent in 2008 to 77 per cent by 2011. Despite universal electrification of schools in Kyrgyzstan and Azerbaijan, in 2012, IAI was available in just 6 per cent and 27 per cent of schools, respectively, due to the lack of Internet service providers (ISPs), high connectivity costs and/or the under resourcing of school budgets (ADB, 2012). Lastly, IAI was also uncommon in the Philippines (8 per cent in 2012) and Sri Lanka (18 per cent in 2011).

In Latin America and the Caribbean, IAI was universally available in a number of Caribbean countries including Anguilla, British Virgin Islands and Saint Kitts and Nevis in 2010, and Barbados and Trinidad and Tobago in 2009. In Uruguay, under the El Ceibal/OLPC project, it was available in 96 per cent of schools by 2009. In contrast, IAI was uncommon in Dominican Republic (12 per cent) in 2013, Ecuador (18 per cent), Guyana (13 per cent) and Turks and Caicos Islands (7 per cent) in 2010, as well as Mexico (12 per cent) in 2009. Chile, under its *Enlaces* project, has made significant progress in terms of offering IAI in its schools. While 45 per cent of public schools offered some kind of IAI in 2009, the proportion of schools using the Internet for pedagogical purposes increased to 70 per cent by 2013.

In countries where IAI is frequently unavailable, other forms of ICT-assisted instruction may be alternatively used to fill in gaps. For example, due to a lack of budgetary funds and a reliance on community donations in Palestine (West Bank) (Pacetti, 2008), Internet and IAI, which was in 30 per cent and 21 per cent of schools, respectively (in 2012) was bolstered by the use of radio and television, which were present in 100 per cent and 77 per cent of schools respectively (see Chapter 2).

In a number of countries, Internet connections in schools are not exploited for the provision of IAI, and instead are used for administrative purposes. For example, in Iran (Islamic Republic of), just 32 per cent of educational institutions offered IAI out of 87 per cent that are connected to the Internet in 2012; the other schools use the Internet principally for administrative purposes (UIS, 2014). Also in Asia, just 40 per cent of schools in Maldives offered IAI in 2012 despite universal Internet connectivity. The Internet is also less than fully exploited for teaching and learning in some other Latin American and Caribbean countries. For example, while IAI was offered in just 7 per cent of schools in Turks and Caicos Islands in 2010, Internet connectivity was available in 54 per cent of schools. While not as substantial, Internet was also less than fully used in Argentina and Brazil, where 23 per cent and 38 per cent of schools, respectively, offered IAI in 2009 and 2010, compared to 36 per cent and 46 per cent that had an Internet connection.

Few data are currently available for Africa; however, according to Chart 7.4, IAI was rare in Ethiopia in 2008, occurring in just 2 per cent of schools, while it was relatively common in Tunisia and in Mauritius, being offered by 81 per cent and 85 per cent of schools, respectively.

IAI has been universal in a number of European countries, including Andorra and Croatia, since 2009, and Finland, Sweden, and the United Kingdom since 2008. In contrast, just 45 per cent and 65 per cent of schools offered some form of IAI in Belarus and Poland in 2008, respectively, out of 61 per cent and 93 per cent of schools with Internet connections.

Chart 7.4: Schools with Internet-assisted instruction (IAI) versus Internet access, 2012 or LYA[9]

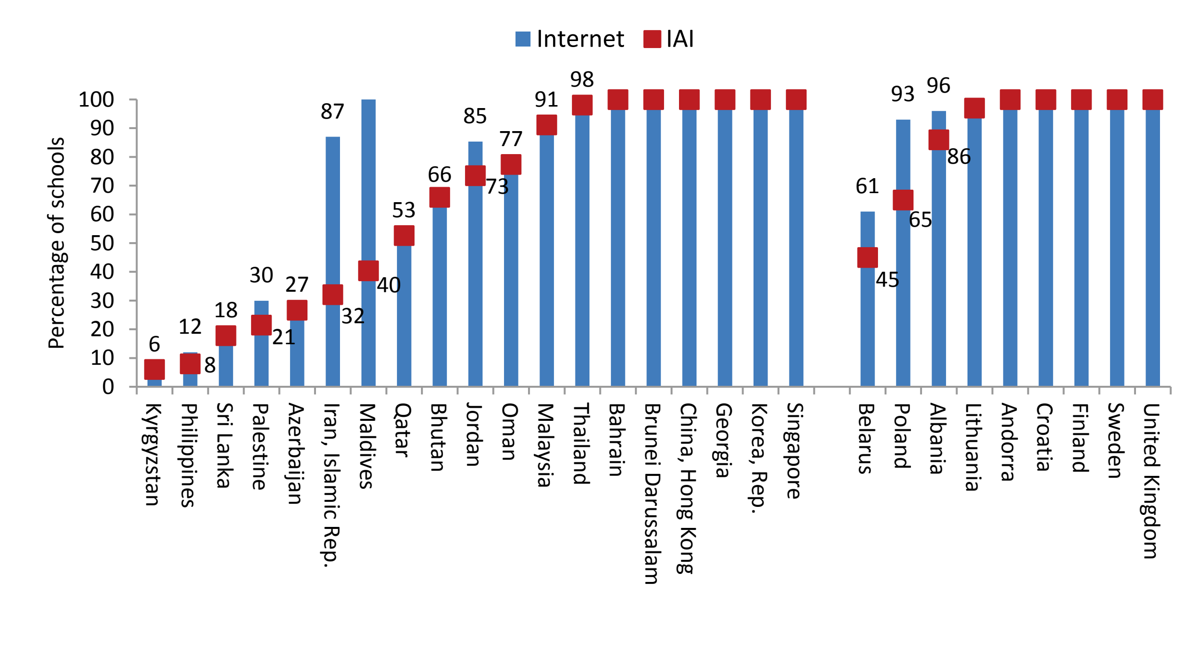
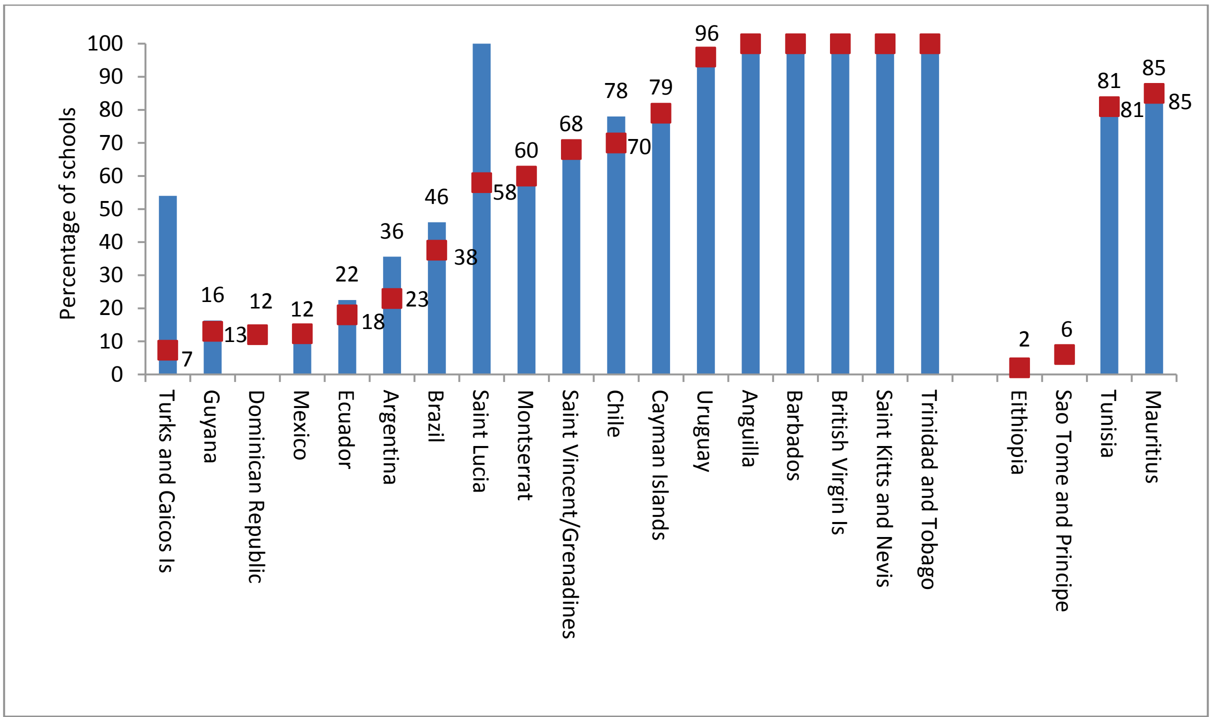


Chart 7.4: Schools with IAI versus Internet access, 2012 or LYA (cont.)



Source: UIS database, Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013.

Notes:

1. The first chart shows countries in Asia and Europe, and the second in the Americas and Africa
2. Reference years range from2008 to 2013 (2008 to 2013 for Africa; 2009 to 2013 for the Americas; 2008 to 2012 for Asia; and 2008 to 2012 for Europe). Full details can be found on the UIS website, http://www.uis.unesco.org/Communication/Documents/wsis-tables-2014.pdf.
3. Data for Bhutan, and Trinidad and Tobago, refer to secondary schools. Data for Guyana and Mexico refer to lower secondary schools. Data for the Philippines refer to primary and lower secondary. Data for Philippines; Azerbaijan; Maldives; Bhutan; China, Hong Kong; Singapore; Belarus; Guyana; Mexico; Trinidad and Tobago; Chile; Barbados and Cayman Islands refer to public schools. Data for Palestine refer to West Bank schools only.

Box 7.8: Uruguay's El Ceibal Project – Internet-assisted instruction using mobile XO laptop computers

Education in Uruguay has long been regarded as the cornerstone to foster social integration and mobilization. *El Ceibal* is a socio-educational project focusing on social and technological inclusion established in 2007 by presidential decree. Its main pillars are: equipment distribution (laptops and tablets); connectivity in schools and public spaces; teacher training and support; user services; and training and support to families. El Ceibal positioned Uruguay as the first country in the world to implement the One Laptop Per Child (OLPC) model in public primary and lower secondary education (general and technical and vocational programmes), providing free Internet connections to educational institutions, as well as to a great diversity of public spaces. Laptops were also given universally to teachers.

Since 2007, El Ceibal has expanded sustainably, resulting in universal availability of Internet-assisted instruction in schools benefitting more than 630 000 users by the end of 2013. Moreover, a learner-to-computer ratio of 1:1 has been achieved in public primary and lower secondary education, in upper secondary technical and vocational (TVET) and professional programmes, as well as in semi-professional programmes taught at the Universidad del Trabajo. In terms of Internet connectivity, 96 per cent of schools have been connected. Concurrently, a total of 911 schools have been migrated to fibre optics and 312 rural schools are connected via 3G. In addition, the El Ceibal network is offered in more than 200 public spaces in prioritized neighbourhoods to ensure additional access.

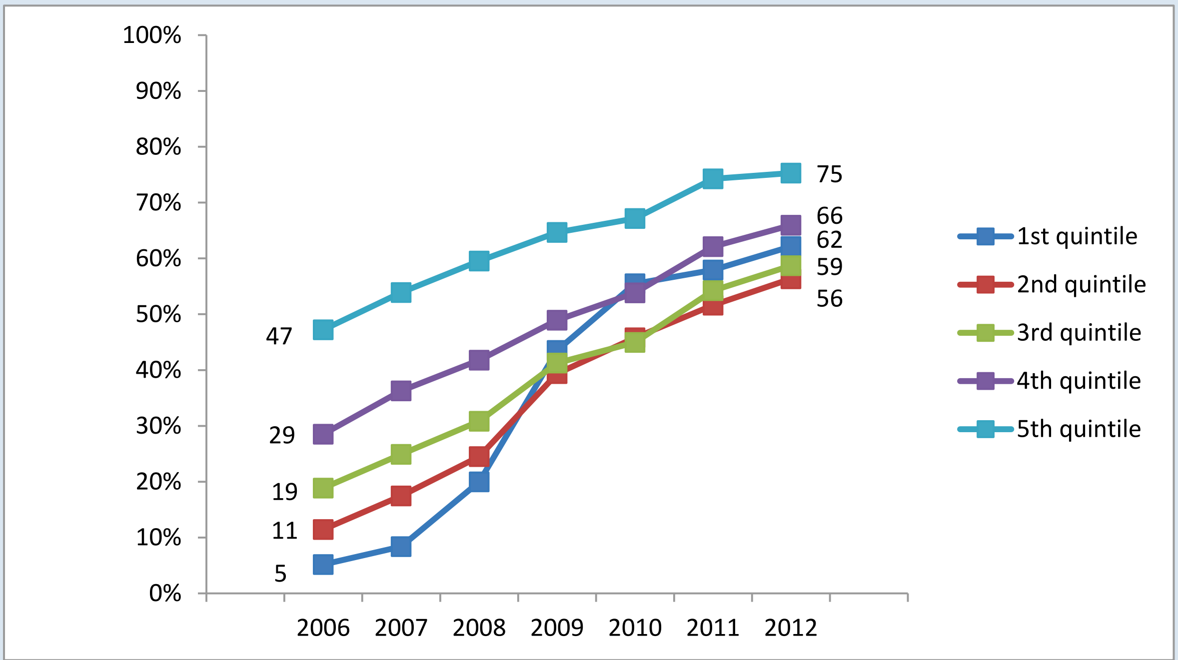
Box 7.8: Uruguay's El Ceibal Project (cont.)

El Ceibal has resulted in a number of additional measures including the development of:

- content management systems to facilitate and promote the use of digital resources in the classroom
- videoconferencing solutions in 61 per cent of urban schools
- expansion of the educational robotics programme to rural schools
- online courses
- the training of 17 000 teachers
- an online evaluation covering all students from grade 3 to 6
- advising and collaborating with various countries inside and outside the region to replicate the Uruguayan experience.

The ceibailitas (that is, XO laptop computers) have changed both the urban and rural landscape in Uruguay by providing its target population more possibilities for new practices and forms of social interaction. As a consequence, it is commonplace to see children in parks and malls with their computer equipment taking pictures, recording videos, searching information on the Internet and sharing their knowledge with the elderly. In terms of access to technologies, El Ceibal has significantly contributed to decreasing the digital divide across Uruguay. For example, in 2006, only 5 per cent of the poorest households had a computer compared to 47 per cent of the richest households; however, by 2012, the proportion of poorest and richest households with a computer had increased to 62 and 75 per cent, respectively, thus, decreasing the gap to 13 percentage points between poorest and richest quintiles (see Box Chart 7.8).

Box Chart 7.8: Households with computers, by income quintiles, 2006–2012



Source: Departamento de Monitoreo y Evaluacion Plan Ceibal, 2014.

Box 7.9: The Jordan Education Initiative (JEI) – Preparing learners for the information society

In response to Jordan's slow GDP growth, young population and concerns over rising rates of unemployment, Jordan, implemented the *Educational Reform for a Knowledge Economy* (ERfKE) in 2003 to create the knowledge, skills and attitudes needed for the global market and the information society. The programme's objectives included curriculum reform, teacher training, adoption of ICT as an enabler of learning, and upgrading existing school infrastructure.

Driven by the private sector's goal to create a high-quality education programme that would harness ICT to reduce the gap between developed and developing countries, Jordan was identified as an appropriate candidate at the World Economic Forum in 2003 due to its committed, clear and aggressive strategy for reform. The Jordan Education Initiative (JEI) thus was born as a public-private partnership involving the Government of Jordan, the international private sector (for example, Cisco, Microsoft, Intel, SMART Technologies, Hitachi and IBM), the local private sector, NGOs and donors, under the auspices of the World Economic Forum's Global Education Initiative.

Designed as a pilot project to leapfrog education reform, the JEI aims to:

- Improve the delivery of education through public-private partnerships.
- Unleash the innovation of teachers and students through the effective use of ICT.
- Build the capacity of the local information technology industry.
- Create a model of reform that can be used by other countries.

In order to review and evaluate Jordan's policy for educational change, JEI selected 100 *Discovery schools*, covering grades 1–12 amongst existing boys and girls schools from different socio-economic classes to inform future nationwide programmes. Discovery schools are equipped with computer labs, networks including LAN, WAN, 3G connectivity and cloud computing, to allow teachers and students alike to more freely access the educational platform in the school environment. Teachers were given laptops and projectors to practise new learning strategies that rely on a blended learning approach, where ICT tools may play a significant role in facilitating interaction between teachers. To facilitate the aims of the ERfKE and JEI, the government also installed the National Broadband Learning and Research Network to connect schools, colleges and universities, and community centres via fibre optics.

E-curricular development strategy is a main focus for JEI and is centred on improving the quality of education through interactive, media-rich content in several subjects including English, mathematics, ICT, Arabic, science and civics. The JEI pedagogical approach is based on collaborative learning models, while ICT is to be integrated throughout the teaching and learning process. Teacher-led learning in the classroom, supported by teacher laptops and data projectors, enable technology to support 80 per cent of student learning time.

Under the scope of *Discovery schools*, by 2013, the JEI had had an impact on more than 80 000 students and 3 000 teachers. In addition, the JEI has been successful in accelerating the deployment of computers and Internet connectivity in schools: the proportions of schools offering some type of computer-assisted instruction (CAI) and Internet-assisted instruction (IAI) by 2011 were 88 and 73 per cent, respectively. However, others note that the teaching model employed by the majority continues to be teacher-centred, which is considered to be inconsistent with the proposed model for ICT-assisted instruction being developed in discovery schools. Therefore, despite the fact that 88 per cent of teachers were considered trained to teach using ICT in 2011, according to some, the need to reinforce teaching capacity remains, in order to facilitate the evolution of more student-centred teaching and collaborative learning approaches.

Source: UIS research from Ministry of Information and Communication Technology, 2012; Light *et al*., 2008; McKinsey and Company, 2005.

Conclusions and recommendations

Under the right conditions, it is believed that ICTs can have a significant impact on the expansion of learning opportunities to greater and more diverse populations, beyond cultural barriers, and outside the confines of traditional educational institutions or geographical boundaries (Haddad and Draxler, 2002). Indeed, ICT can also play a role in improving the teaching and learning process by reforming conventional delivery systems to meet the educational needs of primary and secondary pupils. However, ICTs by themselves cannot provide the education that learners need to become productive citizens in society and to contribute to the economic, social and political life of their countries. Rather, ICT enhances the quality of learning and facilitates state-of-the-art skills formation best when pedagogical principles are adequately adhered to and implemented in the reformulation of education delivery. Moreover, to ensure sustainability of education provision, national circumstances including current policy environment, infrastructure and economic factors need to be considered and taken into account.

For Target 7, indicators to measure the adaptation of curricula such as 'proportion of schools with CAI' and 'proportion of schools with IAI' are relatively difficult to collect (compared with those for Target 2). For the limited sample of countries for which data are available, the variation across countries is striking. While a number of developed and high income 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 adapt curriculum using ICT to meet the challenges of the information society. Typically, countries that have strong policies and plans that set targets for ICT in education with high-level government and sector-wide support have also shown the most rapid change amongst developing countries. This is true for a number of countries including Chile, Colombia and Uruguay in Latin America, as well as for Oman, Jordan, Thailand and Georgia in Asia.

Countries that have adopted full scale implementation of CAI and IAI in their schools also typically have a relatively high proportion of trained teachers, compared to those that are still in the early stages of implementation. Looking at the gap observed, albeit across the limited number of countries with available data, countries 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 that have employed effective models and policies for integrating ICTs in their curricula.

While evidence suggests that in a number of countries progress is being made towards the achievement of Target 7, it is still not possible to give a comprehensive review of achievements against Target 7. For example, while data have been collected for an increasing number of countries since the launch of the UIS international data collection on ICT in education (80 by the year 2013), data are still missing for many developing countries, particularly in Africa, Asia and Oceania. Moreover, demonstrating progress is further complicated by a lack of time series data for the majority of countries to permit reliable measurement. However, the situation should improve since UIS is currently conducting statistical capacity-building activities in Africa to be followed by data collections, and is moving towards conducting a biennial global data collection on ICT for education beginning in 2015.

Nevertheless, it is possible to draw some conclusions related to the training of teachers and the provision of advanced forms of ICT-assisted instruction for both developed and developing countries. While an adequate pool of trained teachers is arguably required to effectively adapt curricula to meet the needs of the information society, guaranteeing an adequate supply remains a challenge confronting many developed and developing countries. Although developed countries typically have greater proportions of trained teachers than developing countries, most countries, regardless of economic position, have trained 10 per cent or fewer teachers to be ICT-qualified for delivering basic computer skills or computing courses. In contrast, the proportions of teachers trained to teach other subjects using ICT in the classroom varies widely. For instance, developed countries, which have a relatively strong policy environment regarding the integration of ICT in education as well as the essential school infrastructure, have relatively high proportions of trained teachers compared to many low income countries, particularly least developed countries (LDCs) where very few teachers are trained. Data for many countries in Asia, Africa and Oceania remain unavailable. In Europe where most teachers are trained at the tertiary level, data are also unavailable due to a lack of monitoring.

In a general sense, adapting curricula means modifying the ways that content is presented and delivered. It means adjusting curricula to ensure that all ICT-mediated content is accessible to all students. Adapting curricula 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 computer-assisted instruction (CAI) and Internet-assisted instruction (IAI) in curriculum design means that more flexibility is required in order to be able to adjust to learners.

Building upon Target 2, which addresses school connectivity, the current target 7 reflects the importance of enabling schools to benefit from ICT. It focuses on teacher training as well as the use of advanced forms of ICT-assisted instruction. Increasingly reliant on ICT, schools are important for providing students with the essential skills needed to effectively succeed in the information society. Given the continued relevance of Target 7, it is recommended that it remain consistent during the post-2015 monitoring period. Nevertheless, some consideration to the indicators may be required.

The key limitation of the teacher training on ICT indicators is the variability existing in terms of how teachers are trained from country to country. Since each of these concepts will vary widely from a few days of in-service training to formal qualifications acquired in tertiary level preservice training programmes, these indicators may ultimately be more useful in terms of demonstrating a country's own progress to meet their own objectives to train teachers, than providing information on the relative capacity of teachers to instruct on the use of ICTs or to be able to use them in their general teaching of curricula. Despite this shortcoming, indicators 7.1, 'proportion of ICT-qualified teachers' and 7.2, 'proportion of teachers trained to teach subjects using ICT', should be retained in the post-2015 environment as they provide valuable information on the readiness of the teaching workforce to use ICT in the adaptation of curricula to meet the needs of the emerging information society. However, UIS should consider collecting additional metadata on teacher training, and/or using other available data to further contextualize the training of teachers relative to ICT in education.

Meanwhile, the key limitation of indicators 7.3, 'proportion of schools with CAI' and 7.4, 'proportion of schools with IAI', is the lack of information related to ICT usage, which is increasingly in strong demand from policy-makers. However, given the slow progress amongst many countries across Asia, the Americas, Africa and presumably Oceania[13] to implement CAI and IAI, and the relative availability of indicators 7.3 and 7.4, they should be retained in the post-2015 environment to measure achievement towards Target 7. Given the perceived disconnect between policy and practice in many countries, possible additional indicators to measure achievements against Target 7 could include disaggregated data for proportions of schools with CAI and IAI by school location. Collecting new indicators on proportions of schools with computers in classrooms versus schools with computers in laboratories and other locations provide some information on ICT usage and reflect the evolution of demand for information as countries move from a phase of building infrastructure for ICT in education (e-readiness) to more focused usage of different ICTs (e-intensity). Other possible additions would be participation indicators, the ‘proportion of pupils enrolled in programmes offering CAI and IAI, by sex’ since these provide proxies for usage of ICT in education and meet the measurements needs of other international frameworks that include objectives for eliminating gender gaps in access, participation and educational quality.

Specific recommendations to countries are:

- To adapt school curricula to meet the challenges of the information society, policies must go beyond mere capital investment in ICT-related infrastructure. It is imperative that initiatives also develop ICT skills amongst the teaching workforce, so that their knowledge and skills can be effectively transferred to students. While it is difficult to determine the ideal proportions of teachers that require training, national circumstances should inform objectives. For example, countries with greater levels of ICT integration in national curricula would require greater proportions of trained teachers than those that do not.
- In most developed and developing countries, just 1 to 10 per cent of teachers are trained to teach basic computer skills and computing (that is, ICT-qualified). Since courses in basic computer skills and more advanced courses in computing require teachers with specific ICT qualifications, countries need to ensure that they train an adequate number of teachers to effectively deliver these courses in all schools or as per curriculum (for example, primary versus secondary schools).
- Beyond basic computer skills and computing courses, ICT may play a role in the instruction of various other curricular subjects. Therefore, an adequate number of teachers should also be trained to teach subjects using ICT in order to adapt curriculum effectively to ICT-assisted instruction. Where ICT is widely integrated across all, or many, curricular subjects, teachers trained to teach subjects using ICT in the classroom may be more essential than ICT-qualified teachers.
- Where resources permit, countries should increase the number of devices per school and connect them to the Internet to ensure that a critical mass of ICT is available to provide sufficient access to computer-assisted and Internet-assisted instruction.
- Where resources permit, countries should allocate desktops, laptops tablets and other computer devices to classrooms, computer laboratories, libraries and other school locations in order to provide pupils with multiple access points.
- In order to firmly ground schools in the information society, countries could consider increasing access to online free and open-source software (FOSS) as well as other open educational resources (OER), in order to improve the quality of CAI and IAI, at relatively low cost,.
- Countries should recognise the role of community media centres (or similar) to play a role in extending the reach of computer-assisted and Internet-assisted instruction to pupils where ICT is not available in schools. This may involve negotiation of schedules and formation of partnerships with public and private entities (for example, Internet cafés).

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Endnotes

[1] UN list of least developed countries (LDCs): http://unctad.org/en/pages/aldc/Least%20Developed%20Countries/UN-list-of-Least-Developed-Countries.aspx.

[2] See Chapter 2 in this report.

[3] Source: OECD. 2011. PISA 2009 Results: Students on line: Digital Technologies and performance (Volume VI). Paris: OECD, Table VI.5.19, page 321.

[4] Data are available for 45 countries, including 29 OECD countries and 16 partner countries. Countries were selected to represent a combination of both developed and developing countries from different regions.

[5] Language of instruction refers to reading, writing and literature in the main language of instruction in schools, which may or may not be pupils' mother tongue.

[6] The scope of all the indicators is ISCED levels 1–3, that is, public and private schools from primary to upper secondary education unless otherwise stated. The International Standard Classification of Education (ISCED) is a classification system for education statistics. The data collected for this report refer to ISCED97 whereby ISCED 1, ISCED 2 and ISCED 3 refer to primary, lower secondary and upper secondary education levels, respectively.

[7] UIS defines teachers as persons employed full-time or part-time in an official capacity to guide and direct the learning experience of pupils and students, irrespective of their qualifications or the delivery mechanism, that is, face-to-face and/or at a distance. This definition excludes educational personnel who have no active teaching duties (for example, headmasters, headmistresses or principals who do not teach) or who work occasionally or in a voluntary capacity in educational institutions. Teacher numbers reflect total teacher headcounts, which include both full-time and part-time teachers.

[8] While the Lave and Wenger (1991) theoretical model for situated learning may have relevance for the data presented in Chart 7.1, it is impossible to state whether this model has been systematically applied in countries in relation to an overall teacher training strategy.

[9] Latest year available. Notes on reference years are under the chart.

[10] UIS is conducting a data collection across Africa during 2014–2015.

[11] For a fuller discussion of learner-to-computer ratios, please see Chapter 2.

[12] See http://e-education.brac.net.

[13] There are no current data for Indicators 7.3 and 7.4 from countries in Oceania.

ENSURE THAT ALL OF THE WORLD'S POPULATION HAS ACCESS TO TELEVISION AND RADIO SERVICES

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

Executive summary

Target 8 reflects the importance of providing the world's population with television and radio access. While analogue TV and radio are usually described as older media, they nevertheless remain very important for providing information to people in both developed and developing countries. Access to these traditional ICT services is still relevant in the information society as they can enhance the achievement of development goals such as education, preserving local heritage and the promotion of cultural diversity. In developed countries, television and radio broadcasters are using newer technologies, such as digital TV, to create better audience experiences. Developing countries are also adopting these technologies, although analogue TV and radio continue to play important roles in development – especially in remote and rural areas where access to new ICT services is limited. For citizens who lack literacy skills, TV and radio serve as important sources of news and information. For these and other reasons, tracking access to all radio and TV services remains an important task, especially for developing countries.

Target 8 is tracked using three indicators. The first two indicators – proportion of households with access to radio and television (respectively) – show that, while the target has not been universally achieved, access levels are reasonably high in developing countries and can be considered as achieved in developed countries (that is, households that want these services have access to them). Of developing countries with available data, most have at least 50 per cent of households with access to radio. About 72 per cent of households in developing countries had a television at the end of 2012, though this target remains largely unmet in Africa, with only 42 per cent of households having television. The target for television access is also unmet in least developed countries (LDCs), with only 35 per cent of households having a TV in 2012.

The third indicator for Target 8 tracks access to multichannel television services. Adoption of multichannel television has been growing rapidly and a little over half of the world's households (or 71 per cent of households with television) had access to one or more multichannel services by the end of 2012. The switch-over to digital television is the most far-reaching development in multichannel television in recent years. Given the increasing demand for limited radio-frequency resources, digital transition is a critical issue for policy-makers, regulators, broadcasters and other stakeholders (ITU, 2010a). Most developed countries have completed, or are on track to complete, the transition to digital television, while developing countries have begun, or are committed to, the transition (ITU, 2013a). As the digital switch-over will be of major policy concern in developing countries in the near future, an additional indicator tracking digital transition could be considered.

The benefits of other multichannel television technologies are more likely to be gained by developed countries and affluent households in developing countries. However, multichannel television does offer opportunities for the less affluent. Compared to terrestrial broadcasting, satellite TV is a cost-effective way to improve coverage for communities currently without television access.

Should there be a post-WSIS target related to broadcasting, it is recommended that indicators 8.1 and 8.2 be retained,[1] as developing countries still have considerable room for progress towards Target 8. Monitoring Indicator 8.3 should also be continued in order to provide insights into the role of different TV-distribution technologies in providing TV services to the world's population. New areas of measurement are suggested to move from the demand focus of the current indicators to the supply of radio and TV services (in terms of the availability and quality of content). The *Media development indicators framework* (UNESCO, 2010) and pilot study could serve as the groundwork for such new indicators.

Finally, this report offers some recommendations for increasing access to TV services:

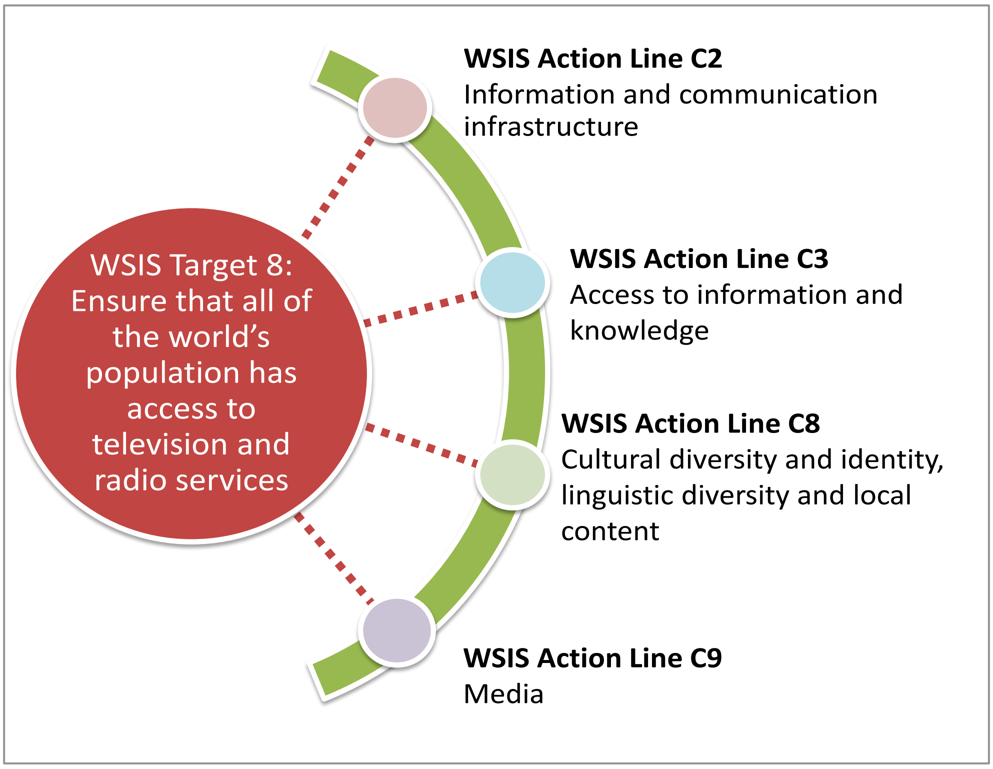
- Provide state assistance for low-income households in order to make TV sets and decoders more affordable and thus help increase household TV penetration.
- Increase the availability of relevant local content as this could also help boost household TV uptake. Appropriate tracking of the availability of content should be an important focus of Target 8 post-2015.
- Encourage more broadcasting stations and multichannel TV operators to offer services in order to increase content variety and competition.
- Countries with a low proportion of households with multichannel television could consider satellite technology as a cost-effective way of increasing coverage to remote and other unserved areas.
- Developing countries in the early stages of digital transition could learn from developed countries that have completed the digital transition.
- Countries with too small a market to justify a national multichannel TV system could take advantage of existing regional systems.

Introduction

Target 8 reflects the importance of providing television and radio access to the world's population. Television and radio, along with fixed telephony, have formed the trifecta of traditional ICT services in the home for several decades. While TV and radio are older media, they nevertheless remain very important for providing information to people in both developed and developing countries. Even with the rapid adoption of new ICTs, such as the Internet, TV and radio have stayed relevant to their audiences. Programmes can now be delivered via a range of devices and platforms, in addition to traditional analogue stand-alone radio and TV sets. In developing countries, TV and radio continue to play important roles in development – especially in remote and rural areas, where access to new ICT services may be limited. In times of crises and emergencies, TV and radio play the critical role of conveying vital information to citizens. They also provide information, allow citizens to express national identity, act as vehicles for domestic content and fulfil educational purposes (*Partnership*, 2011). For citizens who lack literacy skills, TV and radio serve as important sources of news and information.

Target 8 is related to WSIS action lines C2, C3, C8 and C9 (see Figure 8.1). Given that Target 8 focuses on television and radio services, its relation to WSIS action lines primarily concerns broadcast infrastructure, media and content.

Figure 8.1: Relevance of Target 8 to WSIS action lines



Target 8 is relevant to Action Line C2 (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 that concern the availability of adequate and affordable ICT equipment, given that radio and TV sets are needed in order to use broadcasting services. Action Line C2 calls, moreover, for encouraging and promoting traditional media.

Target 8 is also relevant to Action Line C3 (Access to information and knowledge). This action line explicitly mentions the Internet, but newer TV transmission technologies such as digital terrestrial TV (DTT) can also significantly increase access to information and knowledge. DTT is not yet deployed in most developing countries, but there is little doubt that it will play a central role in fulfilling some of the public services related to communications. Indeed, broadcasting technologies, both traditional and new, are important for disseminating information and knowledge almost instantaneously – especially for people who are illiterate or have limited access to new media.

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." (ITU, 2010b). Broadcasting is arguably better placed than newer media to fulfil these roles, in view of the still wider availability of broadcast devices in developing countries compared to devices required for Internet access.

Broadcasting is referred to in WSIS Action Line C9 (Media). This action line recognizes that the media have an essential role in the development of the information society and are important contributors to freedom of expression and plurality of information. One of the elements of Action Line C9 is to "Encourage traditional media to bridge the knowledge divide and to facilitate the flow of cultural content, particularly in rural areas." (ITU, 2010b). Traditional media are essential for promoting linguistic diversity and cultural identity, given their relatively high prevalence. In order to take full advantage of the media, it is important to "Encourage the development of domestic legislation that guarantees the independence and diversity of the media" and "Reduce international imbalances affecting the media, particularly as regards infrastructure, technical resources and the development of human skills ..." (*Geneva Plan of Action*, ITU, 2005).

TV and radio are particularly important where other information sources, such as newspapers and the Internet, are not widely accessible. For some rural and remote communities, broadcasts by community radio stations are sometimes their only means of accessing news and locally-relevant content. Community radio also has a special place in programmes of the Communication and Information Sector at UNESCO[2] and is often set up to address crucial social issues at a community level (such as poverty and social exclusion), to empower marginalized rural groups and to catalyse democratic processes and development efforts. Box 8.1 looks at community radio and its role in development for marginalized communities.

Box 8.1: Community radio and development

Community radio has played an important development role for vulnerable communities in the past two decades. Involvement with community radio can occur in two directions: (1) pushing information to the community and (2) bringing together residents. In the first function, community radio delivers locally-relevant content to its listeners. In rural and remote regions, community radio can share timely and relevant information on development issues, opportunities, experiences, life skills and public interests (Da Costa, 2013). In the second function, community leaders use the platform to engage other locals in communal activities. Community radio gives citizens the means to make their views known on decisions that concern them and allows them to express and enrich their identities (Myers, 2011). Consequently, some advocates of community radio have attributed the medium with the ability to democratize and empower the marginalized (Conrad, 2011). The following list illustrates the role that community radio plays in four different areas – new technology, public services, food security and human rights:

Introducing new technology. In the early 2000s, community radio was recognized as an important catalyst for rural communities to be introduced to the Internet. UNESCO's *Radio browsing the Internet* program allowed community broadcasters to discuss website information in the local language and adapt the information to local interests.[3] Listeners can request information on specific topics, such as market trends, agriculture, health or life skills for poverty alleviation. The broadcasters search the web for the requested information and put the results on air. They can also arrange for online discussions between health workers, agricultural extension workers or other individuals with technical experts to discuss a particular problem and broadcast the results.

Improving public services. Community radio can act as a rallying point for community projects to improve public services, such as the provision of electricity, building of a community school or neighbourhood clean-up efforts. For example, in Budikote, India, broken pipes for the village water supply were promptly mended by the local authorities when Namma Dhwani Community Media Centre radio recorded and aired the complaints of local women.[4]

Enhancing food security. Community radio can enhance food security in farming communities by disseminating information about new agricultural practices. Research conducted by the African Farm Radio Research Initiative (AFRRI) in five African countries found that farmers who listened more frequently to radio programs had better knowledge of agricultural improvement practices and were more likely to adopt the promoted practices.

Campaigning for human rights. Another impact of community radio is its ability to campaign for human rights in its various forms. For instance, in South Africa, Soweto's Jozi FM has been involved with the Gay and Lesbian Organisation (GLO) over the years to put gay and lesbian rights issues in the public domain. The collaboration has helped GLO to dispel some of the homophobic stereotypes and myths prevalent in society at large and has provided a platform for gays and lesbians to discuss their own rights. In Nepal, the Supreme Court of Nepal ruled in 2003 that the state should provide free education to people with disabilities, but many disabled people did not know their rights. Radio Swargadwari raised the issue frequently, informing and educating the disabled about these rights and also campaigning for local districts that were neglecting their responsibility.

While community radio can give local voices access to media and provide an alternative to mainstream broadcasters, the medium has developed at different paces in different countries. Political considerations, it seems, are major factors governing the development of community radio. Some governments have a more open attitude towards community radio, while others have been more restrictive. New ICTs also challenge community radio stations to stay relevant and rethink how to run programming in the new media landscape.

Source: ITU research.

Availability of data and scope

The purpose of Target 8 is to track access to television and radio services. The term "access" can be interpreted in a number of ways – from signal coverage, to device availability to actual use. Current satellite technology provides coverage to the whole world so theoretically, access to TV and radio signals is complete. However, it is more useful to know the extent to which the world's population makes use of devices to receive the broadcasting signal. In service to this goal, the Partnership on Measuring ICT for Development (*Partnership*, 2011) proposed three indicators for Target 8:

Indicator 8.1: Proportion of households with a radio

Indicator 8.2: Proportion of households with a television

Indicator 8.3: Proportion of households with multichannel television service, by type of service.

The indicators focus on households as the unit of measurement. This focus acknowledges that broadcasting is often a shared experience among family and friends. Furthermore, the existence of a broadcast receiver in a household suggests that different family members have access to it. The three indicators refer to household access to the relevant ICT equipment or service, not to use of those products by individual household members. Household data for indicators 8.1 to 8.3 are available through censuses and household surveys containing questions on access to TV and radio. Increasingly, the patterns of ICT ownership are shifting from shared access at home to individual access by various devices. The next section discusses the impact of these trends in terms of measuring Target 8.

Evolving definitions for Target 8

The current review of Target 8 was undertaken in a time of flux when the indicators were being updated to reflect changes in the ICT landscape. More than a decade has passed since 2003, when the WSIS targets were first established and ten years is a very long time in the ICT domain; just consider the phenomenal diffusion of mobile telephony between then and now. In terms of evaluating Target 8, Internet-enabled devices are redefining traditional notions of TV and radio and add complexity to measurement. At the first meeting[5] of the ITU Expert Group on ICT Household Indicators (EGH)[6] at São Paulo, Brazil in 2013, the EGH reviewed, among others, two core indicators on ICT household access pertaining to Target 8. The purpose of the revision is to keep up to date with the evolution of technologies and services.[7] The substantive revisions proposed to the relevant indicators are underlined:

HH1 – Proportion of households with a radio. A radio is defined as a device capable of receiving broadcast radio signals, using common frequencies, such as FM, AM, LW and SW. A radio may be a stand-alone device, or it may be integrated with another device, such as an alarm clock, an audio player, <u>a mobile telephone or a computer</u>.

HH2 – Proportion of households with a TV. A TV (television) is defined as a device capable of receiving broadcast television signals, using popular access means such as over-the-air, cable and satellite. A television set is typically a standalone device, <u>but it may also be integrated with another device, such as a computer or a mobile telephone</u>.

The revisions were endorsed at the 11th World Telecommunication/ICT Indicators Symposium (WTIS)[8] and the final definitions were released in the 2014 *Manual for Measuring ICT Access and Use by Households and Individuals* (ITU, 2014). The definitions of radio and television generally applying for the current review are from *Partnership* (2010) and are:

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 and digital audio player (MP3 player) but excludes radios integrated with a mobile phone or in a computer.

> A TV (television) is a stand-alone 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.

Some countries do not comply with the *Partnership* definitions and may, for instance, apply a narrower definition of radio (for example, excluding radios integrated with all other devices). Consequently, data reported on households with a radio are not always comparable and penetration rates will depend on the definitions applied.

Although the definitions used in the current report exclude radio and TV functionality in computers and mobile phones, it is unlikely that the separation will be maintained post-2015. Many mobile phones now have a FM antenna that makes it possible to listen to radio. This is probably the most common case today of radio usage through mobile phones in developing countries. In developed countries, Internet-enabled electronic devices are allowing more audiences to stream radio and TV programs, but this use has yet to gain traction in developing countries, where mobile broadband uptake is limited. Radio and TV streaming through the Internet (for long periods) may consume considerable data (about 1 Mb per minute for medium quality voice), and are likely to be costly for audiences in both developed and developing countries. Given the trends in convergence of consumer devices, the 2013 revisions to HH1 and HH2 were necessary for measurement to keep pace with technological advances.

Ensuring that ICT definitions are updated is important for clarifying the objective of measurement. The 2010 definitions generally applying for this report focus more on stand-alone devices than the updated definitions. However, Target 8 does not cover the quality and availability of radio and TV programmes, which will be important considerations for the post-2015 agenda (this is discussed in greater detail in *Conclusions and recommendations*).

In addition to the basic TV and radio indicators, HH1 and HH2, in 2013, EGH discussed and agreed on a new indicator HH13 to measure the 'proportion of households with multichannel television, by type'.

Data on multichannel TV subscriptions are also collected from administrative sources by ITU. The World Telecommunication/ICT Indicators Symposium 2013, held in Mexico in December 2013, endorsed the proposal of the Expert Group on Telecommunication/ICT Indicators (EGTI) to review the definitions of the indicators on TV broadcasting, and to add the indicator 'TV broadcasting subscriptions' to the list of core indicators on ICT infrastructure and access of the *Partnership*.[9] The inclusion of HH13 in the *Partnership*'s core indicators will encourage countries to collect data on household access to multichannel TV from household surveys. Data should be broken down by the type of multichannel technology: cable TV, satellite (direct-to-home) TV, Internet-protocol TV and digital terrestrial TV. This information will contribute to better monitoring of access to multichannel TV services and thus complement the indicator on TV access.

Table 8.1 presents the data sources for measuring Target 8. Data for indicators 8.1 and 8.2 are collected by ITU annually. Radio and TV data are becoming scarcer because many developed countries have stopped tracking these indicators. Data for Indicator 8.3 were estimated based on administrative data collected by ITU on the number of multichannel TV subscriptions. The addition of the indicator 'proportion of households with multichannel television' to the *Partnership*'s list of core ICT indicators should make it possible to provide more accurate figures for Indicator 8.3 in the future.

Table 8.1: Data sources for indicators for measuring Target 8

Indicator		Partnership core indicator or data source		Data availability[10]
8.1	Proportion of households with a radio	HH1	Proportion of households with a radio	Country data are available for 24 countries for at least one year in the period 2008 to 2012
8.2	Proportion of households with a TV	HH2	Proportion of households with a TV	Country data are available for 78 countries for at least one year in the period 2008 to 2012. ITU estimates are available for an additional 24 countries.*
8.3	Proportion of households with multichannel television service, by type of service		Administrative data sources	Data are estimated for 140 countries based on ITU administrative indicators 'Terrestrial multichannel TV subscriptions' and 'Direct-to-home (DTH) satellite antenna subscriptions', as well as other administrative data sources.

Source: ITU.

Note: * Available data series show that the proportion of households with a TV changes very slowly over time, even in those regions with low TV penetration levels. It is therefore possible to estimate the current proportion of households with a TV without the need for complete country data for each year.

Achievements against Target 8

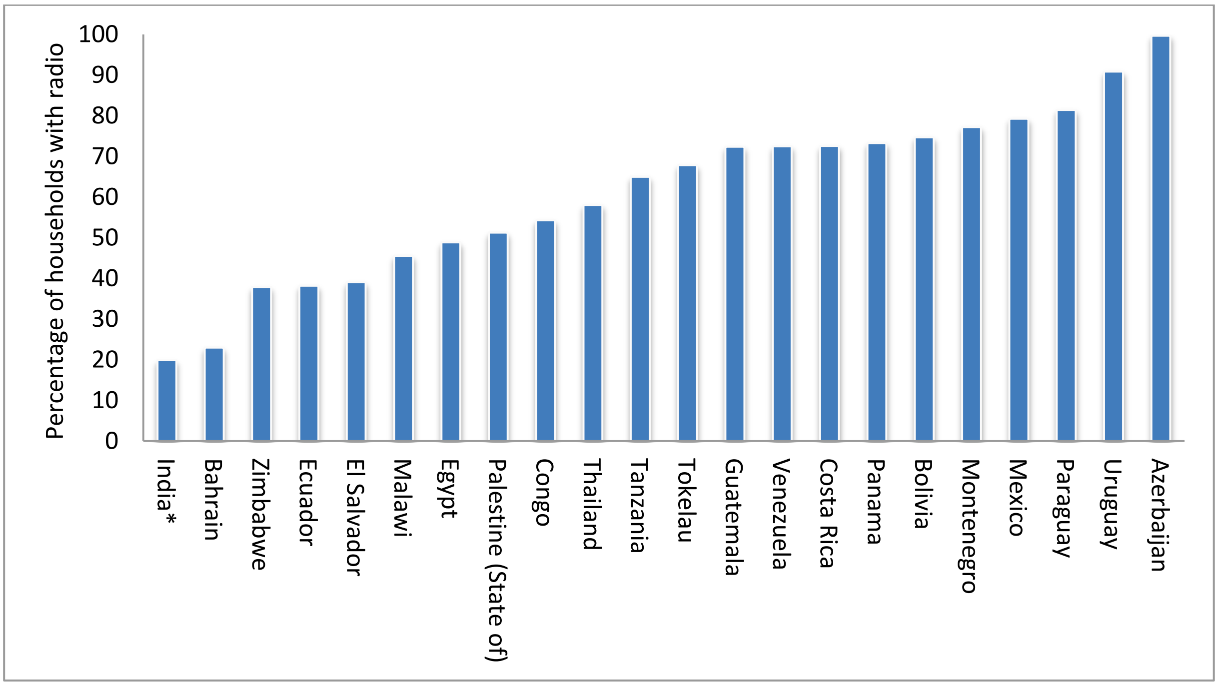
Current satellite technologies enable TV and radio signals to be received all around the globe and thus coverage of the world's population is complete. At the end of 2012, almost 80 per cent of households worldwide had a TV (ITU, 2013c), making the medium still one of the most pervasive ICTs among the world's population. Penetration across regions is not uniformly high; only two in five households in Africa had a TV at the end of 2012. Globally, household radio access has seen a decline in recent years that has coincided with the diffusion of new media. However, it remains relevant as a source of entertainment and as a means of disseminating information to mass audiences.

Households with a radio

This is measured by Indicator 8.1 and is *Partnership* core indicator HH1. It refers to radio access at home by in-scope households.

Household penetration levels are generally high but the target of "all of the world's population" has not been achieved. Data availability was low for this indicator, with only 22 countries having recent (and reasonably comparable) data. Of the countries with available data, 15 had household penetration rates of over 50 per cent (Chart 8.1). The majority of developed countries have either never compiled this statistic or have stopped compiling it because penetration levels are very high.

Chart 8.1: Households with radio, 2012 or 2011



Source: ITU World Telecommunication/ICT Indicators Database.

Note: * Refers to transistor radios only.

Table 8.2 shows the proportion of households with a radio from 2009–2012 for the small number of countries that provided multi-year data. In nearly all countries for which data are available, the proportion of households with a radio has decreased or remained about the same. The largest decline was in Egypt (a 28 percentage point decrease from 2009 to 2012), while Montenegro bucked the trend and reported an increase of 32 percentage points from 2009 to 2011. Overall, the data indicate a global trend of decreasing radio access.

In the 1990s, it was said that radio was the medium of the developing world: "In the developing world, radio is a conveniently cheap and portable medium ... It is also a conveniently oral medium wherever literacy is low" (Hendy, 2013). Radio "remains the world's most ubiquitous medium, certainly the one with the widest reach and greatest penetration" (Pease and Dennis, 1993). Just two decades later, one would only have to replace the instances where "radio" appeared above with "mobile phones" for a fairly accurate assessment of the state of ICT ownership in the world today. Mobile phones are the technology of the times but even though the radio has diminished in importance, it remains relevant to the achievement of developmental goals. As an example, in Benin, households with greater radio access understood the hazards of malaria better, and were more likely to invest their own resources on bed nets (Keefer and Khemani, 2012) and the education of their children (Keefer and Khemani, (2011).

The statistics that reflect the decline of radio in households need to be reconciled with the development potential of community radio programmes (discussed in boxes 8.1 and 8.2). While radio access may be declining in importance in developed and developing countries with higher GNI per capita, in other developing countries, the radio is still relevant to many countries because it is affordable and can be battery-operated. In the absence of electricity and the ability to afford more costly ICTs, radios remain the most accessible ICT medium for many rural populations. In fact, new ways of engaging rural radio audiences have been created with the increasing penetration of basic mobile phones. For instance, in rural Zambia and Malawi, the Centre for Development Informatics and the International Development Research Centre are combining local radio and basic mobile phones to promote engagement in climate change issues.[11] The project helps community radio stations to deliver accurate and relevant information on topics such as deforestation, clean cook stoves and climate change. To enhance engagement and create a participatory media environment, text messages (SMS) are used to facilitate interaction between radio stations and listeners about the climate change programmes. Early results include pledges from local leaders to begin reforesting depleted forests. Box 8.2 describes how another community radio station in Zambia is helping to preserve traditions and create a sense of inclusion among the elderly.

Table 8.2: Households with a radio, 2009–2012

Country	2009	2010	2011	2012
	Percentage of households with a radio			
Azerbaijan	100	99	100	100
Bahrain	..	..	23	23
Bolivia	77	..	..	75
Brazil	86	86	..	..
Congo	62	58	54	..
Costa Rica	78	77	76	73
Ecuador	40	38	38	..
Egypt	77	69	55	49
El Salvador	43	43	42	39
Jamaica	86	85	..	..
Malawi	..	53	46	..
Mexico	83	83	81	79
Montenegro	45	..	77	..
Paraguay	83	82	85	81
Senegal	80	79	..	..
Thailand	58	66	58	..
United Arab Emirates	..	49	..	53
Uruguay	93	92	92	91

Source: ITU World Telecommunication/ICT Indicators Database.
Note: .. not available.

Box 8.2: Community radio and the preservation of culture

Macha is a rural chiefdom, based in Zambia's Southern Province. The environment is a typical resource-limited rural setting. Members live in scattered homesteads, with very little infrastructure and have a subsistence lifestyle. The local culture is governed through traditional structures, involving community leaders as chiefs, (senior) head men and others.

The idea for a community radio station in Macha was first conceived in 2003. The Government of the Republic of Zambia later granted a permit in 2005 and Vision Community Radio Macha received an official broadcast license in 2011. The radio signal currently reaches an area with a diameter of about 140 kilometres, covering at least four chiefdoms and reaching a potential 150 000 people.

One of the most popular programmes on Radio Macha is "Butonga Tutabusowi", which means "We do not have to forget Tonga traditions". The program is put together by village elders, who organized themselves to produce weekly broadcasts that last about half an hour each. Content focuses on culture and heritage in the local community. Aired programmes feature topics such as courting, marriage, funerals, bathing, rituals and clothing. Interactivity is achieved using very basic technology: one of the radio presenters would give his/her mobile phone number and read received SMS text messages on the air. The messages contain inquiries or additional information and sometimes initiate debate.

The elderly people who are involved in the programmes mention that without the radio station it would not be possible to have their voices widely heard. They add that the radio programme "makes them feel included, part of the community, and part of the modern world". The radio has provided them with a unique and complementary platform to be able to share the rich knowledge that they possess. Their involvement in the community radio station has made them feel included in education and modern culture.

Source: van Stam and Mweetwa (2012).

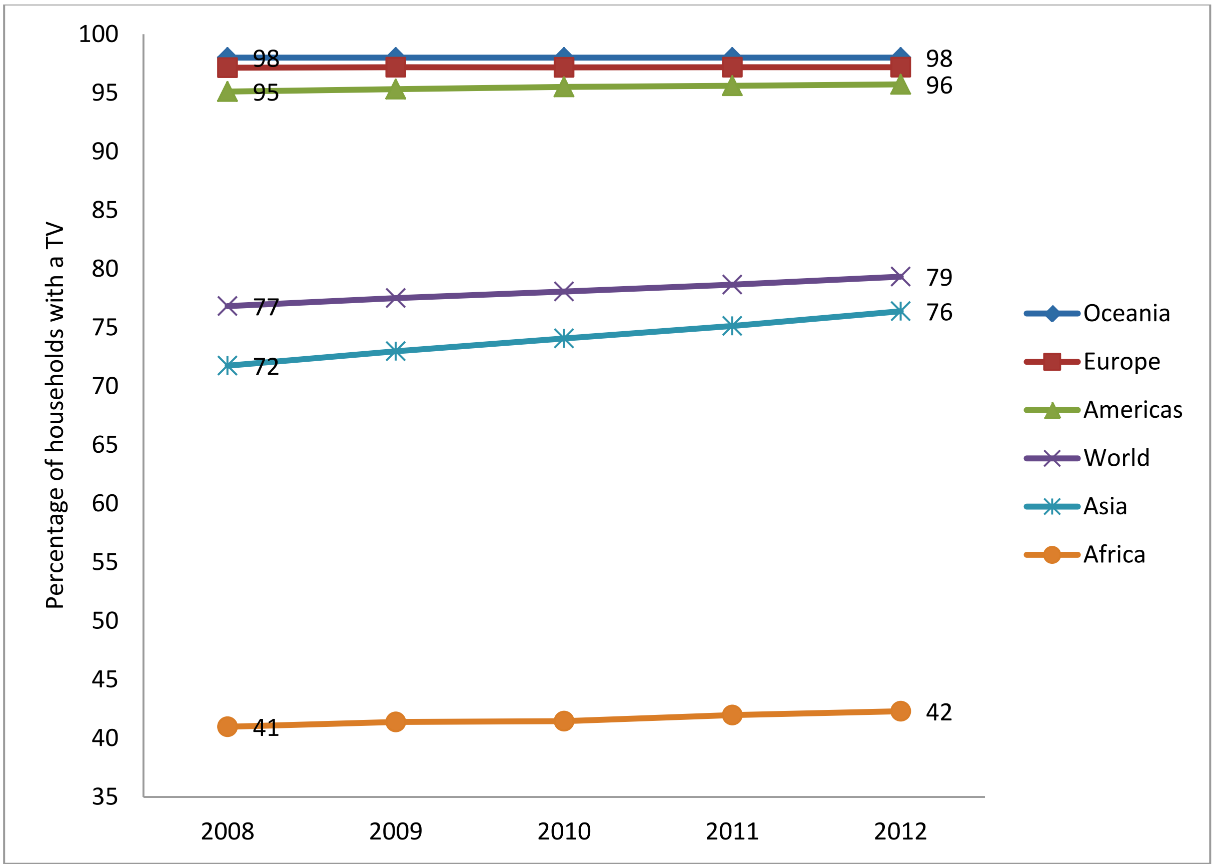
Available household level data suggest that broad access to radio has not been achieved, especially for developing countries. Developed countries have achieved the target and most do not track this indicator. Looking ahead, the definition of radio applying to Indicator 8.1 will become broader following the 2013 revision of HH1, with the inclusion of radios integrated with mobile telephones and computers. Monitoring access to radio services (as opposed to devices) is more complex. While household penetration of radio receivers is generally decreasing, this decline does not necessarily result in people being cut off from radio programmes. Radio content can be accessed from different devices and information can be acquired in alternative ways using mobile phones or web-browsing in Internet cafes. Given the relevance of radio in the development context, it is recommended that monitoring of access to radio services be continued post-2015 with the updated definitions. The scope of the indicator could be broadened to include the quality and availability of radio programmes in addition to tracking of radio equipment.

Households with a TV

This is measured by Indicator 8.2 and is *Partnership* core indicator HH2. It refers to television access at home by in-scope households. Data were estimated by ITU using survey data, with additional information provided by Digital TV Research.

Compared to radio data, TV data are more widely available. At the end of 2012, ITU estimated that there were 1.4 billion households with at least one TV set globally, corresponding to 79 per cent of all households. Household penetration rates are generally high, though there are few countries with 100 per cent access. While this target has not quite been achieved, steady progress has been made, with around 95 million new households acquiring a TV between 2008 and 2012 – outpacing global growth in the number of households during the same period (66 million). In contrast to the decline in the reach of radio reported for Indicator 8.1, TV reach is increasing. Chart 8.2 shows the proportion of households with a TV by region. Asia and Africa both trail the global average in household penetration of TV. At the end of 2012, Asia had a penetration rate of 76 per cent and in Africa, only 42 per cent of households had access to a TV.

Chart 8.2: Households with a TV, by region, 2008–2012



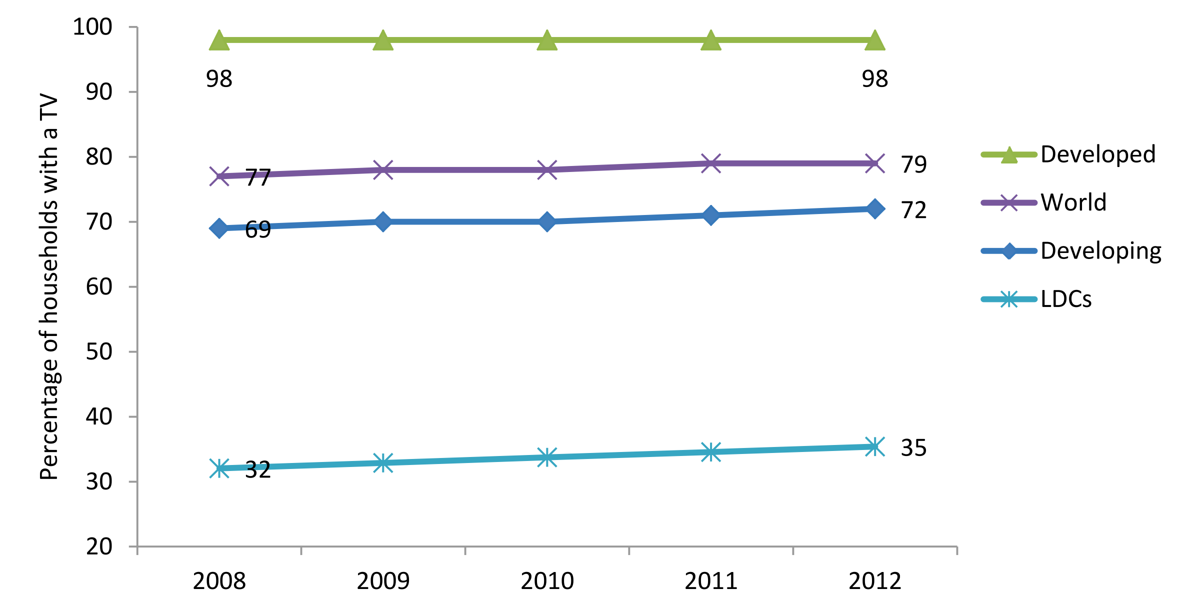
Source: Estimated based on Digital TV Research[12] and ITU World Telecommunication/ICT Indicators Database.

Notes:

1. Data cover 140 countries, accounting for 98 per cent of all households in the world.
2. Data for Oceania include only Australia and New Zealand.

Chart 8.3 shows the proportion of households with a TV, by level of development, from 2008 to 2012. The data show that developing countries are catching up with developed ones in terms of household access to TV. In developing countries, 69 per cent of households had a TV in 2008 and this increased to 72 per cent in 2012, representing an addition of 87 million households with a TV in the developing world. In the developed world, nearly all households had a TV by 2008 (98 per cent). This figure remained constant during the four-year period 2008 to 2012. However, a much lower proportion of households in least developed countries (LDCs) have access to TV, with 32 per cent of households having a TV in 2008 and 35 per cent in 2012.

Chart 8.3: Households with a TV, by level of development, 2008–2012



Source: Estimated based on Digital TV Research and ITU World Telecommunication/ICT Indicators Database.
Note: Data cover 140 countries, accounting for 98 per cent of all households in the world.

The stable TV reach in developed countries and growth in developing countries suggest that television remains an integral part of the information lives of people around the world. Alternative modes of accessing TV programmes are still not widespread. In 2013, only four per cent of households in European countries received their television programmes over the Internet (European Commission[13]). In France (13 per cent) and Sweden (11 per cent), at least one in ten households accessed television programmes over the Internet. These relatively low numbers suggest that accessing television programmes via the Internet has yet to gain traction, even in countries with a high penetration of both TV and broadband Internet. At least in the immediate future, the standalone TV will remain relevant in today's information society. Access to television opens up opportunities for information, entertainment and education. Box 8.3 describes Same Language Subtitling (SLS), a television-based innovation that is improving literacy in India. The innovation is the winner of the International Prize for Literacy (2013) from the Library of Congress (LOC, 2013).

Box 8.3: How television is improving literacy through same-language-subtitling

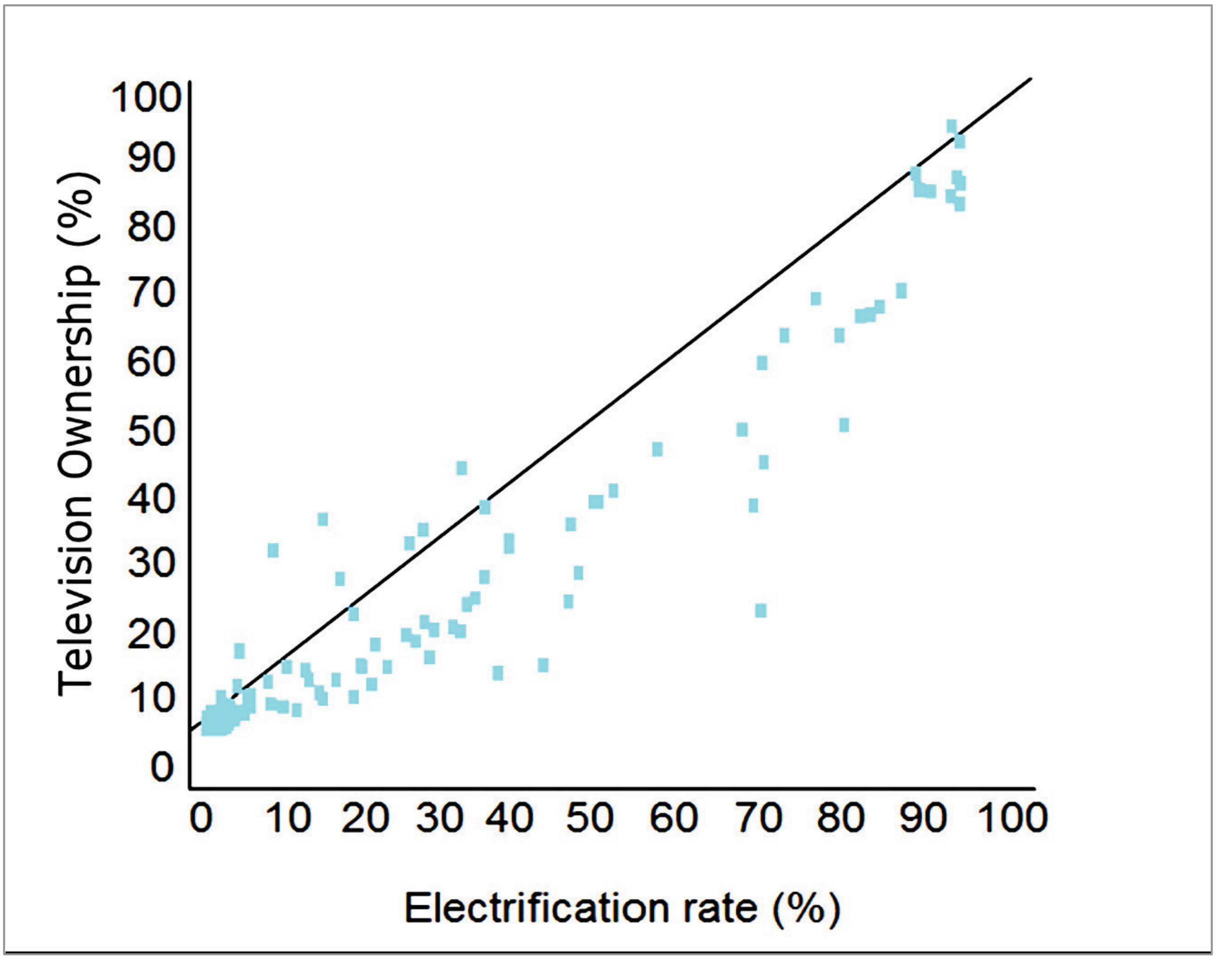
Same Language Subtitling (SLS) is the idea of subtitling the lyrics of television and video in the same language, providing viewers with both auditory and visual recognition of words to increase reading comprehension. SLS has been implemented on several popular Bollywood films' songs on Indian television in ten languages. The subtitles are designed to change the colour of every word in time with the song to provide reading practice to weak readers (USAID, 2013).

The innovation was first implemented on Indian national television in 1999 and reaches more than 200 million weak readers every week, in a country with 300 million weak readers. In a country that produces more than 1 000 movies and more than 5 000 music videos every year, SLS has great potential to improve literacy in a way that fits into peoples' media routines. In 2009, former US President Bill Clinton said "Same Language Subtitling doubles the number of functional readers among primary school children. A small thing that has a staggering impact on people's lives."

Source: Planet Read.

Despite television's potential to help achieve developmental goals, it is still out of reach of many households in developing countries. Around 349 million households in developing countries did not have a TV by the end of 2012 and therefore the total number of people who cannot watch TV at home is still fairly significant in the developing world (ITU, 2013c). In Africa, only 42 per cent of households had a TV by the end of 2012,[14] compared with 84 per cent in the rest of the world. Low household electrification is one of the main reasons for the relatively weak TV penetration in Africa. Fewer than 25 per cent of households in Sub-Saharan Africa have access to electricity (AFREA, 2012). Indeed, research from the World Bank indicates that lighting and TV account for at least 80 per cent of rural electricity consumption and thus the bulk of the benefits delivered by electrification (World Bank, 2011). Between 2008 and 2012, the African region experienced a one percentage point increase in households with TV but household penetration is expected to further increase as national electrification plans improve access to electricity. The relationship between TV ownership and the extent of household electrification is shown in Figure 8.2.

Figure 8.2: Electrification and television ownership in rural areas[15]



Source: World Bank.

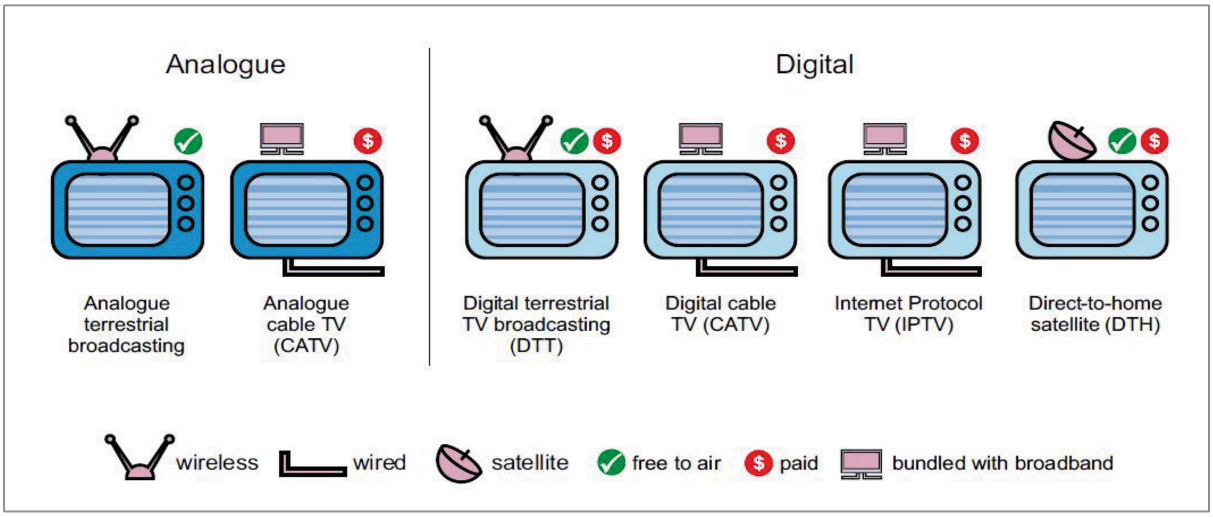
Households with multichannel TV access

This is measured by Indicator 8.3 and refers to multichannel television access at home by in-scope households. It excludes analogue terrestrial broadcasting. Data were estimated by ITU using subscription data. Additional information was provided by Digital TV Research. Multichannel television refers to services that provide additional TV programming beyond the free-to-air analogue terrestrial channels. Multichannel TV services include cable TV, direct-to-home satellite services, Internet-protocol TV and digital terrestrial TV. They may or may not be subscription-based, and may be analogue or digital. Multichannel television services are defined as follows in the 2011 WSIS statistical framework (*Partnership*, 2011):

- cable television (CATV) – multichannel programming delivered over a coaxial cable for viewing on television sets
- direct-to-home (DTH) satellite – received via a satellite dish capable of receiving satellite television broadcasts
- Internet-protocol (IPTV) – multimedia services such as television/video/audio/text/graphics/data delivered over an IP-based network managed to support the required level of quality of service, quality of experience, security, interactivity and reliability, it does not include video accessed over the public Internet, for example, by streaming. IPTV services are also generally aimed at viewing over a television set rather than a personal computer
- digital terrestrial television (DTT) – the technological evolution from analogue terrestrial television, which broadcasts land-based (terrestrial) signals.

Figure 8.3 shows the main TV-distribution technologies described above (ITU, 2013c). As shown in the figure, CATV can be analogue or digital. Terrestrial TV is transmitted with radio waves and does not involve extensive cabling or satellites. Terrestrial TV signals can also be analogue or digital. Indicator 8.3 focuses on multichannel television, which includes all the different TV-distribution technologies below except for analogue terrestrial broadcasting.

Figure 8.3: Main TV-distribution technologies



Source: ITU (2013c).

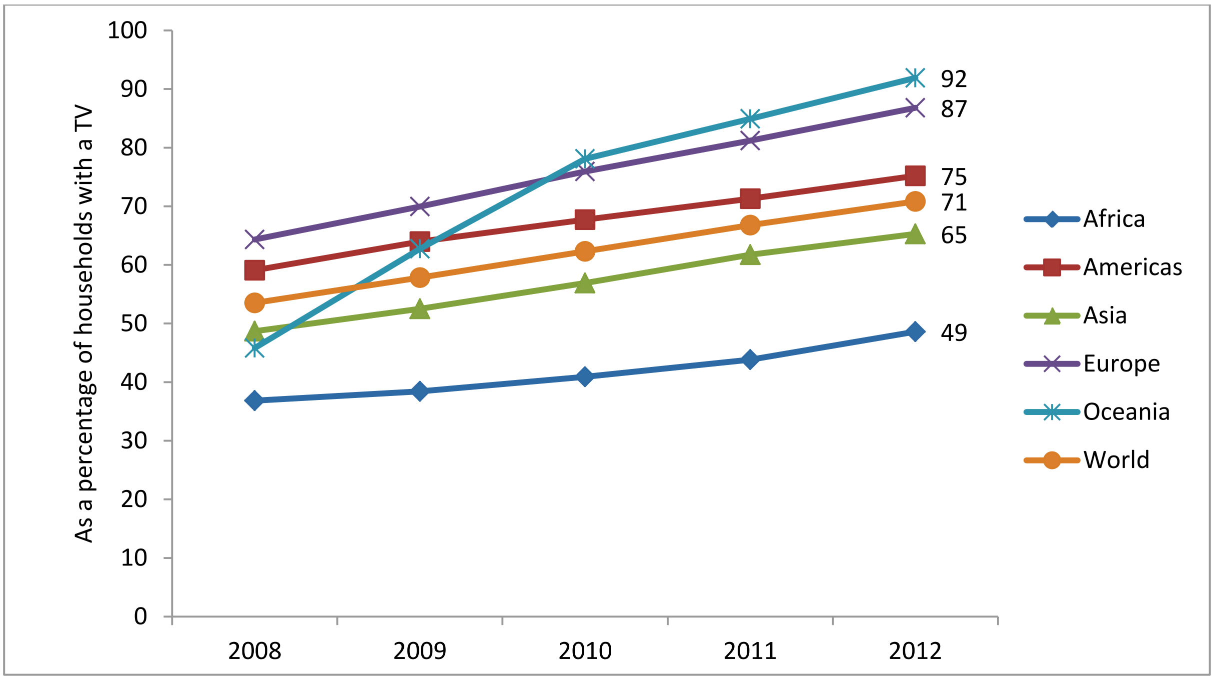
Indicator 8.3 is split into two parts:

- Proportion of households with access to any multichannel television service
- Proportion of households with access to multichannel television, by type of service/s.

Data for Indicator 8.3 are adapted from *Measuring the Information Society 2013* (ITU, 2013c). Estimates were based on Digital TV Research and ITU data. Data cover 140 countries, accounting for 98 per cent of all households in the world. Of total households in the world, 56 per cent had access to multichannel television service by the end of 2012. Of households with a TV, 71 per cent had access to multichannel television by the end of 2012. Chart 8.4 shows households with multichannel television service by region from 2008 to 2012.[16] The total proportion of households with TV that also had access to multichannel TV increased from 54 per cent to 71 per cent between 2008 and

2012. The increase was most significant in Oceania (Australia and New Zealand, for the purposes of this report). The number of households in Oceania with access to multichannel TV doubled from 2008 to 2012, mostly due to the DTT transition. By 2012, nearly half of households in Africa that had a TV set also had access to multichannel TV.

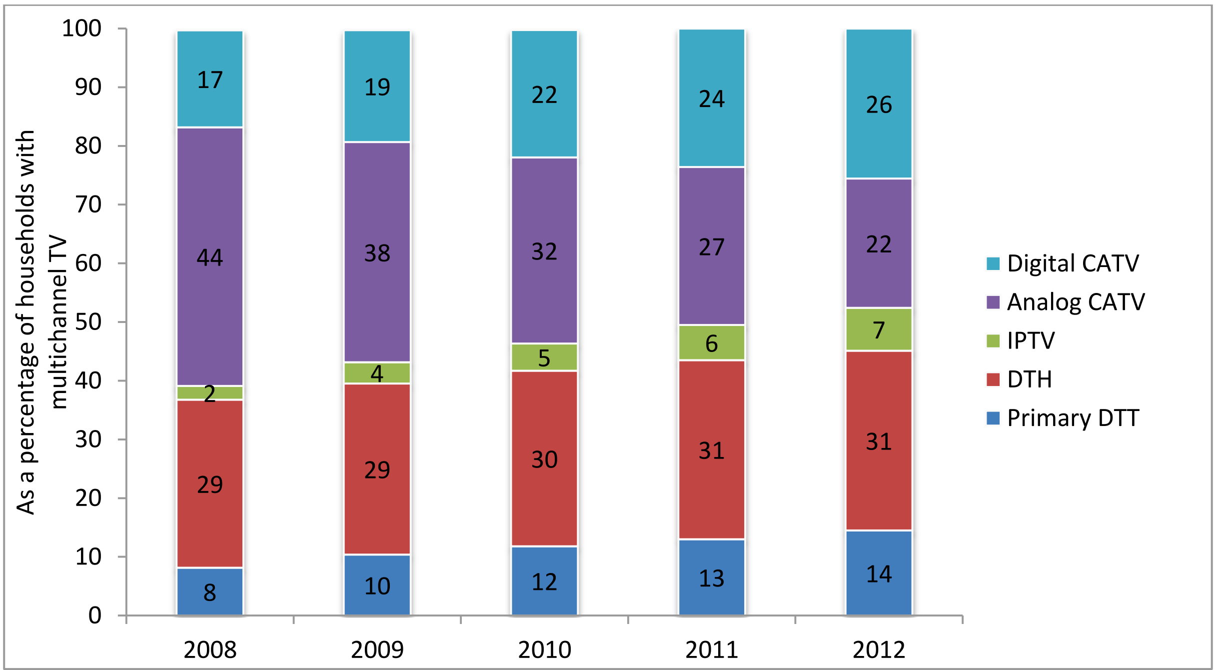
Chart 8.4: Households with multichannel television, by region, 2008–2012



Source: Estimated based on Digital TV Research and ITU World Telecommunication/ICT Indicators Database.
Note: Data cover 140 countries, accounting for 98 per cent of all households in the world.

In terms of access to multichannel television by type of service,[17] 48 per cent of households with multichannel TV had CATV (26 per cent had digital CATV), 31 per cent had DTH, 7 per cent had IPTV and 14 per cent received DTT as their primary means of television access.[16] Chart 8.5 shows the proportion of households with multichannel TV, by technology from 2008 to 2012. Globally, the number of households with analogue CATV declined by 89 million (from 305 million in 2008 to 216 million in 2012), while the number of households with digital CATV increased by 137 million (from 114 million to 251 million in the same period). The numbers suggest that growth comes from households switching over from analogue to digital CATV as well as new households subscribing to digital CATV.

Chart 8.5: Households with multichannel TV, by technology, 2008–2012



Source: Estimated based on Digital TV Research and ITU World Telecommunication/ICT Indicators Database.

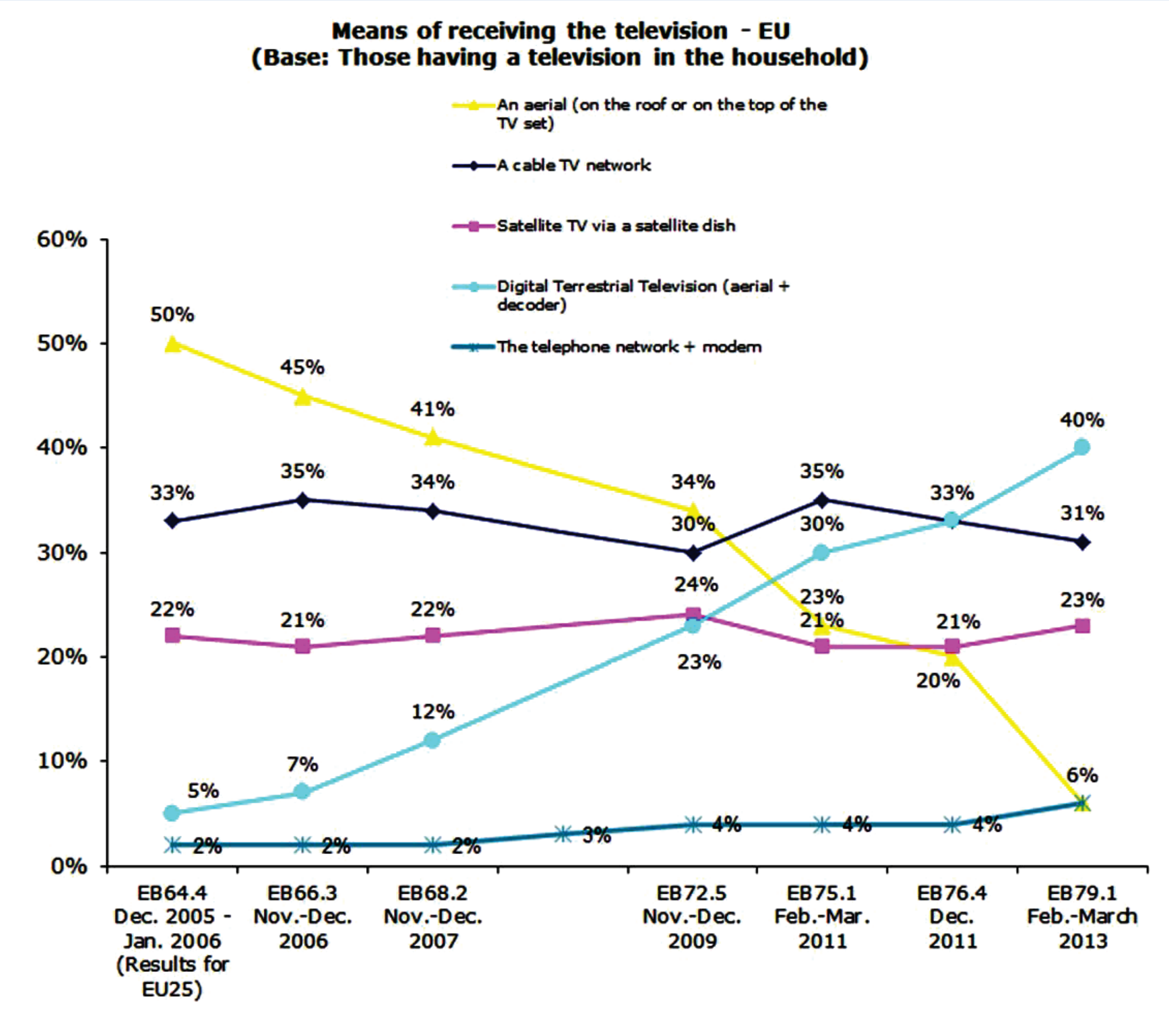
Note: Data cover 140 countries, accounting for 98 per cent of all households in the world

Box 8.4 shows the means of receiving TV for countries in Europe from 2006 to 2013, based on *Eurobarometer* (European Commission, 2013). In these more mature markets, subscriptions for CATV and DTH are reasonably stable. The growth reported earlier is mainly fuelled by developing countries, as discussed later in this chapter.

Box 8.4: Means of receiving TV in the European Union, 2006–2013

Chart Box 8.4 shows the means of receiving television in the EU based on data from Eurobarometer from 2006 to 2013. Over this period, Cable TV's household penetration[18] has been relatively stable and ranged from 30–35 per cent. Satellite TV's household penetration has also been stable at an average of 20 per cent. In addition, the statistics clearly show the inverse relationship between analogue and digital TV penetration. As household penetration of analogue TV ("aerial" in the figure) fell from 50 to 6 per cent, the household penetration of digital TV increased from 5 to 40 per cent. The trend is a direct consequence of the switch over from analogue to digital TV signals in recent years. Nearly all European countries have switched over to digital TV signals and stopped transmitting analogue terrestrial signals by 2013. Bulgaria terminated its signal on September 30, 2013 and Hungary terminated its signal on October 31, 2013.

Chart Box 8.4: Means of receiving television in the EU



Source: Eurobarometer.

Note: "telephone network + modem" refers to television services that are delivered through the telephone network and decoders. TV via the Internet is monitored separately.

Cable television (CATV)

Of total households with multichannel TV, nearly half (48 per cent) had a CATV subscription at the end of 2012. This translates to 467 million households, up from 420 million at the end of 2008. Since the mid-term review in 2010 (ITU, 2010b), CATV has remained the leading multichannel service around the world. China is currently the largest CATV market, with 175 million households and India is second, with 62 million households. By the end of 2012, 45 per cent of all households in China received cable TV and 27 per cent in India. CATV penetration was higher in several developed countries, such as Belgium (68 per cent), Canada (59 per cent), Luxembourg (68 per cent), Netherlands (65 per cent) and Switzerland (65 per cent). In general, CATV has remained strong in these developed countries, where CATV services are often included as part of household rent.

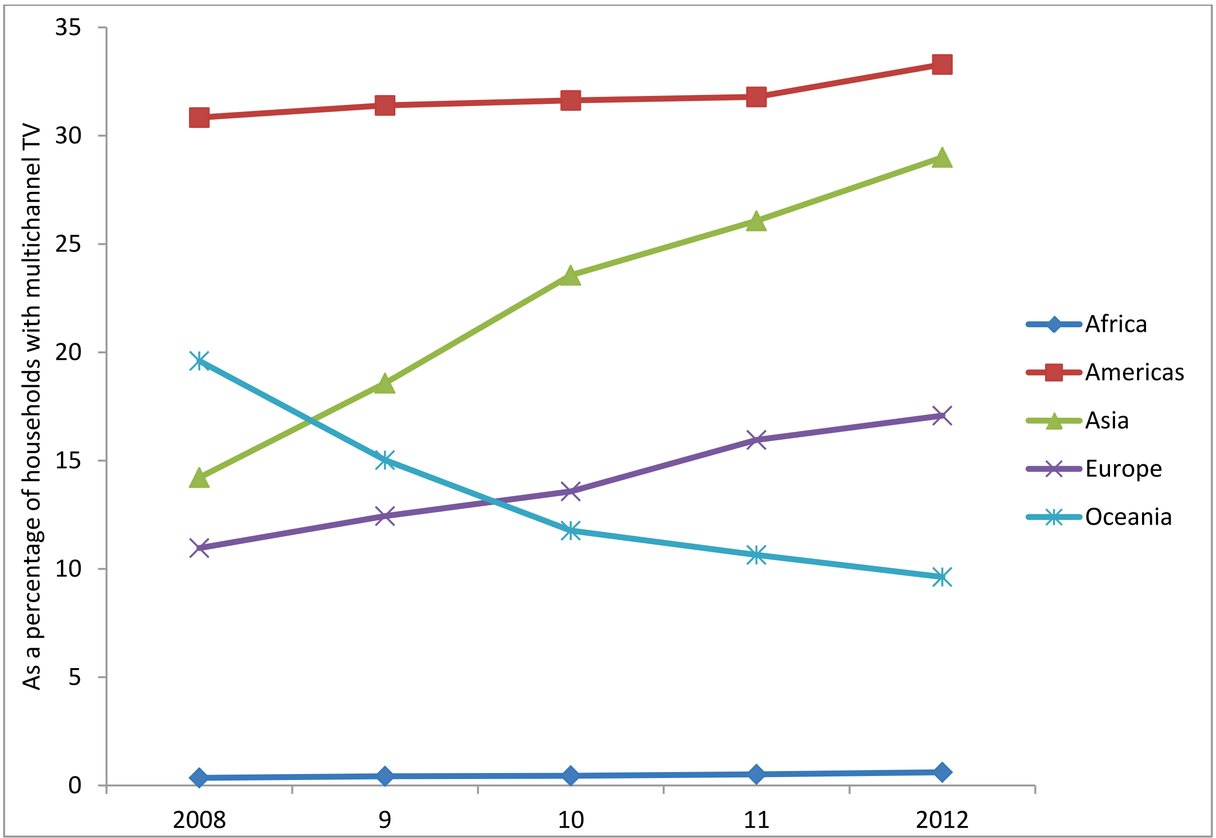
One caveat to the high penetration of CATV is that in some countries, the technology is used to retransmit terrestrial channels without adding new programming. In India, most cable subscribers are still on basic analogue cable networks that carry less programming. In countries such as the United States, CATV providers are required to retransmit public-service broadcasters under *must-carry* schemes (FCC, 2013) for reasons such as avoiding signal interference.

CATV is well developed in the Americas, Asia and Europe regions, but virtually non-existent in Western Asia (Arab States) and Africa. There is scarce incentive to invest in new cable television networks in Western Asia and Africa, given the high cost and the success of DTH satellite TV in those regions.

Digital cable TV

Of households with CATV, over half globally (251 million) had digital cable (26 per cent of households with multichannel TV). This was an increase from 114 million households in 2008 (17 per cent of households with multichannel TV). The most dynamic region in terms of digital cable uptake was Asia, where the percentage of households with multichannel TV that subscribed to digital cable doubled between 2008 and 2012 (see Chart 8.6). Europe also experienced strong growth, while the Americas retained first position as the region with the highest share of digital cable subscriptions in households with multichannel TV. The level of digital cable as a share of multichannel TV was negligible in the Africa region. A decline in Oceania (Australia and New Zealand) was most likely due to subscribers opting for other TV distribution technologies.

Chart 8.6: Households with digital CATV, by region, 2008–2012



Source: Estimated based on Digital TV Research and ITU World Telecommunication/ICT Indicators Database.
Note: Data cover 140 countries, accounting for 98 per cent of all households in the world.

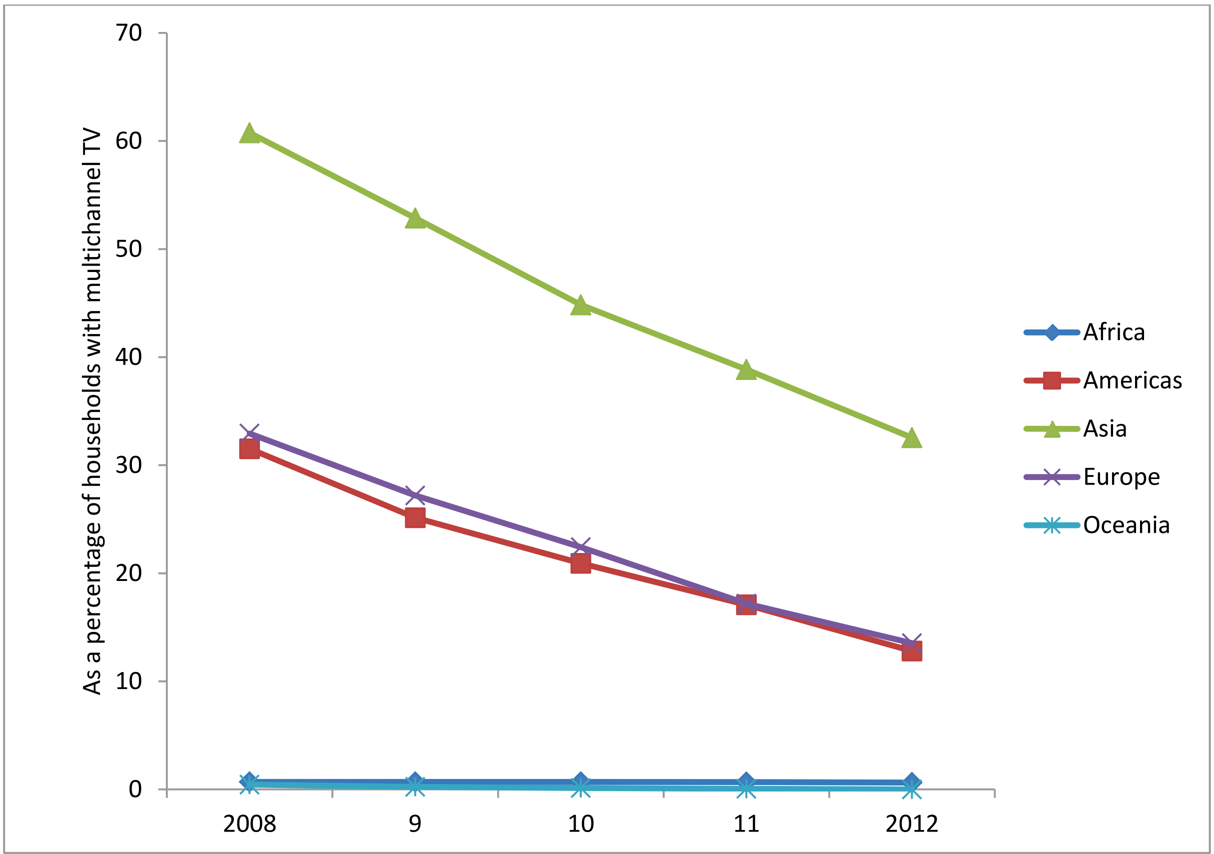
In terms of countries leading in digital cable TV subscriptions, China had an estimated 113 million digital cable TV subscriptions by the end of 2012, up by 18 million on the previous year and up by 77 million since 2008. China accounted for 45 per cent of the world's digital cable TV subscriptions by the end of 2012. In relative terms, more than half of all households received digital cable TV in Denmark (51 per cent), Finland (54 per cent), Luxembourg (51 per cent) and Malta (53 per cent).

In 2012, the global number of digital cable subscriptions overtook analogue cable total due to the strong digital CATV growth in Asian countries such as China and India, and a decline in analogue CATV subscriptions in developed countries (ITU, 2013c). The number of subscriptions to digital cable TV in developing countries overtook the developed countries' total in 2010. By the end of 2012, developing countries accounted for 57 per cent of the world total. Countries in the Asia region accounted for more than half the global digital CATV subscriptions by 2012.

Analogue cable TV

The number of analogue cable (CATV) subscriptions fell by 89 million between 2008 and 2012, because of the conversion of subscriptions to digital CATV. This translates to a 50 per cent decrease of household subscriptions to analogue CATV from 2008 to 2012 (from 44 per cent of households with multichannel TV in 2008 to 22 per cent in 2012). Chart 8.7 shows the proportion of multichannel TV households with analogue CATV, by region from 2008 to 2012. Although Asia advanced considerably in the conversion, there were still more analogue than digital CATV subscriptions in the region at the end of 2012 and Asia accounted for almost three-quarters of all analogue cable subscriptions. In China and India, cable switch-over to digital CATV remains a challenge and there were still 62 and 54 million homes (respectively) receiving analogue cable TV at the end of 2012 (ITU, 2013c).[19]

Chart 8.7: Households with analogue CATV, by region, 2008–2012



Source: Estimated based on Digital TV Research and ITU World Telecommunication/ICT Indicators Database.
Note: Data cover 140 countries, accounting for 98 per cent of all households in the world.

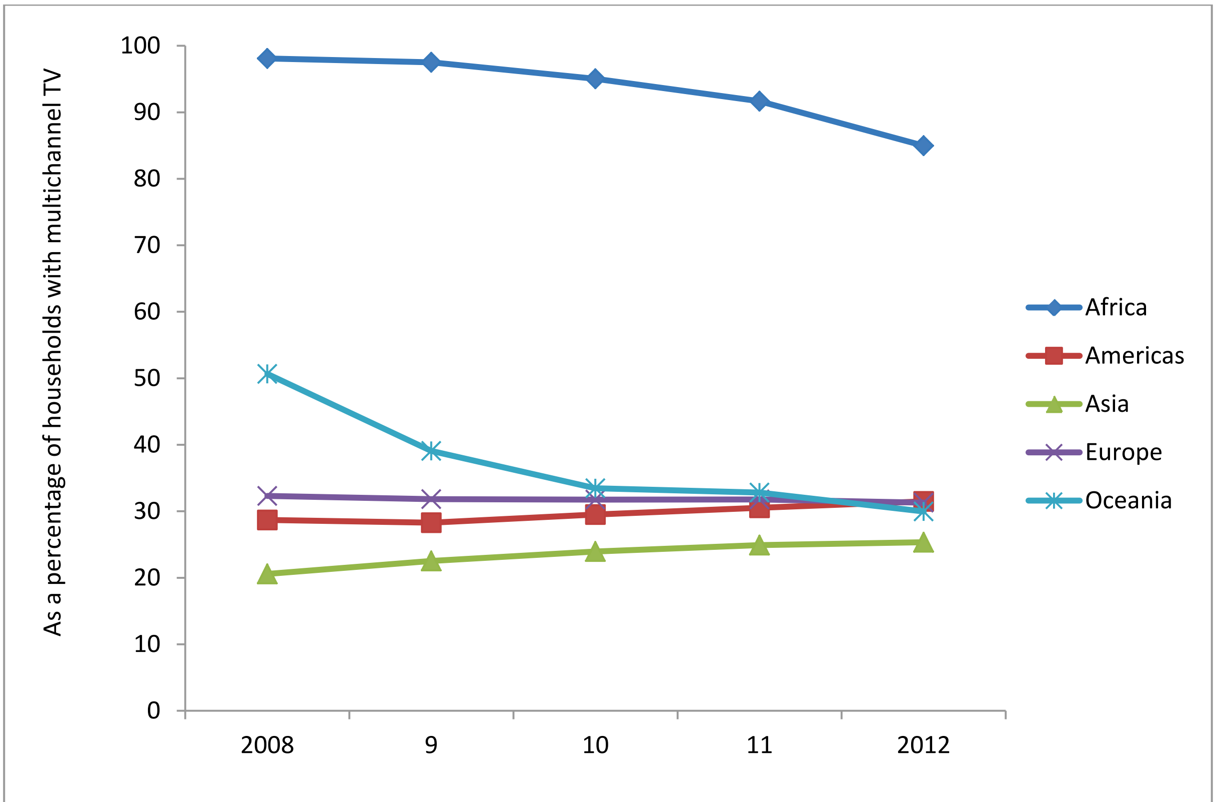
Monitoring the conversion from analogue to digital CATV is an important step in making sure that people have access to high quality TV services. Importantly, digital CATV networks can deliver broadband Internet and fixed telephony as well as TV services; operators can therefore compete directly with telecommunication operators. In countries where public policy permits such inter-modal competition, the availability of digital CATV should result in lower prices for consumers – as service providers will have to compete both within and between modes of TV distribution. For these reasons, monitoring of digital conversion, especially for developing countries, is recommended as a new indicator for Target 8 (this is also discussed in the later section on DTT).

Direct-to-home (DTH) satellite

Digital satellite broadcasting offers more channels, better quality and increased functionality compared to analogue cable. A major advantage of satellite TV over cable and IPTV is its low initial infrastructure costs relative to the large coverage it can achieve as soon as it starts operations. DTH satellite TV thus offers the possibility for both developing and developed countries to provide nationwide high-quality broadcasting. DTH can be used to reach remote areas that tend to have lower population densities, because it is faster to deploy DTH to cover a large area than to build a wired network. Pan-regional satellite services are developing across the world and may help to achieve economies of scale as well as channels for local content. DTH subscribers only need a satellite dish and a set-top box (the latter costing an estimated USD 50 for basic equipment to USD 300 for a box that can record HDTV signals) (Digital Landing, 2012).

DTH satellite broadcasting covers the world and is growing rapidly in popularity. By the end of 2012, 301 million homes (31 per cent of households with multichannel TV) watched TV via a satellite dish, up from 198 million at the end of 2008. The developing country total climbed to 164 million by the end of 2012, 80 million up on the total at the end of 2008. Chart 8.8 shows households with DTH satellite TV, by region, from 2008 to 2012. In Africa, the share of multichannel TV households with DTH fell from 98 per cent in 2008 to 85 per cent in 2012. This decrease was mainly due to the increase in the share of DTT-only households. In absolute terms, this was an increase of nearly 8 million (from just under 27 million households in 2008 to just over 34 million households in 2012).

Chart 8.8: Households with DTH satellite TV, by region, 2008–2012



Source: Estimated based on Digital TV Research and ITU World Telecommunication/ICT Indicators Database.
Note: Data cover 140 countries, accounting for 98 per cent of all households in the world.

The overall increasing importance of DTH satellite TV is noteworthy: in all regions the number of households subscribing to DTH satellite TV grew between 2008 and 2012. Growth was most significant in the Americas, where the total number of households with DTH satellite TV grew from 44 million to 65 million (31 per cent of households with multichannel TV). Satellite TV is playing a pivotal role in delivering TV services in Africa and will continue to fill the TV coverage gap in Africa. In South Africa, for instance, 50 of the 55 television channels were transmitted by satellite only in 2011 (UIS, 2013). When satellite-TV platforms were first launched, many observers believed that uptake would be restricted to rural areas outside the coverage of the fixed terrestrial networks. However, because it often provides hundreds of channels, satellite TV appealed to city dwellers too, especially because cable networks were slow to convert to digital. Free-to-air satellite television (such as Freesat in the United Kingdom and Tivusat in Italy) has been utilized by several governments to ensure that every home (including those in remote areas not covered by the digital terrestrial TV network) can receive digital television signals (ITU, 2013c). This is one strategy that could be pursued by countries in Africa to provide access to TV services for their population.

The technology is particularly important in India, the satellite-TV world leader at the end of 2012, with 42 million homes receiving satellite-TV signals (or 40 per cent households with multichannel TV). The United States followed with 37 million, corresponding to 30 per cent of all households with multichannel TV. In the Western Asia and Northern Africa sub-regions (Algeria, Bahrain,[20] Jordan, Kuwait, Morocco, Saudi Arabia and Tunisia), penetration of DTH satellite TV was more than 80 per cent of households with multichannel TV by the end of 2012. This is likely to be a result of the relatively low coverage of alternative multichannel platforms (DTT, CATV and IPTV) and the large number of channels offered through free-to air satellite transmissions (ITU, 2012). The high penetration contrasts with 31 per cent of households with multichannel TV in both Europe and the Americas. In Asia, analogue terrestrial broadcasting still has the highest household penetration followed by CATV. In India, DTH services were introduced in 2003 and operators were able to attract household subscriptions by adding value added services (VAS) and interactive services, including movies on demand, gaming and shopping.[21]

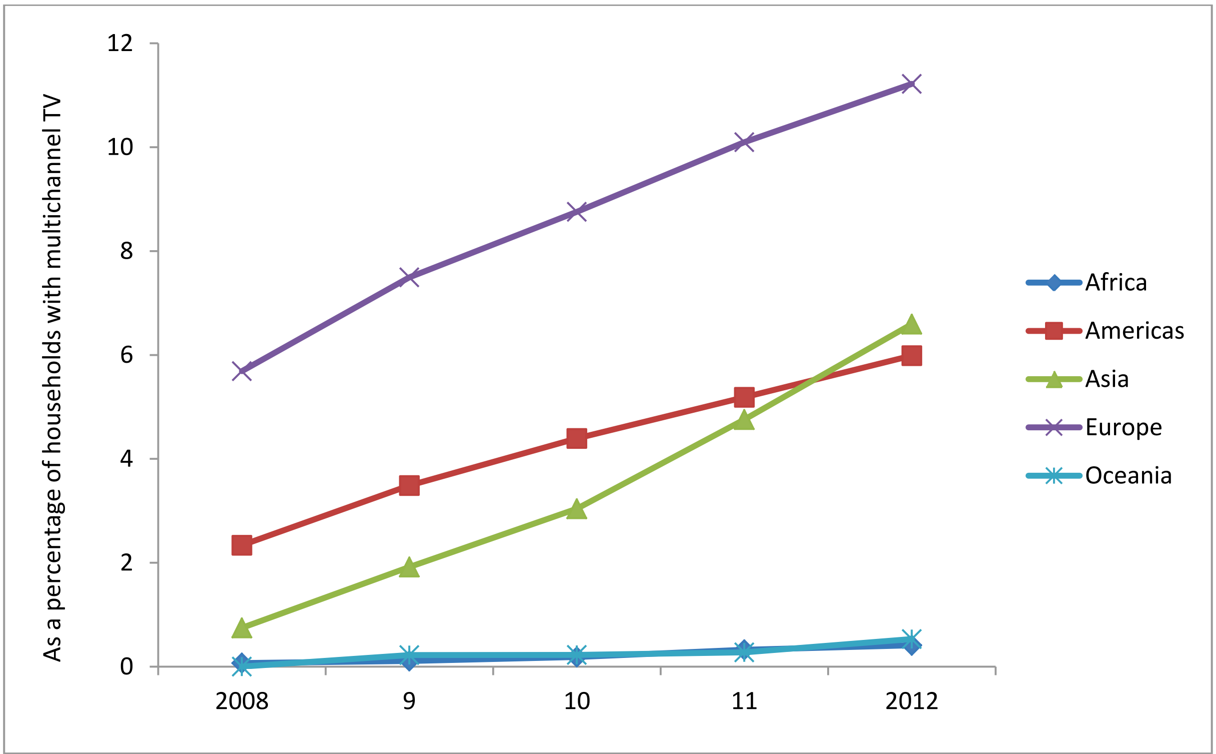
In terms of level of development, the most rapid growth of DTH has been in developing nations, where terrestrial channels are limited and cable TV is non-existent, or where cable systems are antiquated, with limited channels and features. In developing countries, the share of DTH among households with multichannel TV increased from 23 per cent in 2008 to 29 per cent in 2012. In developed countries, the share remained fairly stable from 35 per cent in 2008 to 33 per cent in 2012.

Internet-protocol TV

Internet-protocol TV (IPTV) is typically delivered over a high-speed fixed ADSL or fibre-optic connection and is provided by broadband operators, directly to consumers. IPTV is a managed service and is generally aimed at viewing over a television set, making the quality of experience comparable with that of other TV platforms (ITU, 2013c). Thus, IPTV is considered as a substitute for cable, satellite or terrestrial broadcasting TV. IPTV should not be confused with over-the-top (OTT) or online TV and video, which is delivered via the Internet.

Compared to the other TV distribution technologies, IPTV has the lowest share of households, only 5 per cent of total households with TV and 7 per cent of households with multichannel TV at the end of 2012. Global IPTV subscriptions reached 72 million by the end of 2012, up by 17 million from the previous year and more than four times the total recorded in 2008. IPTV penetration (as a percentage of total households with multichannel TV) in developed countries stood at 10 per cent by the end of 2012, compared with 4 per cent in 2008. In developing countries, 5 per cent of households with multichannel TV received IPTV by the end of 2012, up from 1 per cent at the end of 2008. Chart 8.9 shows households with IPTV, by region, from 2008 to 2012.

Chart 8.9: Households with IPTV, by region, 2008–2012



Source: Estimated based on Digital TV Research and ITU World Telecommunication/ICT Indicators Database.
Note: Data cover 140 countries, accounting for 98 per cent of all households in the world.

At the end of 2012, most IPTV subscriptions were in Europe (28 million), China (19 million) and the United States (11 million), altogether accounting for over three-quarters of the world's IPTV subscriptions. The percentage of households with a TV that subscribed to IPTV was almost 10 per cent in Europe in 2012. France was the leading country in Europe, with 12 million IPTV subscribers by the end of 2012. In relative terms, China, Hong Kong was the world leader by the end of 2012 in terms of IPTV subscriptions as a percentage of households with TV (48 per cent), ahead of France (47 per cent), Singapore (35 per cent), Slovenia (32 per cent) and the United Arab Emirates (30 per cent).

As noted in *Measuring the Information Society 2013* (ITU, 2013c), IPTV penetration has been limited thus far because of three factors: low broadband infrastructure, affordability of communication service packages and restrictive telecommunication policy. IPTV has had low penetration in countries that typically have low broadband infrastructure and a low number of fixed broadband subscriptions. In the European Union, high rates of fixed high-speed broadband penetration and the popularity of bundled ICT services are enabling factors for IPTV reception at home. In terms of affordability, many operators only provide IPTV services as part of a bundle, which requires a substantial economic commitment on the part of the subscriber and is thus beyond the means of a large proportion of the population in the developing world. In contrast, an estimated 45 per cent of households in Europe purchased a bundle of communication services from the same provider at the end of 2012, a two percentage point increase over December 2011. Households from Luxembourg (68 per cent), the Netherlands (66 per cent) and Slovenia (63 per cent) were most likely to have purchased a communication service bundle (European Commission, 2013). The third factor for the limited penetration of IPTV is that some countries do not allow telecommunication operators to enter the TV market through IPTV. This is changing with convergence, as the regulatory trend is to foster cross-competition between TV and telecommunication operators, including the authorization of IPTV services where they are still prohibited (ITU, 2013c).

Digital terrestrial television

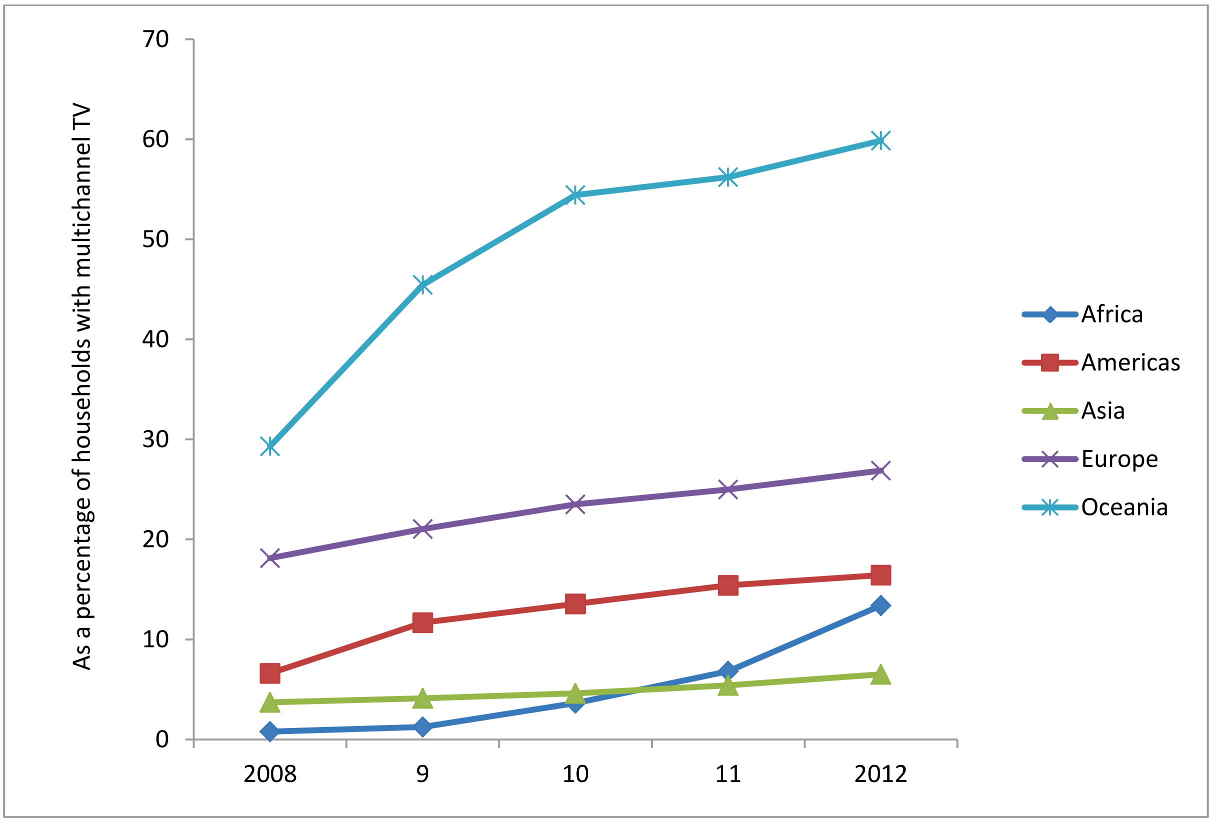
There are many advantages that digital terrestrial television (DTT) offers over analogue terrestrial television. DTT offers:

- a wider choice of programmes from a greater number of TV channels and radio stations
- improved flexibility of use due to better portable and mobile reception
- services that are more interactive
- the potential to contribute to serving the specific needs of the elderly or disabled by providing them with services such as better subtitling, audio commentaries or signing (Europa, 2006).

For many households, DTT is a low-cost investment, as the set-top boxes are relatively cheap and most of the channels on offer are free-to-air. Depending on the technology involved, most boxes retail at USD 15 to USD 60. Many governments have subsidized or given away set-top boxes for lower-income homes. In addition, most new sets are built with integrated DTT receivers, and in several developed countries this has become a legal requirement for authorized product manufacturers (DigiTAG, 2013). As a result, digital TV tuners are becoming more commonplace on all TV sets within a household – not just the main set.

DTT has experienced substantial growth over the last five years, as governments aim to meet the targets set nationally and internationally for the digital switch-over. Globally, there were 142 million households with only DTT[22] (10 per cent of households with TV; 14 per cent of households with multichannel TV) by the end of 2012, up by 24 million from a year earlier and 86 million from 2008. In contrast, the proportion of households with a TV receiving only analogue terrestrial TV broadcasts (not multichannel by definition) fell from 46 per cent in 2008 to 29 per cent in 2012. Chart 8.10 shows households with only DTT, by region, from 2008 to 2012.

Chart 8.10: Households with only DTT, by region, 2008–2012



Source: Estimated based on Digital TV Research and ITU World Telecommunication/ICT Indicators Database.
Note: Data cover 140 countries, accounting for 98 per cent of all households in the world.

As expected, growth in households with only DTT was strongest in regions with the highest rate of switch-over and modest in Africa and Asia where many countries have yet to make the switch. At the 2006 ITU Regional Radiocommunication Conference (RRC-06), 107 countries from Europe, Africa, Central Asia and the Middle East, as well as Iran (Islamic Republic of), adopted the GE06 Agreement[23] with a view to phase-in digital broadcasting. The switch-off began in 2006, with the Netherlands the first country to switch to digital-only broadcasting on December 11, 2006.[24] Another point of agreement was that analogue signals would no longer by protected from interference by digital signals in 2015. Table 8.3 shows analogue switch-off dates of selected countries that have completed the DTT transition.

Table 8.3: Analogue switch-off dates, selected countries that have completed the DTT transition

Country	Date	Country	Date	Country	Date
Australia	2013	Korea, Rep. of	2012	Sweden	2007
Czech Republic	2011	Latvia	2010	Tanzania	2012
Estonia	2010	Netherlands	2006	Uganda	2012
Finland	2007	New Zealand	2013	United Kingdom	2012
Germany	2008	Norway	2009	United States	2009
Ireland	2012	Poland	2013		
Italy	2012	South Africa	2013		
Japan	2012	Spain	2010		

Source: DigiTag, 2013.

To date, the digital switch-over is most advanced in Europe, where at least 13 countries have switched off analogue terrestrial broadcasting. The region has the highest DTT household penetration, being home to 47 per cent of global primary DTT households by the end of 2012. In the Americas, the first DTT switch-over milestone was in 2009, with the analogue switch-off in the United States. Other large countries in the region, such as Brazil, are in the process of switching over. The Africa and Asia regions started to make some progress in the transition to DTT in 2012, while Australia and New Zealand (in Oceania) made the switch in 2013. As Chart 8.10 shows, the share of DTT-only households in Africa surpassed that of Asia in 2011. In terms of the absolute number of households, Italy had 17 million primary DTT households at the end of 2012, followed by the United States (16 million) and China (14 million). In relative terms, the proportion of primary DTT homes to households with a TV was highest in Spain (76 per cent), followed by Italy (73 per cent) and Australia (62 per cent).

Digital switch-over is likely to be complex – and costly – in countries where the analogue network is most developed. Therefore, some African countries have found digital switch-over to be a relatively easy task, since it is a simple matter of replacing a single analogue transmitter with a more powerful and efficient digital one, even though this may also imply that further efforts are necessary to extend terrestrial broadcasting network coverage (ITU, 2013c). Given that the DTT switch-over is still pending in most developing countries, it is one of the main areas of policy attention in the near future. Since it is a relevant challenge in terms of delivering radio and television services to the world's population, the switch-over could be added as an indicator for Target 8.

Conclusions and recommendations

The objective of Target 8 is to ensure that all of the world's population has access to television and radio services. Access to the traditional ICT services of radio and TV is still relevant in the information society. They are critical for reaching out to remote or displaced communities and can enhance the achievement of development goals such as education, preserving local heritage and fostering the promotion of cultural diversity. Widespread adoption of these basic ICT services could spur demand for more high-end content and services, and ultimately give rise to more competitive telecommunications markets. Several constraints pose challenges to a more complete achievement of Target 8. Economic constraints remain significant for some households in developing countries – for instance, many rural households in these countries can hardly afford proper nutrition, let alone pay for a radio or TV set. Even if the poor could afford and are willing to pay for the devices, infrastructure constraints such as the lack of electricity and terrestrial coverage in rural areas still limit household access to radio and TV services.

Target 8 is tracked by three indicators and all three are focused on equipment. The first two indicators for measuring Target 8 — household access to radio and household access to TV —provide a picture of fairly widespread access. In developed countries, most households are able to access radio and TV. In most developing countries for which data are available, at least 50 per cent of households had access to radio by the end of 2012. About 80 per cent of households globally had at least one television set by the end of 2012. However, the target for television access remains largely unmet in Africa, with only 42 per cent of households in Africa having a television set by the end of 2012. The target for television access is also unmet in least developed countries, with only 35 per cent of households having a TV in 2012.

Although an overall decline in households with radio sets was observed, other evidence suggests that there is considerable value in pursuing Target 8 in respect of radio. For least developed countries and many countries in the African region, traditional mass media are still important tools for accessing information and opportunities that ICTs can provide. For example, the World Health Organization disseminates health information to refugees and displaced persons through 'low cost, low-technology' communication systems such as community radio and battery-operated public address systems (WHO, 2009). Even as households around the world switch over to digital transmission and adopt multichannel television, it bears remembering that there are significant numbers of poor or displaced communities that still have inadequate or no access to basic radio and television services. For them, access to these services could be their only means of accessing public services and receiving essential relief items.

Turning to Indicator 8.3, adoption of multichannel television has been growing rapidly and slightly more than half of all households (or 71 per cent of households with television) had access to multichannel services by 2012, compared to two in five in 2008. The impact of multichannel television is technology- and region-specific. The switch-over to digital television is the most far-reaching development in multichannel television in recent years. Most developed countries have completed, or are on track to complete, the transition to digital television, while developing countries have begun or are committed to the transition. However, the transition does not guarantee an improvement in coverage, which is still a challenge – especially in developing countries. In most cases, service providers would just be switching over to digital transmission without building new infrastructure to improve coverage (ITU, 2010b).

The benefits of other multichannel technologies (CATV, DTH satellite and IPTV) are more likely to be felt by developed countries and affluent households in developing countries. According to commercial research conducted by CASBAA (2014), the growth of multichannel (non-terrestrial) television is greatest in the Asia-Pacific region, which has about 468 million households with multichannel TV (489 million in total for Asia and Oceania in this report).[25] The CASBAA report highlights the rise of the middle class in the region that is fuelling the growth of multichannel TV. In particular, higher-than-average penetration rates were reported among affluent households. For households that can afford these services, multichannel television offers more varied content and value-added services like time-shifts and programmes on-demand.

Should there be a post-WSIS target related to broadcasting, it is recommended that indicators 8.1 and 8.2 be retained (and updated with the 2013 definitions) since most developing countries still have considerable room for progress towards these targets. A more thorough evaluation of Target 8 could be made if data collection efforts in the least developed countries were intensified.

Monitoring Indicator 8.3 by technology should be continued in order to provide insights into the role of different TV-distribution technologies in providing TV services to the world’s population.

Future indicators could address the missing supply-side of radio and television services by measuring media regulation aspects that help understand the global environment in which media operate and the availability and quality of domestic broadcast services. Broadcast content is often of interest to populations when it is available in a language they understand or there is local content. The *Media development indicators framework* first published by UNESCO in 2008 could serve as a basis and groundwork for future indicators on availability and quality of radio and television content. The framework has been endorsed by member states of the International Programme for Development of Communication (IPDC). The UIS has also developed and pilot-tested a questionnaire on media statistics in 2012; a guidebook of indicators was published in 2013.[26] Data from the survey will substantially fill the gap for Target 8 indicators.

Since digital switch-over will be of major policy concern in developing countries in the near future, an additional indicator tracking digital transition is recommended.

New indicators on multichannel TV could focus on demand-side data such as distribution of television channels by transmission signals, ownership and geographic coverage. The pilot study conducted by UIS collected some of these data from 60 countries in 2012.

In service to making further progress towards Target 8, several recommendations specific to increasing access to TV services are offered. Countries with low household penetration of TV can consider initiatives that increase both demand and supply. In terms of increasing demand, state assistance for low-income households in order to make TV sets and decoders more affordable could help increase household TV penetration.

Initiatives to increase the availability of relevant local content should be promoted and could also help boost household TV uptake. Appropriate monitoring of access to local and relevant content should also be implemented (the aforementioned UIS questionnaire collected data on community radio and television). To achieve these ends, countries could consider allowing more broadcasting stations to operate in order to increase content variety and encourage more competition among operators. The principles of plurality and media diversity are also endorsed in the UNESCO framework (UNESCO, 2010).

With regard to increasing supply, the digital switch-over presents an opportunity to expand the reach of free-to-air multichannel TV, and satellite technology could be a complementary cost-effective way of extending coverage to remote and unconnected areas. Countries could allow more providers to operate to increase competition and lower the costs of existing multichannel services for consumers. The current digital switch-over offers an unprecedented opportunity for developing countries to provide TV services to previously underserved communities.[27] Lessons learned by developed countries that have completed the transition could help developing countries in the early stages of the transition to make significant progress towards achieving Target 8.

It should be noted that multichannel television offers opportunities for the less affluent. Satellite TV is a cost-effective infrastructure to build for remote areas compared to terrestrial broadcasting and is thus a viable means of implementing nationwide broadcasting. Countries with too small a market to justify a national system could take advantage of existing regional systems, or national broadcasters could arrange to have their channels made free-to-air via DTH (*Partnership*, 2010).

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Endnotes

[1] And updated with the definitions revised by ITU in 2013 (ITU, 2014).

[2] See http://www.unesco.org/new/en/communication-and-information.

[3] See http://portal.unesco.org/ci/en/files/17593/11014593681Com_radio.pdf/Com_radio.pdf.

[4] See http://www.unesco.org/new/en/communication-and-information/intergovernmental-programmes/ipdc/priorities/developing-community-media/namma-dhwani-community-media-centre/.

[5] See http://www.itu.int/en/ITU-D/Statistics/Pages/events/brazil2013/default.aspx.

[6] EGH is ITU's expert group to review the statistical indicators for measuring ICT access and use by households and individuals. ITU's Expert Group on Telecommunication/ICT Indicators (EGTI) has the mandate to revise the list of ITU supply-side indicators (that is, data collected from operators), as well as to discuss outstanding methodological issues and new indicators. For more information on the ITU expert groups on ICT indicators, see http://www.itu.int/en/ITU-D/Statistics/Pages/definitions/default.aspx.

[7] See http://www.itu.int/en/ITU-D/Statistics/Documents/events/brazil2013/Final_report_EGH.pdf.

[8] See http://www.itu.int/en/ITU-D/Statistics/Documents/events/wtis2013/WTIS13_final_report.pdf.

[9] For more information on the Partnership on Measuring ICT for Development, see http://www.itu.int/en/ITU-D/Statistics/Pages/intlcoop/partnership/default.aspx.

[10] Includes ITU member states with available data for the years 2011 or 2012. Estimations are either done by countries or ITU.

[11] See http://www.niccd.org/sites/default/files/NICCD_Mitigation_Case_Study_Cookstoves.pdf.

[12] See http://www.digitaltvresearch.com/.

[13] See http://ec.europa.eu/public_opinion/archives/ebs/ebs_396_en.pdf.

[14] MIS 2013 (ITU, 2013c) reported that only about one-third of households in Africa had access to TV. The figures in the current report are not identical as different regional classifications were used. In this report, the UN M49 classification was used.

[15] Figure 8.2. The World Bank used data for 53 countries, several with data from more than one survey, giving a sample of 113 observations. The graph plots the percentage of people in rural areas owning television against the rural electrification rate.

[16] Estimates presented in this section refer to TV distribution technology on the primary TV set in order to avoid double counting.

[17] The proportion of households with access to multichannel television, by type of service is calculated by dividing the number of in-scope households with each type of multichannel television service by the number of households with any multichannel television service. The results are then multiplied by 100 to be expressed as a percentage. Since these estimates only refer to TV-distribution technology on the primary TV set, the sum of percentages is 100.

[18] The Eurobarometer reports different types of TV distribution technology for households and percentages add up to more than 100 per cent. ITU reports TV distribution technology on the primary TV set in order to avoid double counting towards the overall household penetration.

[19] Chapter 5 of MIS 2013 (ITU, 2013c) provides a detailed description of public policy aimed at the conversion and how the industry has reacted.

[20] The dominance of DTH satellite TV in Jordan is consistent with data from the Media Statistics Survey conducted by the UNESCO Institute for Statistics.[25] In Jordan, 45 out of the 47 television channels were offered only via satellite in 2011.

[21] See http://search.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DAF/COMP/GF/WD%282013%2943&docLanguage=En.

[22] "households with only DTT" means that the household has digital TV but does not have a pay-TV subscription. It is assumed that the household watches only DTT.

[23] For more information on GE06, see http://www.itu.int/ITU-D/asp/CMS/Events/2011/ITU-ANFR/ITU_GE06.pdf.

[24] See http://radio-tv-nederland.nl/historie/analogetv/kranten_artikelen.html.

[25] The difference in the numbers is due to different regional classification for countries.

[26] See http://stats.uis.unesco.org/unesco/ReportFolders/ReportFolders.aspx

[27] Chapter 5 in MIS 2013 (ITU, 2013c) offers detailed recommendations for countries that are still in the early stages of the transition to DTT.

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

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

Executive summary

The emergence of an information society requires more than access to infrastructure, equipment and services. For users, infrastructure, equipment and services are important because they provide access to information – or content – that they can use in order to pursue their objectives (as governments, businesses, organisations or individuals) and can share with others. They need to be able to find content that is affordable, relevant to their needs and circumstances, and available in languages that they can understand, with formats they can use.

Target 9 deals with the development of content and the technical means required to facilitate linguistic diversity. While these are critical aspects of the information society, quantitative measurement of content and language is challenging both because of limited data and rapid developments in content provision and platforms on which content is accessed. Major developments in these areas since WSIS include the rapid growth of user-generated content, including online social networks; the emergence of mobile apps; and the growing significance of cloud computing models of content storage and access. The opportunities arising from automated translation are now having significant impact on availability of content by language, while the period since WSIS has also seen the introduction of top level Internationalised Domain Names.

Five indicators were selected for monitoring Target 9 (*Partnership*, 2011). Four of these are concerned primarily with language, while one seeks to provide a proxy for local content.

The first two indicators – the proportion of Internet users by language, at country and global levels – have proved extremely difficult to measure because of severe data limitations. Few countries have so far included sufficient questions on Internet usage and language in national censuses and household surveys to enable assessment of Internet user numbers by language, while global estimates currently available are out-of-date and of questionable statistical value. There are also statistical challenges in identifying the language characteristics of national populations. However, it is clear from the evidence that is available that the linguistic diversity of Internet users has increased since WSIS. The proportion of Internet users whose primary language is English has fallen significantly as access to the Internet has become more widespread, from an estimated 80 per cent in the mid-1990s to less than 30 per cent in 2011. More than 300 languages are now available on Wikipedia and more than 100 on major social networks. There has been particularly strong growth in the number of Chinese speakers online.

No satisfactory data are currently available to measure the third indicator selected in 2010 – the number of webpages by language. Comprehensive analysis of this indicator requires a combination of web-crawling and language identification techniques that has not been undertaken by independent research institutes since 2007. Only very limited data are available from commercial sources. What is available suggests that there is growing linguistic diversity in web content, although English remains the most widely used language on websites. Wider linguistic diversity is likely to be found in user-generated content on social networking and other sites.

The fourth indicator – the number of domain name registrations for each country code top level domain (ccTLD), weighted by population – was selected to serve as a proxy for local content, that is, for content created within each country. The value of this indicator can be improved by including geolocated registrations of global top level domains (gTLDs) within countries and by comparing findings with the number of Internet users as well as total population. Data made available for this report show that the number of domains registered per head of population has been falling by almost three-quarters worldwide since WSIS, but is still much lower in developed countries (18 ccTLDs or 6 TLDs p.c.) than in developing countries (241 ccTLDs or 131 TLDs). The number of Internet users per TLD is falling in developed countries but growing in developing countries because of their high rate of growth in Internet usage.

The fifth indicator – the number and share of Wikipedia articles by language – serves as a proxy for user-generated content online. Extensive data published by the Wikimedia Foundation show that there has been a marked decline in the proportion of articles in English, from 46 per cent of all articles in 2003 to 15 per cent in 2013, and a corresponding increase in the proportion of articles in languages that are not among the ten most-used international languages (from 26 per cent to 58 per cent). However, corresponding data on pageviews show that there is a higher level of linguistic concentration in access and use of Wikipedia content.

The chapter also includes some available data on website usage and on user-generated and social media.

The quantitative measurement of content and language is challenging. Should there be a post-WSIS target related to content and language, it is recommended that indicator 9.1 be retained but suspended until there is more widespread collection of data on Internet usage cross-classified by language spoken (for example, collected by national statistical offices in population censuses); that indicator 9.4 should be retained following revision to include gTLDs and IDNs as well as ccTLDs; and that indicator 9.5 should also be retained but extended to include Wikimedia data on content creators and pageviews. It is recommended that indicators 9.2 and 9.3 should be withdrawn because no satisfactory data are likely to become available for these, but that consideration should be given to including indicators related to online social networks and mobile apps. The possibility is also suggested of incorporating qualitative data in the monitoring of content and language, and of building a more comprehensive portfolio of quantitative and qualitative data for selected representative countries.

Introduction

Eight of the ten targets that were adopted in the WSIS Geneva *Plan of Action* are concerned primarily with access to infrastructure and to facilities that enable effective use of access. However, access to physical infrastructure and facilities is only one aspect of the enabling environment for the effective use of Internet and other online services. Other factors that are essential in enabling the development potential of ICTs to be fulfilled include: the affordability of access; the presence of relevant skills among potential users (including literacy, computer literacy and research and analytical skills); and the availability of relevant content that is readily accessible to users. Accessibility, in this context, is highly dependent on the language(s) in which content is available.

WSIS Target 9 addresses these issues. It has two distinct but interlinked concerns:

- to encourage the development of content online and
- to put in place technical conditions that facilitate the presence and use of all world languages[1] on the Internet.

The availability of content and linguistic diversity are not new issues for the information society, but have been critical to the dissemination of information and knowledge in earlier communications media, including speech, print and broadcasting. Access to information and, thereby, knowledge is a principal factor in enabling individuals to maximise economic opportunity and social networks; in spreading knowledge of health and other social issues; in facilitating business innovation; and in enabling governments to develop policies and programmes that effectively address the social and economic needs of their societies. It is at the heart, therefore, of sustainable development, a primary focus of the post-2015 development agenda, as well as of progress towards the information society. Two aspects of this are equally important:

- the publication of information or content and
- the ability of people and organisations to access content and interact by sharing information with others through communications platforms.

These can be described as the supply and demand sides of content.

Innovations in information and communication technologies and markets before and since WSIS have greatly extended access to both information and interactive communications, creating the opportunity for individuals, organisations, businesses and governments to make more effective use of information in enhancing development outcomes. In particular:

- The Internet has greatly extended the amount of content that is published or made publicly accessible, particularly through the WWW, and greatly extended the reach of that content to much wider groups of potential users. Subject to restrictions in some countries, Internet users anywhere in the world can access the great majority of content that is published online. Access can be easily shared through e-mail, instant messaging and other online platforms as well as offline networks.
- Since WSIS, interactive services such as online social networks, blogs, microblogs, and audio and video file-sharing services – sometimes referred to as Web 2.0 services – have expanded greatly, facilitating enormous growth in publication of user-generated content and interactive information-sharing amongst Internet users.

- Also since WSIS, mobile telephones have evolved from voice telephony devices into multipurpose digital devices that are widely used to share audio, image and video content and to access the Internet as well as for voice and text communications. A new content market has emerged around smartphone applications (mobile apps), overlapping with and supplementing online content accessed through the Internet. The number of apps available for Apple iPhones was reported to have exceeded 1 million in October 2013,[2] while the number of Android apps was reported to have exceeded 1.1 million by February 2014.[3]

Access to information depends on the affordability, availability and accessibility of content as well as connectivity. These different factors are interlinked. A study published jointly by the OECD, UNESCO and the Internet Society (2011) found that there was both "… a strong correlation between the development of network infrastructure and the growth of local content" and "… a significant relationship between the development of international bandwidth and the price of local Internet access," suggesting a virtuous circle between infrastructure, affordability and content production. The availability of relevant skills is also critical to individuals' and organisations' ability to make use of content. UNESCO has developed a set of largely qualitative indicators that can be used to monitor the extent of media and information literacy within different societies, including the quality of national ICT environments, content access, the availability of analytical capabilities and content generation.[4]

Literacy is obviously important in enabling access to content. Some 775 million adults worldwide are estimated to be illiterate, over 10 per cent of the world's population, the majority of them in developing countries.[5]

The languages in which content is available are equally important in determining its accessibility to potential users. There are a little over 7 000 languages in use worldwide today, whose primary speakers are distributed as set out in Table 9.1.

Table 9.1: Distribution of world languages by area of origin

Region of origin of language	Living languages		Number of speakers	
	Count	Percentage	Millions	Percentage
Africa	2,146	30	789	13
Americas	1,060	15	51	1
Asia	2,304	32	3,743	60
Europe	284	4	1,647	26
Pacific	1,311	19	7	0.1
Totals	**7,105**	**100**	**6,236**	**100**

Source: Ethnologue, http://www.ethnologue.com/statistics, viewed 4 March 2014.

Note: speakers of a language in this table are not necessarily located in their primary language's region of origin.

Of these, at least 24 have more than 50 million and 85 more than 10 million first language speakers, some of these distributed amongst numerous versions or dialects. However, almost 50 per cent of living world languages have fewer than 10 000 first language speakers and many of these do not have written form. Some countries have especially large numbers of languages, most notably Papua New Guinea whose seven million inhabitants share 836 different tongues.[6] Estimated language distribution by speaker numbers is set out in Table 9.2.

Table 9.2: Distribution of world languages by number of first language speakers

Population range	Living languages		Number of speakers	
	Count	Percentage	Millions	Percentage
100 million to 1 billion	8	0.1	2,528	41
10 million to 100 million	77	1	2,382	38
1 million to 10 million	308	4	963	15
100,000 to 1 million	928	13	295	5
10,000 to 100,000	1,798	25	61	1
1,000 to 10,000	1,984	28	8	0.1
Fewer than 1,000	2,002	28	0.5	0
Totals	**7,105**	**100**	**6,236**	**100**

Source: Ethnologue, http://www.ethnologue.com/statistics/size, viewed 4 March 2014.

The majority of published content has always, therefore, only been available in a limited range of languages that are much more widely used, particularly languages that have widespread international reach (such as Arabic, French, Portuguese, Spanish and English) and/or are the principal languages in countries with large populations and diasporas (such as Russian and Chinese). This has continued to be the case with professionally published content on the Internet, such as webpages, though minority languages appear to be more widely used in interactive and user-generated content (such as e-mail, instant messaging and social networks), as in voice telephony.

This imbalance in favour of content in a small number of languages has resulted in concern, reflected in this target, over the need for greater linguistic diversity online in order to ensure that all people are able to access content that is relevant to them in a language that is accessible to them, particularly their mother tongue. In 2003, UNESCO adopted a recommendation concerning the Promotion and Use of Multilingualism and Universal Access to Cyberspace.[7]

Particular attention has been paid by UNESCO and other agencies to the survival of threatened languages, including those spoken by indigenous peoples, and to the preservation of information and knowledge expressed in those languages, in line with the United Nations *Declaration on the Rights of Indigenous Peoples*[8] and other international instruments.

The principal WSIS Action Line that is concerned with content and language is Action Line C8, whose remit covers "… cultural diversity and identity, linguistic diversity and local content" and which is facilitated by UNESCO. Its priorities include:

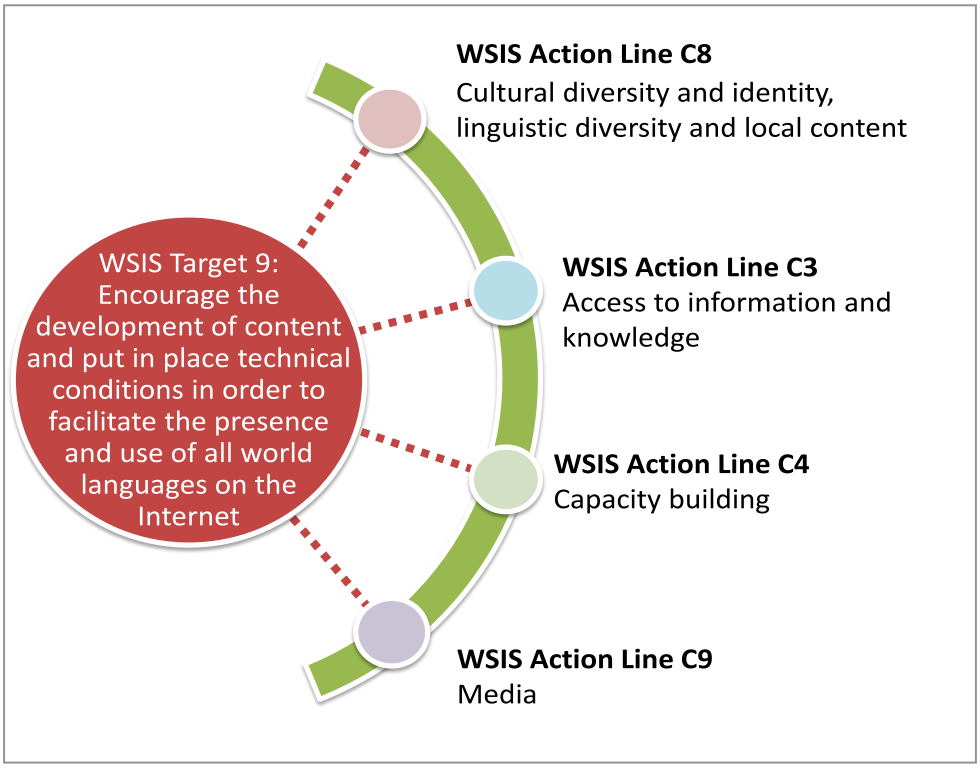
- the development and implementation of policies that "… preserve, affirm and promote diversity of cultural expression and indigenous knowledge and traditions"
- support for "… local content development, translation and adaptation"
- the provision of "… content that is relevant to the cultures and languages of individuals," including marginalised groups such as those who are not literate
- the promotion of software in local languages
- the promotion of technologies and research in areas such as translation, voice-assisted software, multilingual search engines and internationalised domain names, which have the potential to increase the accessibility of content to those who do not have requisite language skills.[9]

Other WSIS action lines are also relevant to content development, access and usage, in particular:

- Action Line C3 encourages governments to promote access to content, including public domain information.
- Action Line C4 is concerned with capacity building, including the eradication of illiteracy, and developing the capabilities of marginalised communities to generate local content.
- Action Line C9 is concerned with media.

This is illustrated in Figure 9.1.

Figure 9.1: Relevance of Target 9 to WSIS action lines



Definitions and challenges of measurement

As noted above, Target 9 is concerned with both:

- online content and
- linguistic diversity online.

The following paragraphs define these terms and discuss the principal difficulties affecting measurement.

Content

The term "content" (or "digital content") is usually used, in the context of ICTs, to include all information and data that are available through digital platforms and services. This includes content on broadcasting platforms, in SMS messages and in mobile apps, as well as content on the Internet. The term "online content" has generally been used more narrowly to refer to content available through the Internet, including webpages; content on social media platforms; and downloadable material in text, audio, video and other formats. However, these definitions are neither precise nor fixed and need to evolve over time as ICT technology and markets change.

WSIS Target 9 has generally been understood to refer primarily to content on the Internet, and this understanding remains valid for this report. Assessing the target in 2010, the *World Telecommunication/ICT Development Report 2010: Monitoring the WSIS Targets, A mid-term review* (WTDR 2010) defined 'content on the Internet' for this purpose as "… any information (webpages, messages, software …) that is available for retrieval by the user, in any format (for example, text, image, audio, video)."[10]

Although 'local content' is not explicitly addressed by the target, it is substantially addressed in the associated WSIS Action Line. There is no generally agreed definition of local content, which has both geographic and linguistic resonance. Some use the term narrowly to refer to information that is specifically and directly relevant to local communities. In 2011, UNESCO, the OECD and the Internet Society defined it, more widely, to include "… all digital content created for an end user who speaks the same language as the author."[11] Others, including the Partnership on Measuring ICT for Development, have sought to use content published on ccTLDs (country code top level domains) as a proxy for local content (see discussion of Indicator 9.4 below). However, these latter approaches are likely to include much content that is global rather than local in character – for example video material distributed by local online broadcasters or content aggregators – and to exclude much that is local rather than global – for example content posted on global social media platforms such as Facebook, Twitter and YouTube.

There are several points along the value chain at which content can, and arguably should, be measured. UNESCO, the OECD and the Internet Society identified four stages of content production and dissemination in their 2011 analysis of the relationship between infrastructure, affordability and local content:[12]

- **content creation** – the production of content intended for distribution online and the preparation of other content for online distribution
- **content preservation** – including the hosting of content
- **content dissemination** – the publication of content, and enabling of access to content, on websites, social media platforms, mobile apps and through other online media
- **content utilisation** – the extent to which content is accessed by online users and the extent to which content is then used to achieve wider objectives – whether the personal objectives of individual users, the commercial objectives of businesses, or the development objectives of governments and other stakeholders.

Less attention was paid to these content dimensions than to language aspects in the selection of Indicators for Target 9 set out in the *Measuring the WSIS Targets: A statistical framework* (*Partnership*, 2011). Ways of addressing these content dimensions more effectively in future are discussed later in this chapter.

Language

The range and diversity of languages across the world were briefly summarised in the introduction to this chapter. The importance and challenges of measuring linguistic diversity on the Internet arise particularly in two parts of the content value chain:

- content creation and publication (the supply of content)
- content access and usage (demand for content).

A number of challenges constrain the measurement of content creation and publication. The technical structure of the Internet is based on generic and geographic domains rather than on languages. Content can be published by any Internet user, through websites or social media platforms, and is not formally categorised by language when posted. Script recognition algorithms can be used to identify scripts used in posted text, but many of these are shared by several languages – in the case of Latin script, by hundreds. Language recognition algorithms have been developed that can be applied to text and these can be particularly valuable in distinguishing between major languages. However, text analysis does not cover audio, image and video content.

In any event, the size of the World Wide Web (WWW) is now so great that the web in its entirety can no longer be readily analysed through web crawlers (indexation programmes such as those used by search engines). Random samples of web content could be gathered by web crawlers for language analysis, but very large samples would be required to make this statistically viable, which would be expensive. Analyses prepared by Internet companies for business development purposes are unlikely to be made available because of commercial confidentiality.

It is equally difficult to measure content access and usage by language. Almost all countries are to some extent multilingual:

- Some countries have several official languages that are used as primary languages by substantial groups within the population. South Africa, for example, has 11 official languages, including one global language (English) and ten that are spoken predominantly within the country or shared with one of its neighbours, as well as a number of other mother tongues not designated as official languages.[13]
- Many countries designate a global language such as English or French as an official language, even though it is spoken by only a minority of citizens. Some countries, equally, have a *lingua franca* – for example Hindi or Kiswahili – that is widely used alongside both local mother tongues and global languages like French and English. It is estimated that the number of people who understand English may be around 15 per cent of world population: a significant proportion but still relatively low compared to the overall population of Internet users.[14]
- Only two territories are identified by Ethnologue as being monolingual.[15] Most countries have substantial linguistic minorities, with a range of secondary language capabilities, whose Internet access may be better or worse than that of other linguistic groups, on linguistic or other grounds. Examples include speakers of global languages within national minorities, such as Spanish speakers in the United States and Chinese speakers in Malaysia, as well as speakers of local minority languages.

For these reasons, it is misleading to attribute a single language to a country when assessing linguistic diversity.

Secondly, a large proportion of individuals are multilingual, to greater or lesser degree, the extent of multilingualism often (but not necessarily) being associated with higher educational attainment. In Tanzania, for example, while a family may speak a local mother tongue at home, primary education is delivered in Kiswahili and secondary education in English. Many people in countries in West Africa speak French or English, and one or more local languages. Hindi is spoken by many people in India as a second language, alongside their mother tongue, while English is also spoken or understood by a significant proportion of the population.

For these reasons, it is problematic to associate individuals' ability to access content with the availability of content in their mother tongue. This is particularly so where mother tongues have small speaker communities or where speakers have almost universal familiarity with other languages (for example because these are the languages of primary education). At the same time, it should be recognised that the availability of content in local languages is important for sustaining cultural identity, particularly for minority communities and indigenous peoples, and should not be judged solely as a route to information.

Thirdly, the extent to which a language is present online is not a simple binary question. The WTDR 2010 identified 12 factors that contribute to the online presence of a language, as well as content itself, including:

- a written form for the language
- codification of its script, alphabet and suitable fonts
- the availability of suitable hardware, such as keyboards
- linguistic software (such as word processing and browsing programmes, spell checkers and dictionaries) that enable content to be developed and viewed in the language concerned
- an informed user community driving content production in the educational and creative sectors and the media
- the availability of automated translation enabling access to content published in other languages
- indexation of content by search engines and other intermediaries.[16]

Developments since WSIS

Major developments have taken place in the environment for online content and language since the World Summit. As with other WSIS targets, these affect both what is and should be measured in relation to Target 9, and the potential for successful measurement.

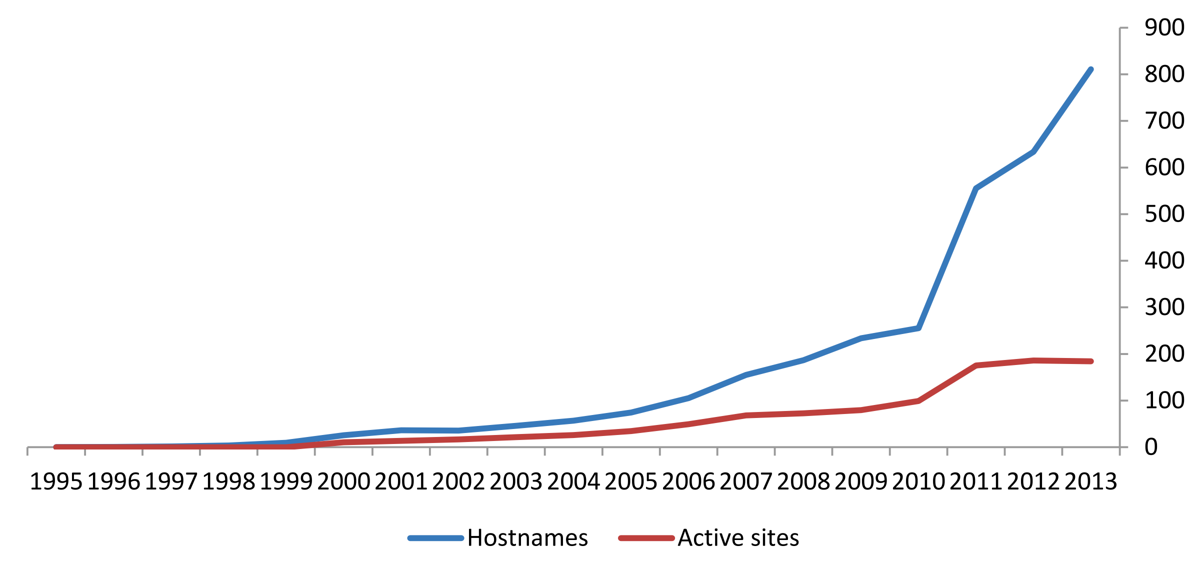
Content

The total volume of recorded data, including both published and unpublished data, is estimated to be doubling every two years.[17] At this rate of growth, the volume of data recorded in 2025 will be more than a thousand times greater than that in 2005. This growth is driven by the rapidly expanding capacity of both computing and communications networks and devices, and by technical developments such as cloud computing, which allows very large data volumes to be hosted and accessed through clusters of data centres rather than requiring storage on users' own devices. Greater network capacity, including the growth of broadband networks, has enabled tremendous growth in the volume of video data downloaded or streamed across the Internet. By 2012, Cisco estimated, video already accounted for 57 per cent of Internet traffic by volume, excluding peer-to-peer file-sharing; with that included, Cisco expected the figure to rise above 80 per cent by 2017 (Cisco, 2013).

Data volumes will increase further as a result of the *Internet of things* (IoT), which will make many objects, as well as people and organisations, active participants in data generation. As with earlier phases of ICT development, the *Internet of things* is likely to be adopted earlier in developed countries than developing countries, because their communications networks generally have higher specifications and because users in developed countries have more financial resources to buy IoT-enabled devices.

The number of websites and webpages has become increasingly difficult to measure since 2005, especially as search engines no longer crawl the entire web when compiling search results. Netcraft's January 2014 website survey identified over 850 million hostnames and approximately 185 million active sites.[18] Given the difficulties of identifying the number of websites overall, or in the indexable web, trends in website growth may be more useful. The growth of websites since 1995, as assessed by Netcraft, is illustrated in Chart 9.1.

Chart 9.1: Netcraft estimates, total websites, millions of hostnames and active sites, 1995–2013



Source: adapted from data in Netcraft, January 2014 Web Server Survey, data from December of each year, http://news.netcraft.com/archives/2014/01/03/january-2014-web-server-survey.html, accessed 6 March 2014.

Some information concerning the popularity and growth of specific web services is included later in this chapter.

The nature of published online information has diversified considerably since WSIS as a result of the growth in network and device capacity and the emergence of new services, particularly those associated with user-generated content, transactions, and audio and video content enabled by much greater bandwidth.

Social media websites have largely emerged since WSIS and now form an important part of the Internet experience for most users, in developing as well as developed countries. A number of specific social media sites, including those identified below, are now among the most accessed websites in a majority of countries where Internet activity is regularly measured. However, local alternatives are more significant in some markets, notably China.

- The number of monthly active users of Facebook, the leading international social network, which was founded in 2004, has grown from almost zero at the time of WSIS to 1.2 billion in 2013. Although the two are not directly comparable, as some Facebook accounts are held by organisations and individuals may have more than one Facebook account, this figure is equivalent to 45 per cent of that for individuals using the Internet worldwide, as estimated by ITU.[19]

- The number of monthly active subscriptions to Twitter, the leading international microblogging service, which was founded in 2007, has grown to 241 million in 2013. About 500 million tweets were posted daily by the end of 2013.[20] A further 507 million people subscribed to the Chinese microblog service Tencent Weibo, out of an estimated 582 million Chinese Internet subscribers.[21]
- By the end of 2013, as many as 100 hours of video content were reported as being uploaded every minute to YouTube, the leading international video-file sharing site, with more than six billion hours of video being watched each month.[22]

Content on user-generated sites such as these now amplifies the total volume of content available. Much of this can be regarded as local content, in that it is generated by individual users and most likely to be accessed by others within their geographical, occupational or personal communities. User-generated content also offers more scope for publication in local languages. However, data on social media usage are limited because of commercial confidentiality. Data availability is discussed further elsewhere in this chapter.

Another important development in content since WSIS has been the growth in open data, that is, the publication of data gathered and analysed by governments and other public bodies so that this can be used by citizens and third party organisations as well as by official analysts. The growth of open data has been driven by freedom of information legislation, and is more advanced in developed than developing countries, though significant steps have also been taken by a number of developing country governments.[23] Although the total volume of information made available in this way is small compared with the growth of social media and video content, it has particular relevance to the developmental outcomes sought by WSIS.

Language

There have been four significant changes in the relationship between the Internet and language since WSIS.

First, the language in which computers and the Internet are developed has a significant bearing on the development of a multilingual Internet. Computer code and programming were initially dominated by the English language, which influenced the evolution of online systems, for example the use of Latin characters and the ASCII[24] character set in the domain name system. User software was also initially concentrated on a small number of European languages, but has since diversified. The operating system Windows 2000, for example, supported 16 languages, but 45 were available in Windows 2003 and 95 language packs are listed as being available for Windows 7. The number of language packs available for Microsoft Office has likewise grown from 33 in Office 2003 to 65 in Office 2013.[25] Internet browsers are essential portals for users of the WWW, and they too have become more multilingual. Internet Explorer now offers 119 languages, including a number in different dialect forms, while Firefox offers 107 and Google Chrome 117.[26]

Secondly, the widespread use of social media and user-generated platforms on the Internet (and of mobile apps) means that a much higher proportion of content is now generated by individuals, often for small user groups with shared characteristics. Major social media sites support a wide range of languages, enabling individuals to generate content in the language of their choice, subject to the technical limitations of the devices they are using. By December 2013, for example, it was reported that 34 per cent of Twitter tweets were in English, with the next most popular languages being Japanese (16 per cent), Spanish (12 per cent) and Malay (8 per cent).[27] There is anecdotal evidence of linguistic adaptation in some languages, for example of users adopting Latin characters when communicating in languages that have different character sets such as Russian and Greek.

The third important development has been the introduction of internationalised domain names (IDNs). A major constraint on the domain name system, until 2010, was that only Latin characters within the standard ASCII character set could be used in top level domains (TLDs), preventing the provision of these in languages using non-Latin scripts. ICANN approved procedures that implement top level IDNs by proxying non-Latin scripts against ASCII characters in 2009, and the first IDN TLDs became available during 2010. UNESCO and the European domain registry EURid reported in 2013 that just over 5 million IDNs had been allocated globally, though these represented less than 2 per cent of domains in use worldwide, while more than 90 per cent of the most popular websites did not yet recognise IDNs in URL links (UNESCO and EURid 2013). More information about the development of IDNs can be found in the third part of the chapter.

The fourth development of significance for language on the Internet concerns automated translation. The enormous quantity of content that is available online cannot be translated manually into all languages, or indeed into any specific language – nor is there significant demand for the translation of much online content, for example tweets or Weibo posts. Automated translation programmes offer the only realistic way of enabling translation that responds to demand from online users. The first automated translation programmes were developed in the 1950s; there has been considerable improvement in their performance since the emergence of the Internet, though problems of quality assurance and reliability remain significant, while reliable translation is least available for languages with limited user numbers. The most widely used online translation service, Google Translate, is currently available in 80 languages.[28] Further discussion of automated translation can be found later in the chapter.

Data availability and scope

The Partnership on Measuring ICT for Development adopted five indicators for Target 9 in its 2011 WSIS statistical framework. The indicators are as follows:

Indicator 9.1: The proportion of Internet users by language, country level

Indicator 9.2: The proportion of Internet users by language, top ten languages, global level

Indicator 9.3: The proportion of webpages, by language

Indicator 9.4: The number of domain name registrations for each country code top level domain (ccTLD), weighted by population

Indicator 9.5: The number and share of Wikipedia articles by language.

This section of the chapter considers the appropriateness and measurability of Target 9; discusses the overall scope and suitability of the five indicators currently selected; summarizes the availability of data envisaged for these indicators in the 2011 WSIS statistical framework; and recommends ways in which, should the target be retained, the portfolio of indicators might be adapted for future monitoring and measurement. Available data for individual indicators are discussed in more detail below.

Access to content and the skills to make use of it, including language, are critically important to the emergence of an inclusive information society. There is, therefore, a powerful case for including measurement of them in the monitoring and measurement of WSIS outcomes. However, the principal challenge of Target 9 concerns the difficulty of defining quantifiable goals against which progress can be measured. There is no obvious upper limit for either content or linguistic diversity. The supply of content – the volume of online information – is growing extremely rapidly, while the range of platforms through which content can be accessed is also broadening. Measures of content that are based around particular forms of content (such as webpages), particular media (such as the Internet) or particular platforms (such as mobile apps) are likely to remain relevant only for short periods of time. One of the principal factors determining linguistic diversity in future is automated translation, the extent and impact of which will also be very difficult to measure.

These factors illustrate the challenges involved in identifying appropriate ways of assessing content and language within the WSIS outcome framework.

The purpose of measuring content and language, like other WSIS targets, is essentially twofold:

- to monitor progress towards the development of an information society, in which there is universal access to the networks, services and content that are required by people, whatever their needs, wherever they live and
- to identify constraints and limitations on this development that can be addressed by governments and other stakeholders in order to accelerate progress and reduce the digital divide.

To have value, indicators for monitoring and measuring progress must enable:

- comparisons to be made at a particular point in time between circumstances in different countries and other relevant categories, such as gender and language groups and
- trends over time to be measured both globally and in individual countries and language groups, also allowing disaggregation where possible by gender, age, disability and other demographic categories.

Data for these indicators must also be relatively easy to gather in the wide range of national contexts concerned, and should be accurate, reliable and timely.

The portfolio of indicators that was selected in 2011 has three main limitations when set against these criteria.

The first concerns the scope of the indicators chosen in relation to the target as a whole. Although the target is concerned with both content and language, the five selected indicators focus predominantly on language. Only one indicator – 9.4 – is concerned primarily with the availability of content, and it is concerned only with the supply side of content (content creation). None of the indicators in the 2011 framework is concerned with the demand side of content (access and use).

The second limitation concerns data availability. Very few data are available for three of the selected indicators (9.1, 9.2 and 9.3), with the result that it is not currently possible to use these as effective measures of either content or language. Reasons for this are discussed below. Data relating to indicator 9.4 are generated by domain name registries and other Internet entities, though these are not widely published or collected. Information derived from historic data sets relating to this indicator has been generously made available and collated for this report through the cooperation and support of a specialist research consultancy, ZookNIC. Data are readily available for indicator 9.5, thanks to the transparent publication of data-sets by the Wikimedia Foundation and community.

The third limitation is that the selected indicators do not include measurement of the very significant developments in content that have taken place since 2003, especially online social media and mobile apps. Only indicator 9.5 derives data from a social media platform, Wikipedia, but this is an unusual social media platform because content creation in its case involves a much smaller group of people than those that access content. The burgeoning significance of social networks, microblogs and audio and video file-sharing sites in content creation and access is therefore inadequately included in the current portfolio of indicators for this target, distorting the overall picture of content creation and access emerging from assessment over the period since WSIS. The same point can be made concerning mobile apps.

Available data concerning content and language on these new media platforms are very limited. Most popular social media platforms are offered by Online Service Providers (OSPs) free to end-users through a business model that uses data-mining techniques in order to target advertising. While OSPs themselves have extensive data on the geographic, linguistic and other characteristics of content carried on their services, these data have considerable commercial value, not least for targeted advertising and for ‘big data’ analysis. Little information from them is made publicly available because of their high commercial value and commercial confidentiality. The Wikimedia Foundation, which is a non-commercial enterprise, is an exception to this model and publishes extensive data that are used in the assessment of indicator 9.5 below.

The implications of these challenges for each of the five selected indicators are discussed below. In summary, this section recommends that, if the present target is to be retained:

- Indicator 9.1 should be retained, but suspended until data of sufficient quality become more comprehensively available as a result of national statistical offices incorporating relevant data collection into national censuses and household surveys.
- Indicators 9.2 and 9.3 should be withdrawn as it is not currently possible to obtain reliable data, and unlikely that this situation will change at least in the short or medium term.
- Indicator 9.4 should be retained in revised form, including gTLDs and IDNs as well as ccTLDs in national counts of domain names, and subject to mechanisms being put in place to secure access to comprehensive data sets from either national registries or independent analysts.
- Indicator 9.5 should be retained but developed to include Wikipedia contributors (content creation) and page views (access and use) as well as articles.
- Additional indicators should be developed to replace indicators 9.2 and 9.3. These should be concerned with measuring the volume and linguistic diversity of content on one or more social networks and on mobile apps.

This final recommendation recognises that the pace of change in available platforms since WSIS has been such that an emphasis on webpages is no longer sufficient to measure online content. It is important to recognise that the emergence of further new platforms for content creation, dissemination and access could also render the indicators recommended here outdated during the next decade.

An alternative or supplement to quantitative monitoring and measurement, of the kind envisaged in the 2011 WSIS statistical framework, would be to gather a wider variety of quantitative and qualitative data on a specified number of countries and territories that are selected to be representative of the world community. While this would not have the same statistical value as monitoring of other WSIS targets, it would enable a more substantive qualitative assessment to be made of trends that are taking place in content and language, alongside those statistical indicators that do prove to be viable. Additional statistical evidence from diverse sources could also be incorporated in monitoring and measurement.

The periodic publication of time series data in tables and charts is only one way of illustrating the spread of online content and language. A number of research institutes and other data analysts have developed considerable expertise in the use of mapping techniques to illustrate trends in online activity, including content and language.[29] Consideration could be given to the potential of techniques such as these for adding insight to those data that are available in this area of WSIS outcomes.

Achievements against Target 9

This section of the chapter considers data availability for the five indicators for Target 9 in more detail, and summarises findings and achievements that can be derived from available data. It supplements these findings with further information, including additional evidence related to these indicators and additional sources concerning social media. The discussion in this section also draws attention to evidence from five selected countries: Brazil, India, Indonesia, Kenya and South Africa. Consideration of each indicator includes a brief assessment of its appropriateness for future monitoring and assessment of Target 9, in the context of the discussion above.

Proportion of Internet users by language, country level

This is measured by Indicator 9.1, which is a measure of the use of the Internet by individuals, classified by language, within each country.[30] Use of the Internet, for this indicator, was intended to include use by an individual within a twelve month period from any location, using any device (including mobile devices). The intention was to calculate this indicator in two forms:

- the proportion of speakers of each language in each country who are using the Internet and
- the proportion of Internet users in each country who are speakers of a particular language.

The attribution of language established for this indicator was to be the 'usual language' or 'mother tongue' for each individual, as identified in national census or household survey data. The UN Statistical Division defines usual language to mean "… the language currently spoken, or most often spoken, by the individual in his or her present home" and mother tongue to mean "… the language currently spoken in the individual's home in his or her early childhood".[31] The problems associated with allocating a single language to an individual in either of these ways have been discussed above.

This indicator was developed on the basis of one of the set of ICT core indicators that were agreed by the *Partnership* following WSIS and, which it was hoped, would be included in national population censuses and household surveys conducted by national statistical offices (*Partnership*, 2010). Core indicator HH7 in this set sought to establish the proportion of individuals who had used the Internet in the previous twelve months (since adjusted to three months, see ITU, 2014). The intention was to assess findings from this indicator alongside data concerning individuals' mother tongues or language preferences collected in the same censuses and surveys.

Data for this indicator are not, therefore, available unless they have been collected in national censuses or household surveys. A model questionnaire and notes for the collection of relevant data in such surveys have been published by the *Partnership*. In 2010, the *Partnership* reported that only 35 developing countries were then collecting data concerning Internet usage (HH7), but no analysis was made of the number of these countries that also collected language data or of analyses of survey outcomes that juxtaposed Internet and language findings.[32] A selective review of national census forms confirms that there is to date limited adoption of the range of questions that could enable assessment as envisaged in the 2011 WSIS statistical framework.[33]

This indicator could have value for assessing access to content by language if this situation changes in the future. It should therefore be retained, but suspended until data of sufficient quality become more comprehensively available as a result of national statistical offices incorporating relevant data collection into national censuses and household surveys.

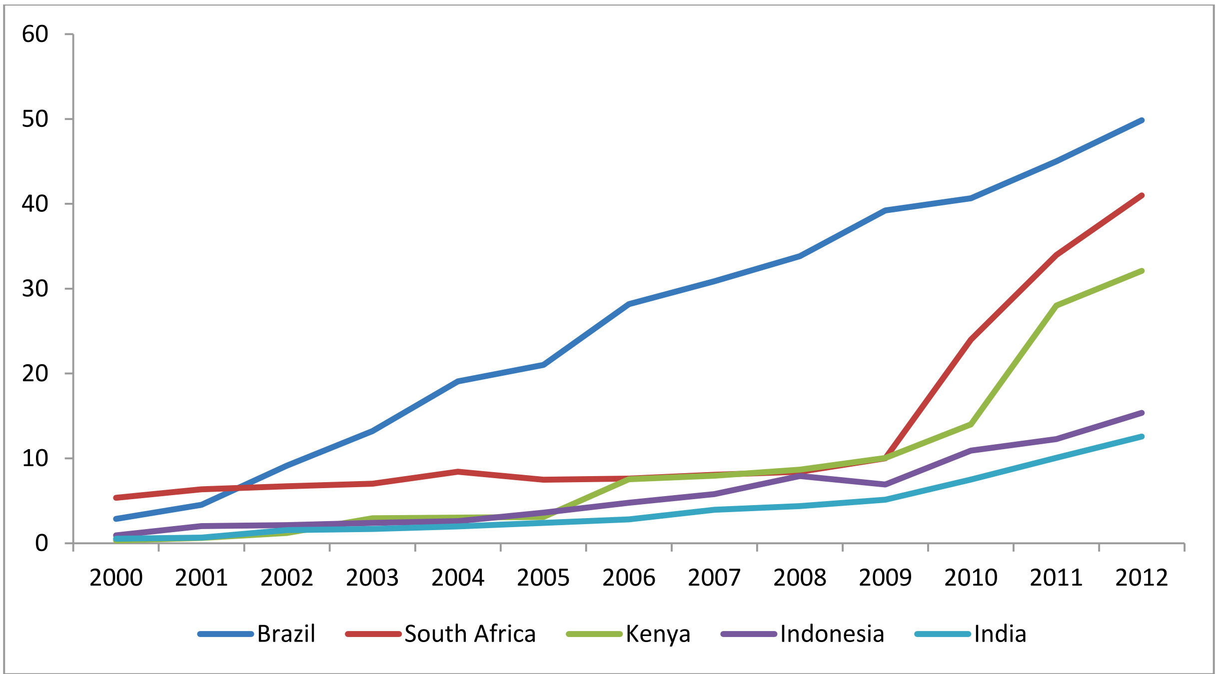
Findings

No reliable data are available for this indicator at present from the sources identified in the 2011 WSIS statistical framework.

Estimates for the overall adoption and use of the Internet in different countries are compiled by the ITU. These are reported in other chapters of this report, which are concerned with access to, and use of, ICT.

Chart 9.2 illustrates the growth in the percentage of Internet users for the five countries that were selected as example countries for this chapter, using ITU estimates. It shows the variable growth rates in Internet use that have been experienced in different developing countries. These have consequential impacts on access to content and the development of content in different languages.

Chart 9.2: Individuals using the Internet, 2000–2012, percentage



Source: ITU World Telecommunication/ICT Indicators Database.

Supplementary data that shed light on Internet adoption and use in different countries are available from some other sources, and these may begin to shed more light on access by language groups. Household surveys were conducted, for example, by the research institute Research ICT Africa (RIA) in some twelve African countries during 2011. These included a question on main household language and extensive questions about language preferences online, as well as more general Internet use.[34] Data from surveys such as this should in time shed further light on variations in Internet access by language group in selected countries at the time that they were taken.

The proportion of Internet users by language, top ten languages, global level

This is measured by Indicator 9.2, which concerns the proportion of Internet users accessing content through the top ten languages in global use (identified in the 2011 WSIS statistical framework as being (in alphabetical order) Arabic, Chinese, English, French, German, Japanese, Korean, Portuguese, Russian and Spanish).[35] It was hoped that this could be reported in two forms:

- the proportion of worldwide speakers of each language who use the Internet and
- the proportion of global Internet users distributed by language.

Some estimates of the proportion of Internet users falling within different language groups have been made at different stages in the development of the Internet. The source identified for this indicator in the 2011 WSIS statistical framework was the Internet data website Internet World Statistics (IWS), which published a calculation for this indicator using data from 2009. These data were derived from a number of sources including ITU and the US Bureau of the Census. IWS has since published an updated tabulation using estimates for Internet use and population for 2011.

As discussed earlier, there are significant statistical challenges involved in estimating the number of speakers using global languages. In making its calculation, IWS states that it allocated a single language to each individual, excluding secondary languages, though it is unclear what methodology was used to select this language in countries where a high proportion of the population is bilingual or multilingual. Other statistical challenges to which IWS drew attention included the need to make adjustments in the data for variable rates of infancy and illiteracy. These challenges, particularly those concerned with language attribution, are sufficient to make it inadvisable to draw strong conclusions from this indicator.

As things stand, there is no realistic prospect of sufficient data becoming available to allow substantive findings to emerge from indicator 9.2. It does not therefore provide a suitable basis for future assessment of Target 9 in the context of the discussion above, and should be discontinued.

Findings

As noted above, some earlier estimates for this indicator were made before IWS published its calculation in 2009. The five-year review of this target, published in 2010, suggested that the proportion of English speakers online in 1996 was as high as 80 per cent.[36] Subsequent estimates were made by Globalstat until around 2005, which found that the proportion of English speakers had fallen to 35 per cent by September 2004.[37]

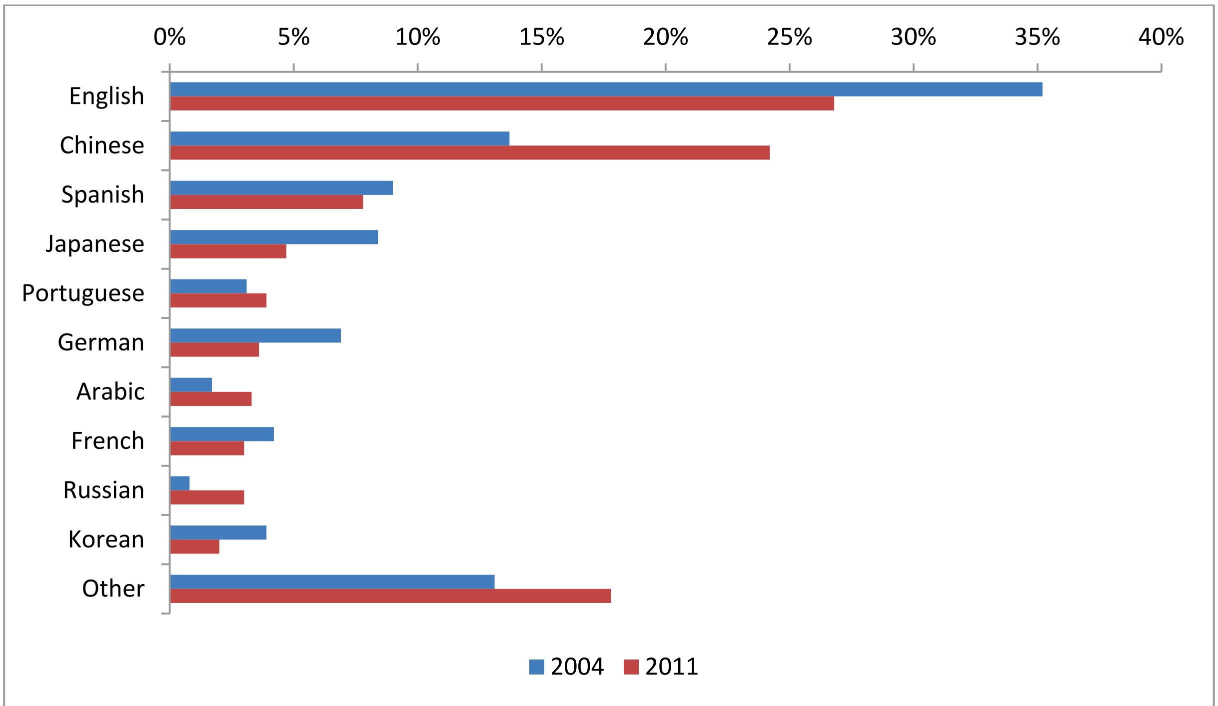
The 2011 estimates published by Internet World Statistics for this indicator are set out in Table 9.3. Chart 9.3 juxtaposes these 2011 data above with findings from the only Globalstat report, from September 2004, which is still available online. It is unclear how far these two data sets are compatible in terms of sourcing and methodology,[38] but they may provide a rough guide to shifts in the proportion of language speakers online. They suggest a decline during the period in the proportion of Internet users who are speakers of English, other European languages and languages from highly developed Asian economies (including Japanese and Korean), and a corresponding growth in the proportion speaking Russian, Chinese and other languages.

Table 9.3: Global Internet users by main global languages, IWS estimates, 2011

Language	Language speakers	Internet users	Internet penetration by language	Language users as percentage of total Internet users
English	1,302,275,670	565,004,126	43%	27%
Chinese	1,372,226,042	509,965,013	37%	24%
Spanish	423,085,806	164,968,742	39%	8%
Japanese	126,475,664	99,182,000	78%	5%
Portuguese	253,947,594	82,586,600	33%	4%
German	94,842,656	75,422,674	80%	4%
Arabic	347,002,991	65,365,400	19%	3%
French	347,932,305	59,779,525	17%	3%
Russian	139,390,205	59,700,000	43%	3%
Korean	71,393,343	39,440,000	55%	2%
Other	2,403,553,891	350,557,483	15%	18%
Total	**6,930,055,154**	**2,099,926,965**	**30%**	**100%**

Source: Internet World Statistics, http://www.internetworldstats.com/stats7.htm.

Chart 9.3: Estimated online language populations, percentage of global online population



Source: Internet World Statistics, http://www.internetworldstats.com/stats7.htm; Globalstat, http://web.archive.org/web/20041019013615/www.global-reach.biz/globstats/index.php3.

The proportion of webpages by language

This is measured by Indicator 9.3, which concerns the proportion of webpages accessible on the WWW that are available in different languages. This was intended to act as a proxy for online content creation by language.[39]

The 2011 WSIS statistical framework recognised that this indicator would be very difficult and expensive to measure because of the size and continued growth of the WWW, and that analysis would require enormous computing resources. Analysts today regard it as highly problematic to estimate the total number of webpages on the Internet, particularly since the volume of the web became so large that search engines ceased to index it as a whole. Netcraft estimated the size of the web in January 2014 at over 850 million hostnames and about 185 million active sites.[40] It was still estimated in early 2014 that 56 per cent of the top ten million websites used English as at least one of their content languages (though this does not mean that English was necessarily the site's predominant language).[41] While broadly representing the overall scale of accessible web content, such numbers can be misleading: for example, they include many pages that do not contain substantive content, while also under-representing the growth in user-generated content such as that on microblogs.

Measurement of this indicator, as defined, would require the systematic and comprehensive use of two complex and expensive sources and methodologies:

- web-crawling programmes, which comprehensively browse the WWW for indexing purposes and
- script and language identification programmes, which can analyse web content to establish the language in which it is written (bearing in mind that an unknown proportion of websites are themselves multilingual).

In the period between WSIS and adoption of this indicator, some relevant data were compiled by an international academic consortium, the Language Observatory Project (LOP).[42] This used a web crawler to search top level domains in a limited range of countries in Africa and Asia. Because of the high resource and financial costs involved, the project was confined to smaller countries, with relatively low content volumes, and to content hosted on ccTLDs, which may be differently distributed by language from that hosted on gTLDs (see Indicator 9.4 below).

However, this project has not reported data since 2007 and does not therefore provide a viable source for this indicator today. While a number of other projects have sought funding for similar work, these have not been successful to date.[43] Therefore, as with indicators 9.1 and 9.2, there are no substantive data available with which to assess progress on this indicator. It would not be feasible for the *Partnership* itself to initiate monitoring of this indicator because of the very high costs involved.

As with indicator 9.2, there is at present no realistic prospect of sufficient data becoming available to allow substantive findings to arise from Indicator 9.3, and it should therefore be discontinued. It may be possible in future to develop an approach that combines random sampling of webpages through a web crawling programme together with language recognition software. For this to be statistically valid, large samples of webpages would be required, and the technique would be expensive. It is therefore only likely to be viable if an independent research institute obtains funding to undertake the work.

A potential alternative source of data concerning content and language across the WWW would be search engines, whose business consists of indexing the web and facilitating access to specific content by end users. These no longer index the entirety of the web, as this is now too large for comprehensive indexing to be effective, but they are likely to have more credible evidence concerning this indicator than other potential sources. However, search engines are commercial businesses. Data concerning content, language and search activity represent an important part of their business model, and are not therefore available for external analysis.

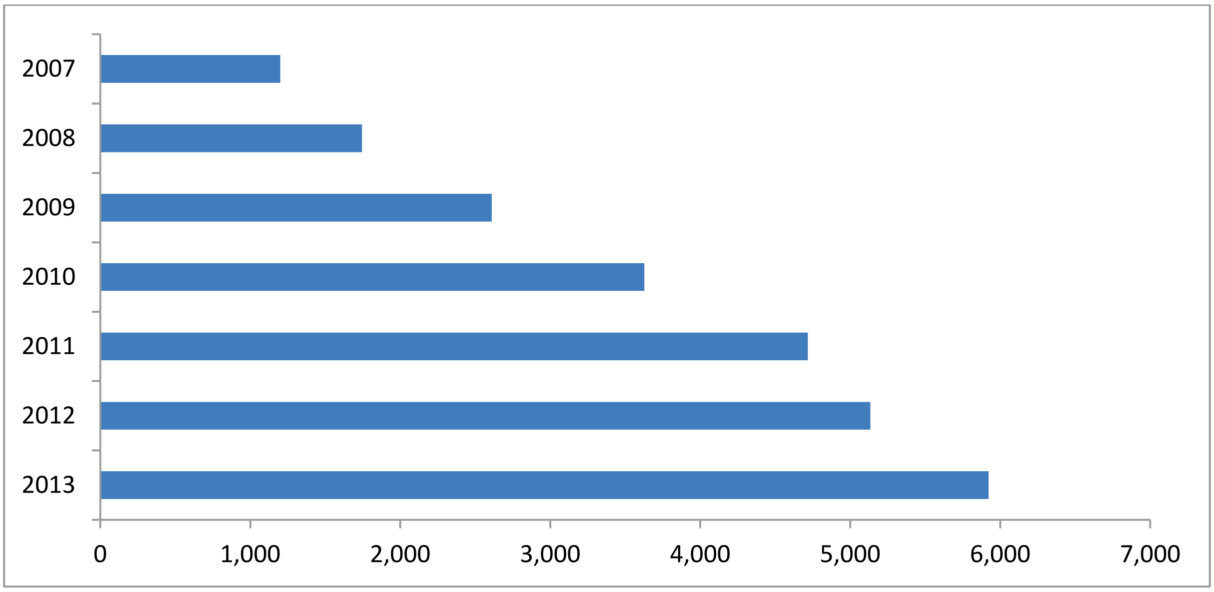
Findings

There are no satisfactory data that can be derived from the source originally anticipated for this indicator, and no substantive alternative data are publicly available.

Some estimates have been made of web content by language in particular regions. In 2013, the UN Regional Commission for Western Asia published data concerning the proportion of websites registered to ccTLD addresses from different Arabic-speaking countries that were in Arabic or English. These data need to be interpreted carefully as only a small proportion of domain registrations in Arabic-speaking countries are ccTLDs (18 per cent in 2013[44]), and because French rather than English is the predominant secondary language in some of them. However, among countries in which English is the prevalent secondary language, the proportion of webpages in Arabic from ccTLD domains varied from less than 17 per cent in Lebanon to more than 50 per cent in Saudi Arabia and Sudan.[45]

Some data have been published on the number of searches that are made using Google search, the leading search engine in most national markets, often with over 90 per cent of the search market, though not (according to 2010 data) predominant in China, Russia, Japan or the Republic of Korea.[46] The number of searches made through Google in 2013 exceeded 2 trillion, amounting to more than 5 billion searches daily. Growth in the number of Google searches daily is illustrated in Chart 9.4.

Chart 9.4: Growth in daily Google searches, 2007–2013, millions of searches



Source: http://www.statisticbrain.com/google-searches/.

With the caveats above concerning particular countries in mind, this can be taken as a useful proxy of the growth of Internet activity and content access in most countries. However, it has not been possible to obtain more detailed information disaggregating search data by country of origin or language.

The number of domain name registrations for each country code top level domain (ccTLD), weighted by population[47]

This is measured by Indicator 9.4. The 2011 WSIS statistical framework selected the number of ccTLD registrations, weighted by population, as a proxy indicator for the amount of content created within a country. This is the only indicator selected within Target 9 that focuses on content by country rather than by language.[48]

Each online content publisher requires at least one Internet domain, which provides it with a Unique Resource Locator (URL, for example, www.itu.int) on the WWW. The Internet domain name system (DNS), which allocates and manages domains, includes two main types of top level domain:

- Country code top level domains (ccTLDs), such as .uk in the United Kingdom and .za in South Africa, are administered by national ccTLD registries. There is one registry per country code.
- Global top level domains (gTLDs) are administered by a number of international businesses and organisations. The large majority of gTLD registrations are currently for .com (commercial) domains, with a further four gTLDs (.net, .org, .info and .biz) accounting for most of the remainder. The number of different gTLDs available is being greatly expanded following agreement in the Internet Corporation for Assigned Names and Numbers (ICANN), which oversees the domain name system. A substantial number of new gTLDs will therefore enter the market in the near future, some of which are likely to compete significantly with ccTLDs.

Internet users may obtain a relevant domain that is registered by either a gTLD registry (such as Verisign for .com or the Internet Society's Public Interest Registry for .org), or a ccTLD registry (such as Nominet for .uk or ZADNA for .za).[49] Many of these fall within subdomains that identify the type of content publisher involved (for example, .ac.uk for an academic entity in the UK; .co.za for a business in South Africa). These subdomains are administered through the relevant top level registry. There are also a small number of sponsored top level domains (sTLDs) that are used by particular communities, such as .aero (reserved for aviation).

Until 2010, top level domains were only available in Latin characters (though it was possible before then to obtain domains that used non-Latin characters in earlier parts of the domain name). Since 2010, ICANN has authorised a number of top level domains that use non-Latin characters (Internationalised Domain Names or IDNs). Languages that have seen significant use of these top level IDNs include Arabic, Chinese, Korean, Persian, Russian, Thai and a variety of languages in South Asia.

As at March 2014, there were approximately 148 million gTLD registrations worldwide (including a little over 1 million sTLDs), representing 54 per cent of the global market, alongside approximately 125 million ccTLD registrations (including a little over 1 million ccTLD IDNs).[50]

Domain registrations are a relatively good proxy for the number of publishers generating content on the Internet within a country because they have to be unique to a particular content source. No two domain names can be identical. The primary source of information for ccTLD registrations is the national ccTLD registry, of which there is generally[51] only one per country. Some, but not many, registries publish data on the number of registrations within their national domain (including subdomains). Where these data are not published, it may be possible to obtain them through direct enquiry or through the use of network utility tools. Most national registries belong to one of four regional associations, some of which also publish data across their regions.[52]

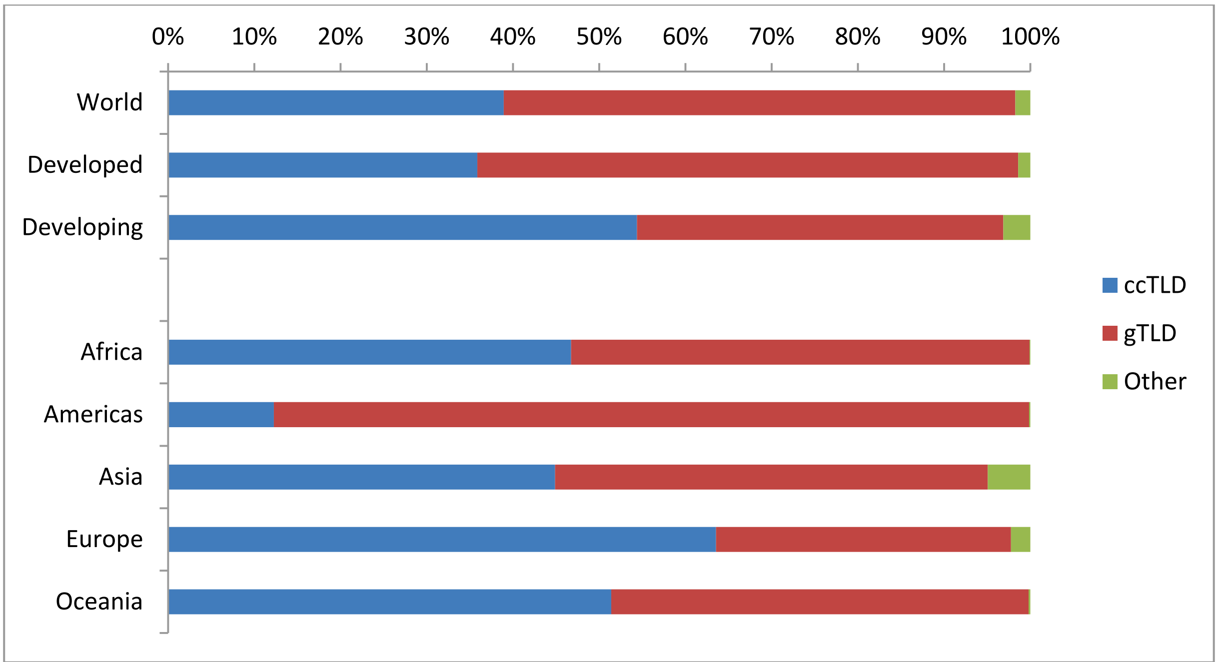
While ccTLD registrations appear at first sight to be a good proxy for local content generation, they have a number of serious limitations and need to be used with caution.

Internet users within a country can choose either a gTLD or a ccTLD registration (or one or more of each). The ratio between gTLD and ccTLD registrations in different countries varies considerably as a result of a number of factors, including the relative cost of registration, the relative complexity and time required for registration processes, and the brand value associated with different national domains. In some countries, for example, the cost of a ccTLD registration is much higher than that for a gTLD. In some, a ccTLD registration may be viewed more positively by a business's customers, because it represents local identity, while in others a gTLD registration may be preferred because it appears to represent global reach and scale. The introduction of many new gTLDs over the next few years could also significantly affect the balance between gTLD and ccTLD registrations. Many of the new gTLDs are designed to appeal to economic, social and cultural sectors or identities, and so offer an alternative option to the geographic branding offered by ccTLDs.

Fortunately, it is possible to use geolocation techniques to identify the country of origin of gTLD registrations, and current data concerning this are published by the Internet domain search database WHOIS.[53]

The balance between gTLD and ccTLD registrations in world regions in December 2013 is illustrated in Chart 9.5. (Data for this Chart include the six leading gTLDs,[54] which account for over 99 per cent of gTLD domains. They exclude 15 ccTLDs that function as virtual gTLDs (see below). IDNs are included as 'Other domains' rather than as ccTLDs or gTLDs.)[55]

Chart 9.5: The balance between gTLD and ccTLD registrations in world regions, 2013



Source: Data supplied by ZookNIC, compiled from ccTLD, Whois and other sources.

Chart 9.5 shows that ccTLD registrations are a minority of total registrations worldwide. In addition, there are considerable variations in the ratio between gTLD and ccTLD registrations in different world regions. Country code registrations are least common in the Americas, because gTLDs have always been the norm in the United States. They are also particularly uncommon in the Arabic-speaking region. Country code top level domain (ccTLD) registrations make up a significant majority of registrations in Europe and are also particularly common in the CIS region. This degree of variation makes ccTLDs alone an unreliable proxy for local content.

The overall balance between gTLD and ccTLD registrations has been relatively stable over the period since WSIS. The proportion of ccTLDs among total registrations worldwide was between 38 per cent and 39 per cent in each of the three years assessed for this report (2003, 2008 and 2013), though there has been a small increase in the proportion of ccTLD registrations in developed countries since 2008 and a more significant decrease (from 60 per cent to 54 per cent) in the proportion in developing countries.[56]

A further complication arises from the fact that not all ccTLD registrations represent local content or local registrants. Some, but not all, ccTLD registries accept registrations from non-domestic users. Some 15 ccTLDs with suitable domain extensions have been marketed or used as, in effect, virtual gTLDs. Examples of these include .me (Montenegro; used for personal websites), .co (Colombia, used as an alternative to .com for business registrations), .nu (Niue; used for various meanings in different languages), .tv and .fm (Tuvalu and the Federated States of Micronesia, both used by broadcasters).[57] The most extreme example of a ccTLD outreaching its domestic market is .tk, the ccTLD for the New Zealand dependency of Tokelau that has some 1 200 inhabitants but makes domain registration available free of charge and was responsible for more than 20 million ccTLD registrations by December 2013 – more than any gTLD other than .com, and 5 million more than the next highest ccTLD, Germany.[58] The 15 ccTLDs that act as virtual gTLDs have been excluded from the analysis in this section of the chapter, leaving a total of approximately 96 million ccTLDs under discussion.

Large businesses and other organisations often have multiple registrations. Global businesses such as Google and Amazon, for example, make use of ccTLDs in many countries as well as their global .com domains (and are in the process of setting up new gTLDs with their own identities). Google can be accessed through some 200 national domains as well as through google.com.[59] Some traditional businesses and organisations also procure a number of domains from both gTLDs and ccTLDs, so that they can visibly provide tailored services in particular countries and also in order to protect trademarks, brand identities etc. These multiple registrations may be more common in larger than in smaller countries because of the greater number of large businesses and organisations in those countries.

The factors discussed above suggest that, rather than using ccTLD registrations alone as a proxy for local content creation, it would be preferable to include both ccTLD registrations and gTLD domains that are registered from within the same national territory, as identified through geolocation. If indicator 9.4 is to be retained, therefore, it should be revised to include both ccTLD and gTLD data, and to incorporate IDNs.

Data required for this indicator are difficult to collate, particularly longitudinal data. The analysis below would not have been possible without the assistance of the consultancy ZookNIC, which has maintained historic data on registrations throughout the period since WSIS. The future viability of this indicator is dependent on access to comparable data being available.

Findings

Domain name data for both gTLDs and ccTLDs are compiled regularly by the consultancy ZookNIC.[60] These data are derived from a number of sources, including published ccTLD registry reports, analysis of TLD root zone files, network utility tools and direct correspondence with registry operators. Historic data from these sources illustrate the growth of registrations within each country or territory over time. The following paragraphs present findings concerning both ccTLD registrations (the existing indicator) and total registrations (ccTLD plus gTLD and other registrations) in different countries and territories over the period since WSIS.

The data and analysis in this section have been prepared in collaboration with ZookNIC, using data from its comprehensive database of domain name registrations, which have been generously made available for this purpose. As indicated above, the data raise a number of interpretation challenges. In addition to the balance between gTLD and ccTLD registrations and the incidence of virtual gTLDs, there are definitional differences between registries concerning what to include in domain counts – for example, some registries may not include inactive domains. A number of registry policies – such as pricing, limits on the number of domains a single entity can register, and identification or residency requirements – also complicate direct comparisons between registries.

It is clear, too, that content made available through local domains is not necessarily local in nature, while a good deal of content that is local in nature is generated on social media sites and therefore not reflected in domain counts. However, the data summarised below, particularly those for ccTLD and gTLD registrations together, do represent a worthwhile proxy for web content that is generated by country and add significantly to our knowledge of relevant trends.

Table 9.4 shows the overall numbers and proportions of registrations by region – and for developed and developing countries as defined by ITU – for each of the three years 2003, 2008 and 2013.

Table 9.4: Total registrations by world region, 2003–2013

	2003		2008		2013	
	Millions	Percentage	Millions	Percentage	Millions	Percentage
World	59.7	100%	173.4	100%	245.2	100%
Developed	49.6	83%	135.9	78%	197.4	81%
Developing	7.1	12%	34.7	20%	45.0	18%
Other/Unknown	3.1	5%	2.8	2%	2.7	1%
Africa	0.3	0.5%	1.0	0.6%	2.3	0.9%
Americas	23.9	40%	71.8	41%	98.9	40%
Asia	5.3	9%	29.8	17%	36.9	15%
Europe	25.8	43%	63.7	37%	98.0	40%
Oceania	1.2	2%	4.2	2%	6.4	3%

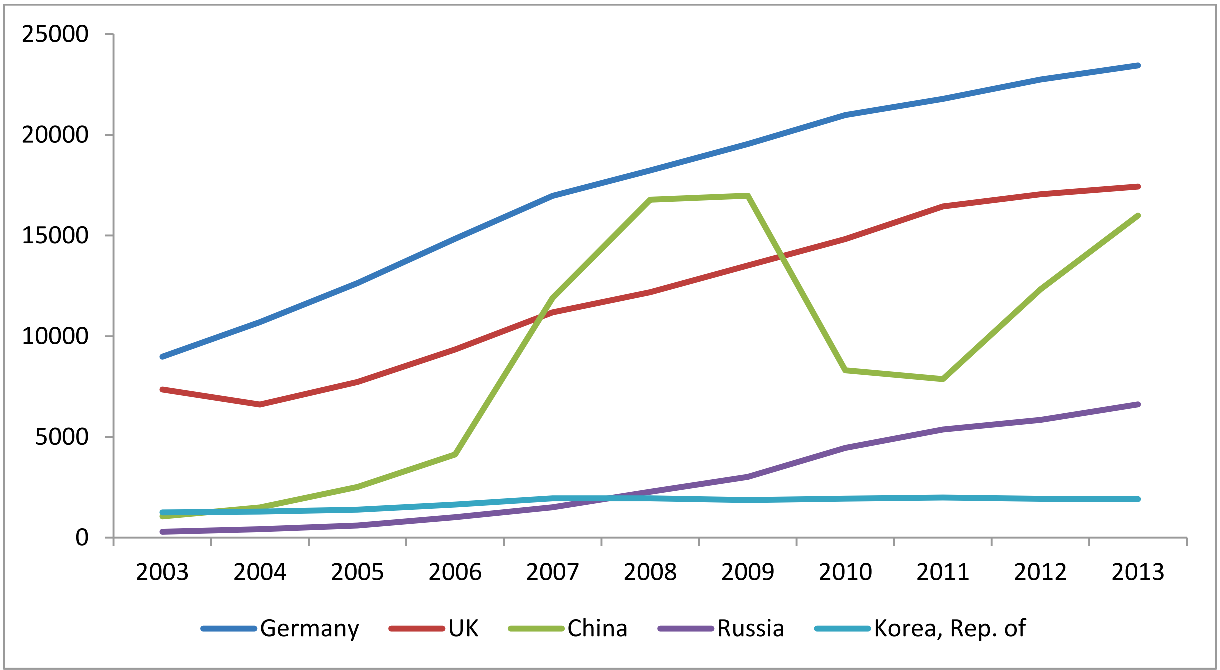
Source: Data supplied by ZookNIC, compiled from ccTLD and other sources (see above).

Note: Figures exclude 15 ccTLDs that act as virtual gTLDs.

This table shows that the Internet has continued to be dominated by content providers in Europe and the Americas throughout this period. The proportions of domain registrations from these two continents are very substantially greater than that from Asia, which has a substantially higher population. The proportion of registrations from Africa remains below 1 per cent, while the continent has a little less than 15 per cent of world population.

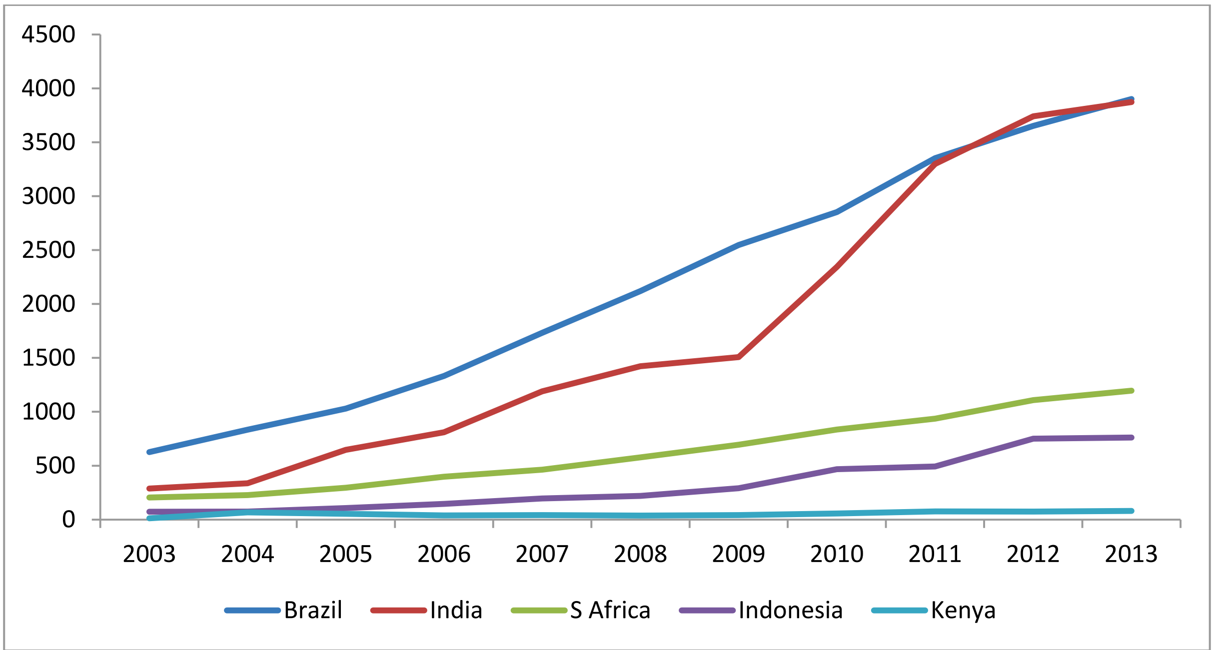
Charts 9.6 and 9.7 show the trend in the development of ccTLD and total registrations for selected countries – including five leading Internet user countries (Chart 9.6) and the five developing countries selected for review in this chapter (Chart 9.7) – year-on-year since 2003.

Chart 9.6: Total domain registrations (thousands), 2003–2013, leading Internet countries



Source: Data supplied by ZookNIC, compiled from ccTLD, Whois and other sources (see below).
Note: Figures exclude 15 ccTLDs that act as virtual gTLDs.

Chart 9.7: Total domain registrations (thousands), 2003–2013, developing countries



Source: Data supplied by ZookNIC, compiled from ccTLD, Whois and other sources (see below).
Note: Figures exclude 15 ccTLDs that act as virtual gTLDs.

These illustrate steady rates of growth in registrations, with more rapid growth in Brazil and India than in other developing countries illustrated. The number of registrations in Kenya is still low, but has also grown steadily, from 12 000 in 2003 to 80 000 in 2013. The rapid growth, decline and return to growth in China, illustrated in Chart 9.6, resulted from a period of aggressive price competition for registrations in the middle years of the decade, followed by a return to more normal registration pricing.[61]

Indicator 9.4, which was adopted in the 2011 WSIS statistical framework, proposed to measure the number of ccTLD registrations per head of population. This indicator can also be calculated as a proportion of the number of Internet users in a country as estimated by ITU. The same calculations can be made for total registrations, including both ccTLDs and gTLDs. Table 9.5 sets out the numbers of people per ccTLD and per TLD registration in world regions for the three years 2003, 2008 and 2013, while Table 9.6 sets out the numbers of Internet users per ccTLD and per TLD for the same three years.

Table 9.5: Persons per ccTLD and TLD registration, world regions, 2003–2013

	2003		2008		2013	
	per ccTLD	per TLD	per ccTLD	per TLD	per ccTLD	per TLD
World	278	106	101	39	75	29
Developed	62	24	27	9	18	6
Developing	1518	727	264	159	241	131
Africa	5103	2859	1839	933	1053	492
Americas	329	36	137	13	80	10
Asia	1804	723	238	137	260	117
Europe	42	28	18	12	12	8
Oceania	51	27	21	9	12	6

Source: Data supplied by ZookNIC, compiled from ccTLD, Whois and other sources (see below).
Note: Figures exclude 15 ccTLDs that act as virtual gTLDs.

Table 9.6: Internet users per ccTLD and TLD registration, world regions, 2003–2013

	2003		2008		2013	
	per ccTLD	per TLD	per ccTLD	per TLD	per ccTLD	per TLD
World	34	13	23	9	29	11
Developed	26	10	16	6	14	5
Developing	83	40	39	23	74	40
Africa	82	46	151	76	221	103
Americas	99	11	61	6	49	6
Asia	124	50	39	23	84	38
Europe	14	9	9	6	9	5
Oceania	22	12	12	5	8	4

Source: Data supplied by ZookNIC, compiled from ccTLD, Whois and other sources (see below).
Note: Figures exclude 15 ccTLDs that act as virtual gTLDs.

Table 9.7 presents the gross and Internet-user populations per ccTLD and TLD registration for a selection of countries in 2012/2013, including the leading Internet and developing countries included in charts 9.6 and 9.7, and other countries representing different economic groupings.

Table 9.7: Gross and Internet-user population per domain registration, 2012/2013

Country		Persons		Internet users
	per ccTLD	per registration (total registrations)	per ccTLD	per registration (total registrations)
Germany	5.1	3.4	4.3	2.8
UK	5.8	3.6	5.0	3.1
China	144.2	91.8	61.0	38.8
Russia	29.1	21.6	15.5	11.5
Korea, Rep.	49.8	25.4	41.9	21.3
Brazil	60.7	51.4	30.2	25.6
India	730.1	323.2	91.85	40.7
Indonesia	2434.3	330.3	373.9	50.7
Kenya	1449.8	555.8	465.4	178.4
South Africa	59.4	44.2	24.4	18.1
Australia	8.5	4.2	7.0	3.5
Spain	26.4	11.9	19.0	8.6
Chile	38.7	32.4	23.8	19.9
Venezuela	123.8	89.1	54.5	39.3
Iran, Islamic Rep.	166.1	104.9	43.2	27.3
Thailand	1053.7	84.8	279.2	22.5
Viet Nam	204.3	123.8	80.7	48.9
Mozambique	6457.5	3697.4	313.2	179.3
Niger	119664.4	4766.1	1687.3	67.2
Burkina Faso	201547.6	15197.5	7517.7	566.9

Source: Data supplied by ZookNIC, compiled from ccTLD, Whois and other sources.

Note: Population data are 2013 estimates; Internet user data are 2012 estimates.

While there are limits to the extent to which ccTLD and TLD registrations can be seen as proxies for local content creation, these data clearly show that there is still very considerable diversity in the extent to which the Internet has become pervasive in different countries, and the extent to which content is being published on the web by content providers in different types of country. In particular:

- Developed countries, which have very high rates of Internet access and use, typically also have high numbers of TLD registrations, with the result that, in many cases, they record fewer than ten people and fewer than five Internet users per TLD.
- Middle income developing countries, most of which have rapidly rising Internet user rates, have higher numbers of citizens and Internet users per registration, often with between 30 and 100 citizens (or between 20 and 50 Internet users) per registration.
- Least developed countries are likely to have much lower levels of registration density, as indicated by the figures for Mozambique, Niger and Burkina Faso in Table 9.7.

As expected, there appears from this evidence to be a broad association between the density of TLD registrations and levels of economic development. However, these are clearly not the only factors involved. Within Europe, for example, significantly more citizens and Internet users are recorded per registration in Spain than in Germany or the United Kingdom. Within West Africa, Burkina Faso has a much lower density of both ccTLD and TLD registrations than its neighbour Niger, which has a comparable level of GDP and a comparable Human Development Index ranking.

One additional finding from these data that is worth noting is the relationship between growth rates of Internet use and registration density. The data in Table 9.6 show that the number of Internet users per registration has fallen over the past five years in the Americas, Europe and Oceania, where Internet usage levels are generally high (and therefore no longer growing at a significant rate relative to population). The number of Internet users per registration rose over the period 2008–2013 in Africa and Asia, because they have higher growth rates in Internet usage than in registrations. Where Internet usage levels are relatively low, it is these rather than registration levels that are likely to be the primary determinants of registration density. Measuring registrations against population is therefore a more reliable proxy for local content generation than measuring them against Internet users.

There is considerable scope for further analysis of data concerning registrations, which could shed further light on patterns in the national and international development of the Internet.

Internationalised Domain Names (IDNs)

Internationalised Domain Names can be registered in three different ways:

- through a non-ASCII TLD (such as .中国 for China or .СРБ for Serbia (which can accommodate either ASCII or non-ASCII characters at lower levels (that is, 'before the dot') (IDN TLD)
- by using non-ASCII characters 'before the dot', combined with an ASCII character ccTLD (IDN.ccTLD)
- by using non-ASCII characters 'before the dot', combined with an ASCII character gTLD (IDN.gTLD).

A full range of IDNs became available in 2010, when the first IDN TLDs were authorised. However, IDN.ccTLDs have been available since 2004, while IDN.gTLDs first became available within .com and .net before then.

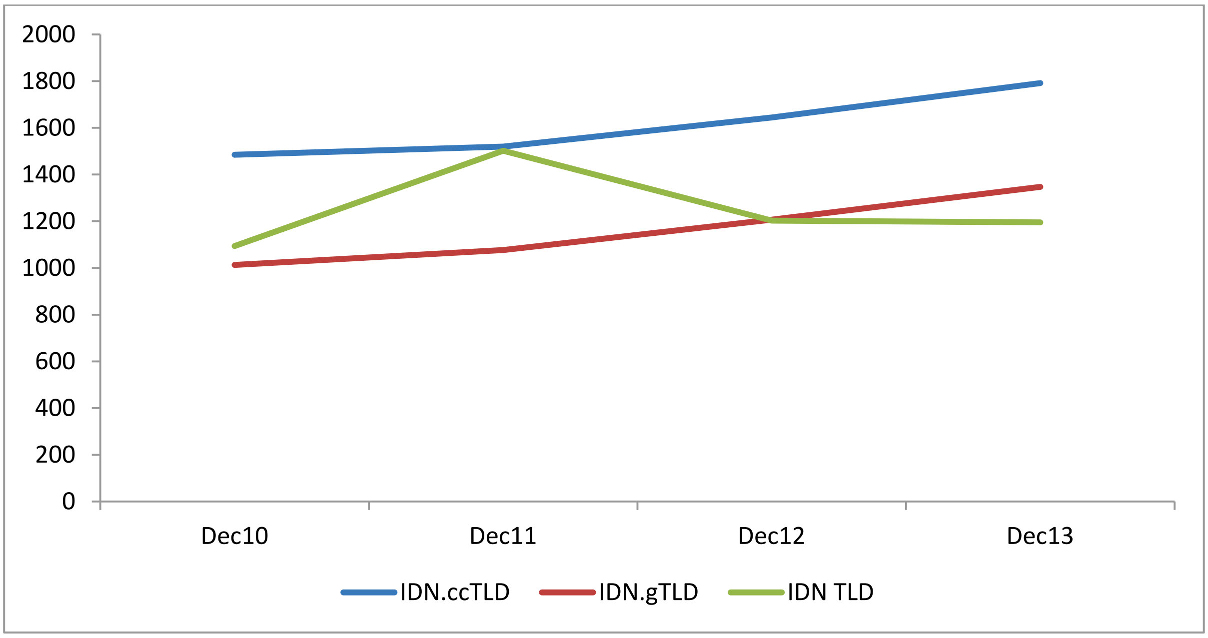
Findings

By late 2013, there were 44 IDN TLDs available, including 41 IDN ccTLDs, representing 31 countries (there were seven representing different language scripts in India), and three IDN gTLDs (one in Japanese and two in Chinese).[62]

Data for IDNs have been kindly provided by ZookNIC for the period since the introduction of IDN TLDs in 2010. Chart 9.8 illustrates the total number of IDN domains extant in December of each year since then.

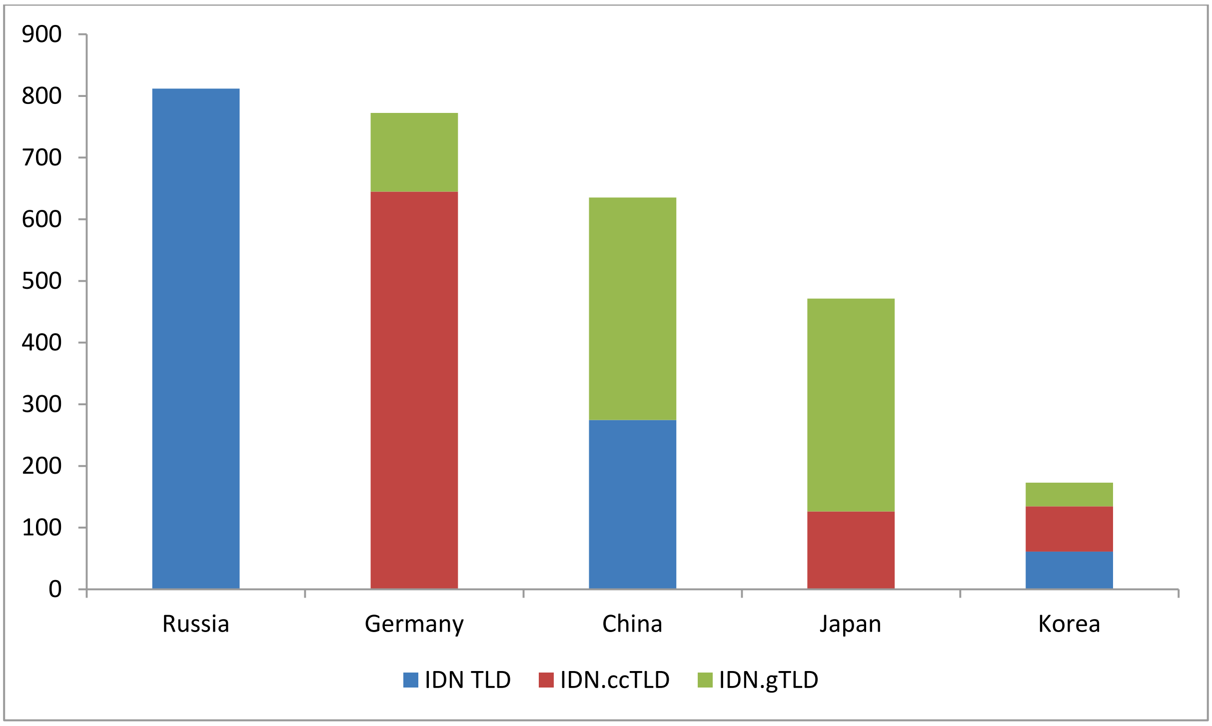
Chart 9.9 illustrates the preponderance of leading countries within each type of domain.

Chart 9.8: Types of IDN, 2010–2013, registrations, thousands



Source: Data from ZookNIC, compiled from ccTLD, Whois and other sources.

Chart 9.9: Number and type of IDN, leading countries, 2013, thousands



Source: Data from ZookNIC, compiled from ccTLD, Whois and other sources.

These data show that there has been only modest uptake of IDNs in recent years. Following an initial surge, since 2011 there has been a decline in the number of registrations with IDN TLDs and only modest growth in the total number of IDN registrations, to stand at just over 4 million in December 2013, according to ZookNIC's data. (This compares with a figure of 5 million cited by the .eu registry EURid and UNESCO in their annual report on world deployment of IDNs for 2013 (UNESCO and EURid, 2013). The difference between these figures probably results from different counting norms concerning unused registrations.[63]) IDNs remain a small proportion of global registrations and this proportion is not growing rapidly at present.

The number and share of Wikipedia articles by language[64]

This is measured by Indicator 9.5, which is concerned with the number of Wikipedia articles by language. It seeks to observe this over time, as a proxy for user-generated online content creation, using data published by the Wikimedia Foundation.[65]

Wikipedia is the largest and most widely used online encyclopaedia. Founded in 2001, its content is created by an online community of independent contributors and editors. Although the most substantial volume of Wikipedia content is in English, by the end of 2013 content was available online in 287 languages. However, 162 of these are listed as having fewer than 1 000, and 63 as having fewer than 100, articles.[66] According to Alexa's rankings, which are derived from selective toolbar-based monitoring, Wikipedia is one of the ten most visited WWW sites, both worldwide and in the majority of the 126 countries on which it publishes data, though it is likely to rank lower than this on pageviews. By February 2014, it received more than 20 billion page views per month, accessing more than 30 million pages of content. In only a few countries – including China – was it not the predominant reference site.[67]

Wikipedia and its related sites (such as Wiktionary and Wikinews) are coordinated by the Wikimedia Foundation, a non-profit organisation that publishes wide-ranging statistical information about its content and other aspects of performance.[68] Although indicator 9.5 is specifically concerned with the language distribution of Wikipedia content (articles), publication of these data also allows analysis of content creation and content access/usage by language. These related aspects of Wikipedia content are also discussed below.

Wikipedia data provide an illustration of trends in online content and language from a website that has a high level of popularity across the globe – though one that is less widely used in some substantial Internet markets, such as China, Russia and the Republic of Korea, than it is in others.

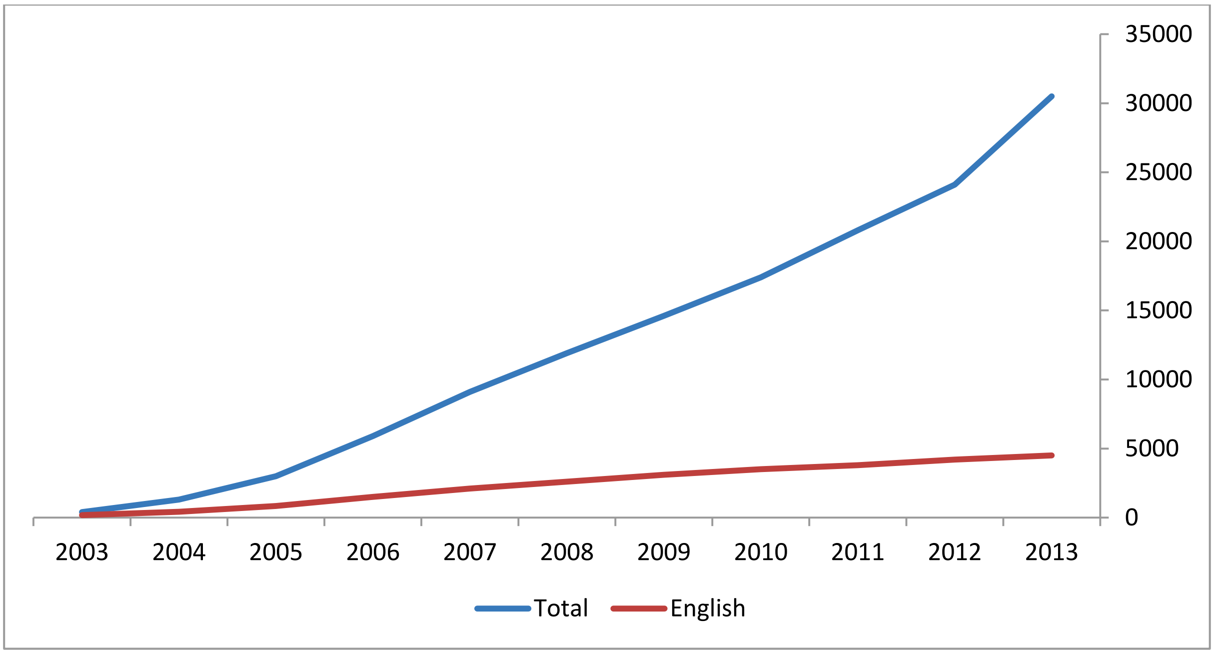
Wikipedia is also to some extent a proxy for the development of user-generated content. However, while its content is user-generated, the ratio between content creation and content access on Wikipedia – between contributors/editors and users/readers – is very different from that on social networking and microblogging platforms, where the majority of users both create and access content. Some information on other social media platforms is therefore included later in this chapter.

Indicator 9.5 has value as a proxy indicator for changes in Internet content by language, though it has significant limitations and its representativeness should not be assumed. Wikipedia is, at present, a major Internet presence in most countries and territories, but reliance on it as a proxy for content by language will lead to under-representation of languages where it is not the primary reference site (particularly Chinese). Furthermore, Wikipedia content is not necessarily representative of other Internet content (or of social media content), nor can Wikipedia's continued pre-eminence as a reference tool be assumed. Nevertheless, much more extensive data are publicly available on Wikipedia content than on other comparable platforms. If the target is retained, therefore, indicator 9.5 should be retained, and extended to include data concerning the languages of contributors/editors (content creation) and page views (content access/usage) as well as articles (content created). The treatment of bot-generated and automatically translated articles within analysis (see below) should be reviewed, in conjunction with the Wikimedia Foundation.

Findings

The total number of Wikipedia articles has risen from 398 000 at the end of December 2003 to 30 500 000 in December 2013. The proportion of articles written in English has declined during this period fell from 46 per cent to 15 per cent. These trends are illustrated in Chart 9.10.

Chart 9.10: Wikipedia articles – total and English language, 2003–2013, thousand articles



Source: Wikipedia statistics at http://stats.wikimedia.org/EN/TablesArticlesTotal.htm.

Data for the number of articles in each language available on Wikipedia are published in time series dating back to 2003. The number of articles by language recorded by Wikimedia at December in each of these years, for the ten languages identified in indicator 9.2, and for all other languages, is set out in Table 9.8.

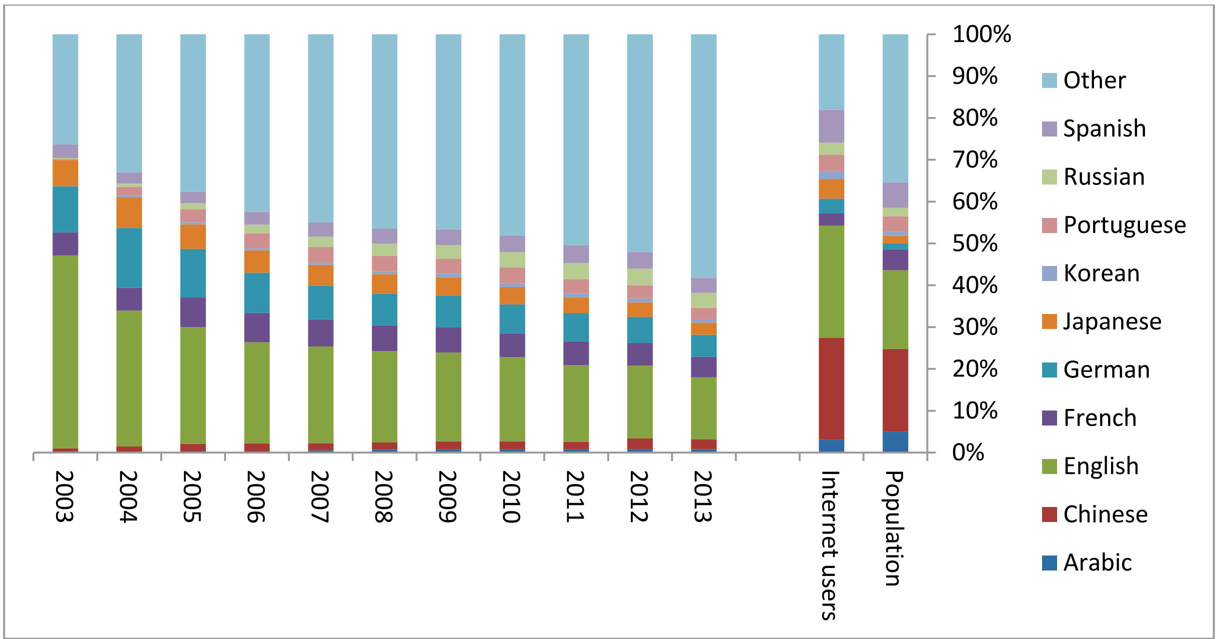
Table 9.8: Wikipedia articles by language, 2003–2013, thousand articles

Year	Arabic	Chinese	English	French	German	Japanese	Korean	Portuguese	Russian	Spanish	Other
2013	250	733	4500	1500	1600	895	262	810	1100	1100	17748
2012	204	610	4200	1300	1500	843	228	760	946	964	12541
2011	160	382	3800	1200	1400	788	186	710	801	870	10501
2010	135	329	3500	1000	1200	726	151	659	638	701	8359
2009	112	279	3100	886	1100	644	119	528	474	550	6807
2008	80	207	2600	738	897	552	83	443	343	431	5526
2007	49	158	2100	592	732	452	49	340	223	310	4095
2006	22	106	1400	410	557	310	30	206	118	178	2463
2005	11	51	837	212	349	175	16	91	46	80	1129
2004	2	17	422	71	186	95	5	28	10	35	429
2003	1	3	184	22	44	25	0	1	1	13	105

Source: Wikipedia statistics at http://stats.wikimedia.org/EN/TablesArticlesTotal.htm, accessed 11 April 2014.

The distribution of articles by language for the ten years since 2003, revealed in Table 9.8, is illustrated in Chart 9.11. This also sets this distribution against the distribution of languages spoken by the population as a whole and by Internet users resulting from the IWS data for 2011 presented under Indicator 9.2.

Chart 9.11: Distribution of Wikipedia articles by language, 2003–2013



Source: Wikipedia statistics at http://stats.wikimedia.org/EN/TablesArticlesTotal.htm, data for December each year.

Chart 9.11 shows that there has been a strong reduction in the proportion of Wikipedia articles that are in English, which has fallen from 46 per cent in 2003 to 15 per cent in 2013; and a corresponding increase in the proportion of articles that are in languages other than the ten most-used international languages, up from 26 per cent in 2003 to 58 per cent in 2013. In fact, several languages that are not in the top ten most popular languages, as identified in indicator 9.2, have substantially higher numbers of articles on Wikipedia than some of those included in this chart. These include several European languages. Dutch, Italian, Polish and Swedish all accounted for more than 1 million articles in 2013, some four times or more than the figure for Arabic or Korean; while Ukrainian and Catalan accounted for just under half a million each. There were also high numbers of articles in some non-European languages, including just under a million in Vietnamese.[69]

These article counts need to be interpreted with care.

- Different language groups in the Wikipedia community take different views of the appropriateness of bot-generated content and automated translation. These differences account for the rapid growth of content in some languages, for example the seventyfold and 20-fold growth in content in the Filipino languages Waray-Waray and Cebuano during 2013. There are even 119 000 articles in the artificial language Volapuk, almost all created in or before 2008. These differences in Wikipedia practice by language community exaggerate the growth in content in ‘Other languages' overall.[70]
- Articles also vary in length and depth. Wikipedia did not at the time of writing publish comprehensive data on the number of words by language in Wikipedia content, or on the number of longer articles by language against which the variation in length and depth of

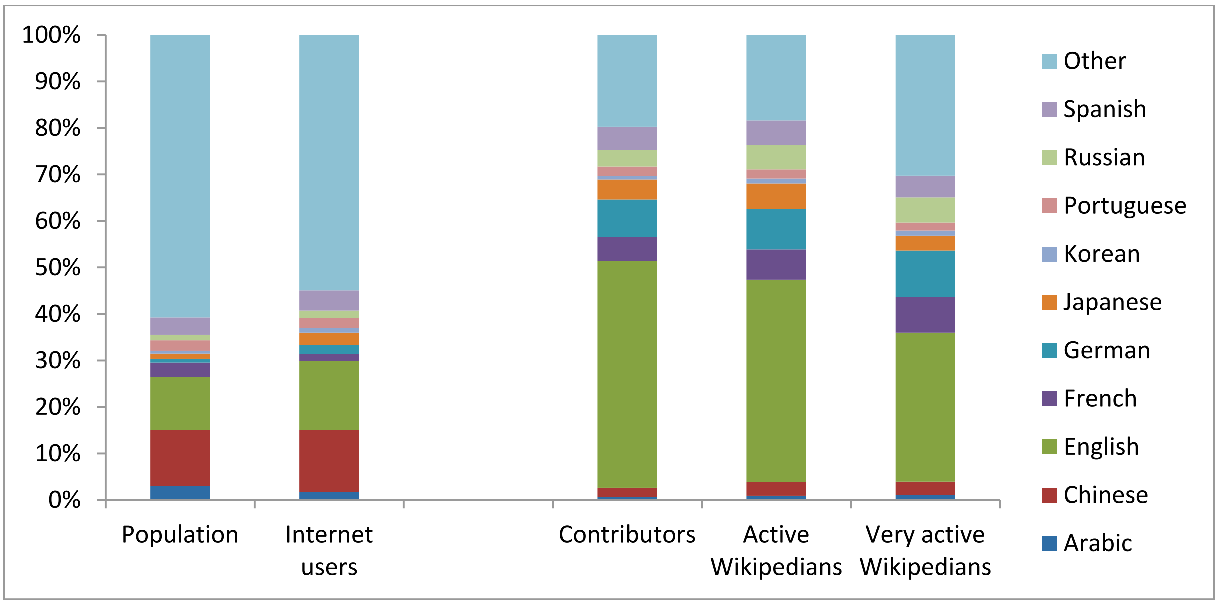
language can be assessed. However, comprehensive datasets for these indicators, covering all languages, should be available from the latter half of 2014.[71]

- As well as considering the language in which content is written, it is also useful to consider the cultural diversity of article content. To do so goes beyond the remit of this report, but some statistical research has been undertaken using articles concerned with geographic locations.[72] Suitable measures of the range of content could be included in future monitoring and measurement.

Regardless of these caveats, the data presented above suggest a strong current of diversification in the languages in which Wikipedia content is available. These can be juxtaposed to some extent with data representing content creation and content access/use.

Chart 9.12 illustrates the proportion of Wikipedia contributors (those who have contributed ten edits or more throughout the life of Wikipedia), active contributors (those who contribute five or more edits per month) and very active contributors (those contributing more than 100 edits per month), in the different language groups. (Figures for contributors therefore include historic contributors who no longer participate, while the other columns include only those who are currently active.) It shows a significantly higher predominance of content creation by contributors writing in English than is suggested by the proportion of articles in Chart 9.11. The higher proportion of minority language users among very active contributors suggests that contributions in those languages may tend to come from a small number of enthusiasts rather than a wider circle of occasional contributors.

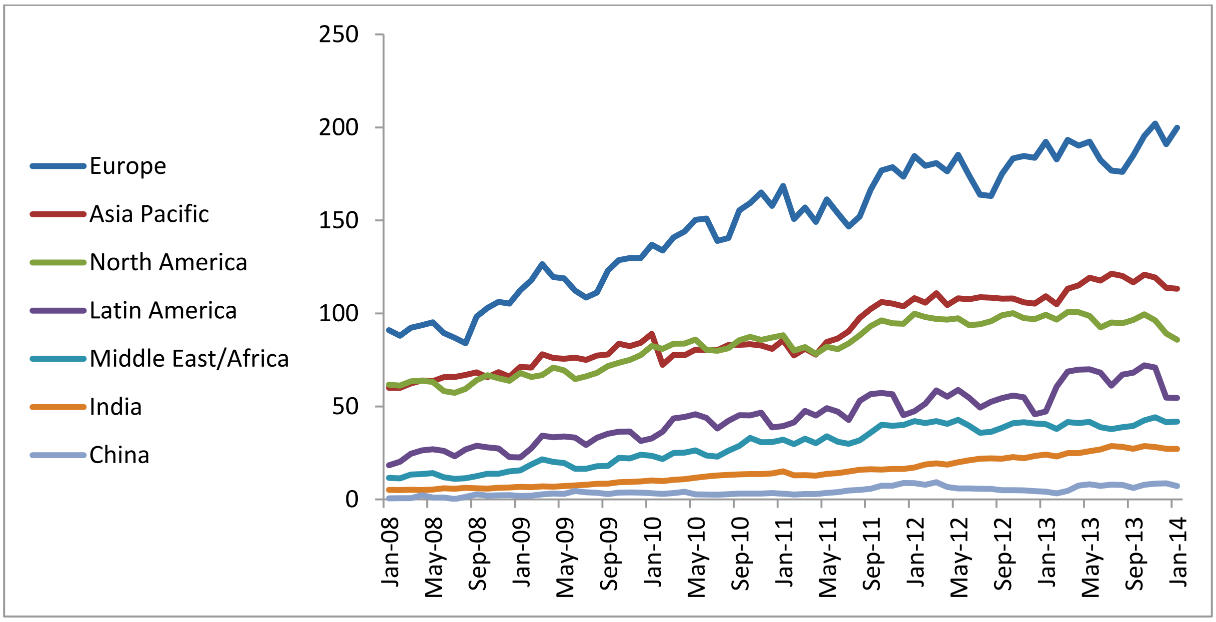
Chart 9.12: Linguistic density of Wikipedia contributors, December 2013



Source: Wikipedia statistics accessed via http://stats.wikimedia.org/EN/Sitemap.htm, accessed 11 April 2014.

The growth of Wikipedia monthly unique visitors by country/region, derived from Comscore's sampling methodology rather than from Wikimedia data, is illustrated in Chart 9.13.

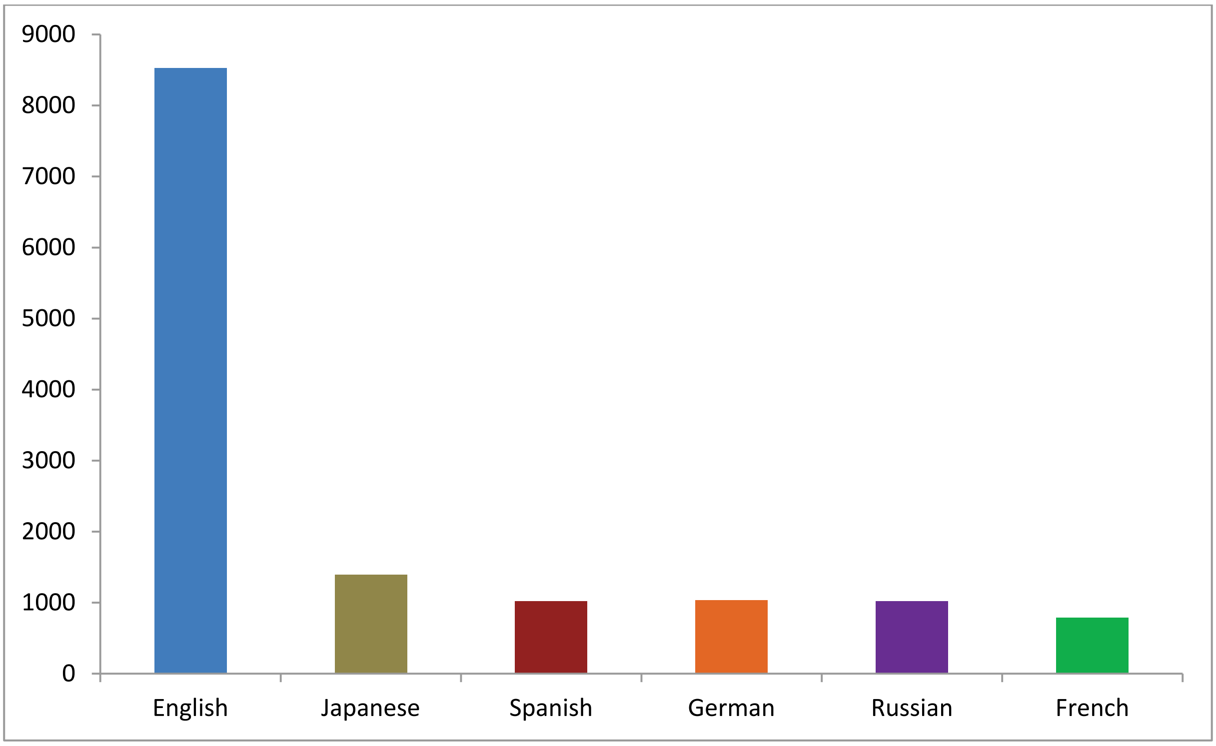
Chart 9.13: Wikipedia unique visitors by country/region, 2008–2013, million pageviews



Source: Wikimedia data at http://reportcard.wmflabs.org/#, derived from Comscore, viewed 10 March 2014.

The distribution of monthly pageviews by language, as at December 2013, is set out in Chart 9.14.

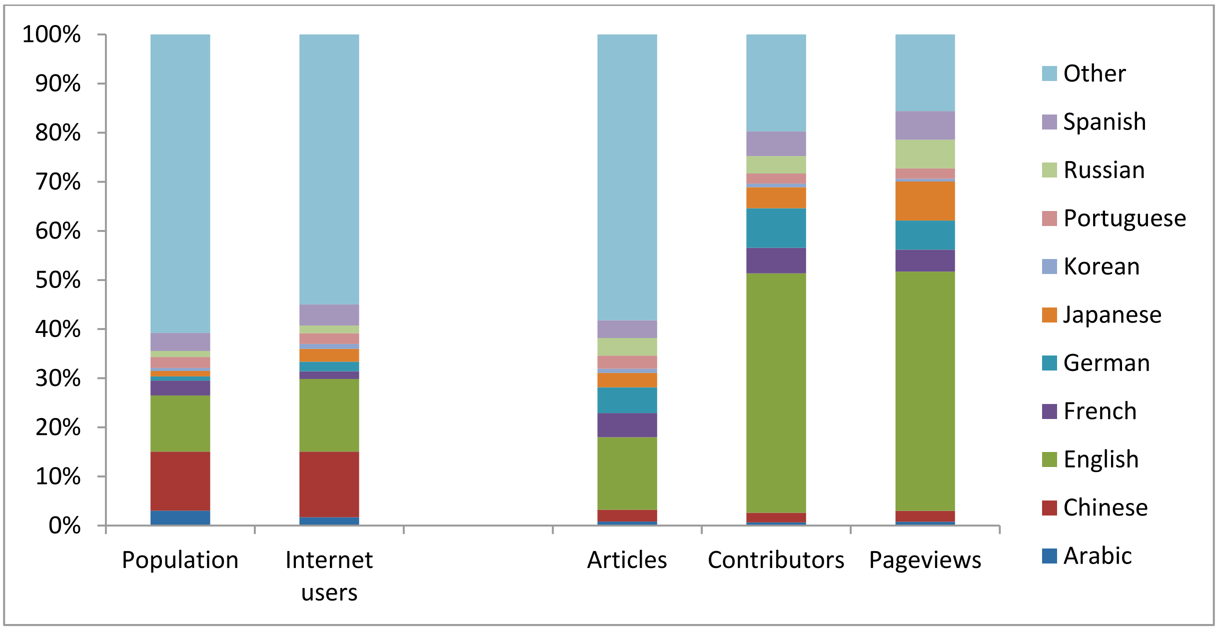
Chart 9.14: Wikipedia monthly pageviews (millions), leading languages, December 2013



Source: Wikimedia data accessed via http://stats.wikimedia.org/EN/TablesPageViewsMonthlyCombined.htm.

These measures of content creation, content itself and content access can be drawn together as in Chart 9.15.

Chart 9.15: Wikipedia contributors, articles and pageviews, leading languages, December 2013

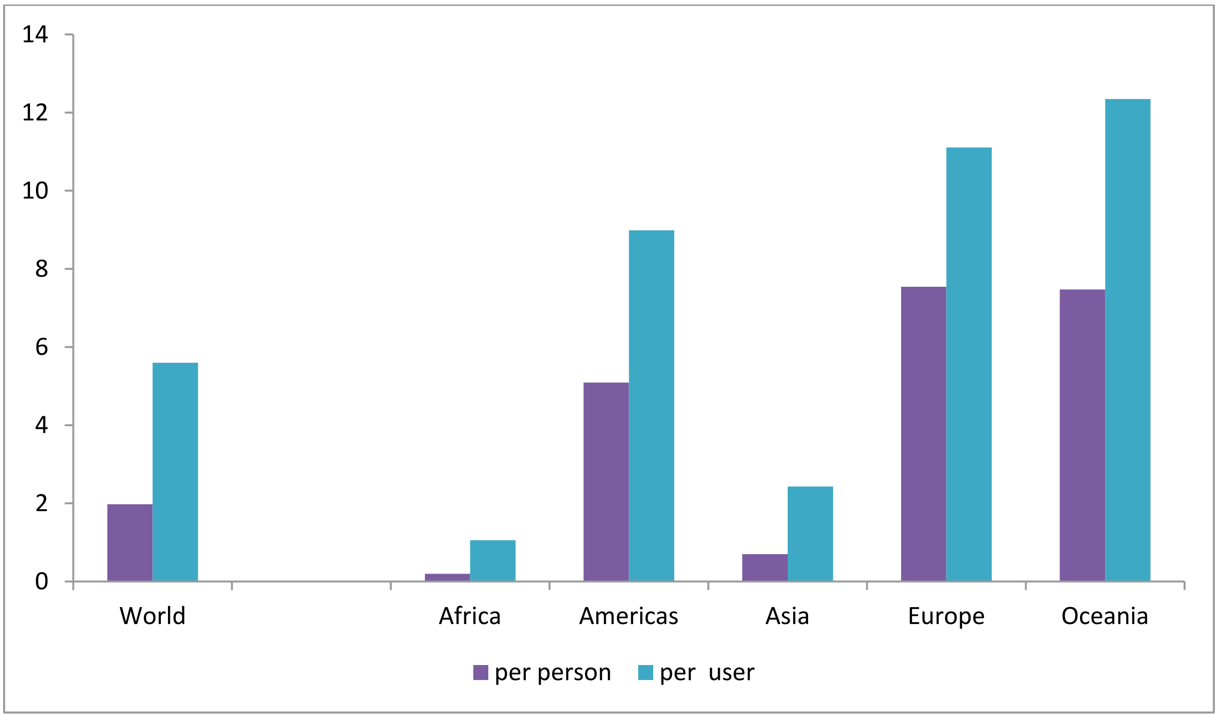


Source: Wikimedia data accessed via http://stats.wikimedia.org/EN/Sitemap.htm, accessed 11 April 2014.

Chart 9.15 illustrates that, while the proportion of English language articles on Wikipedia has declined, English has remained the predominant language for access by Wikipedia users.

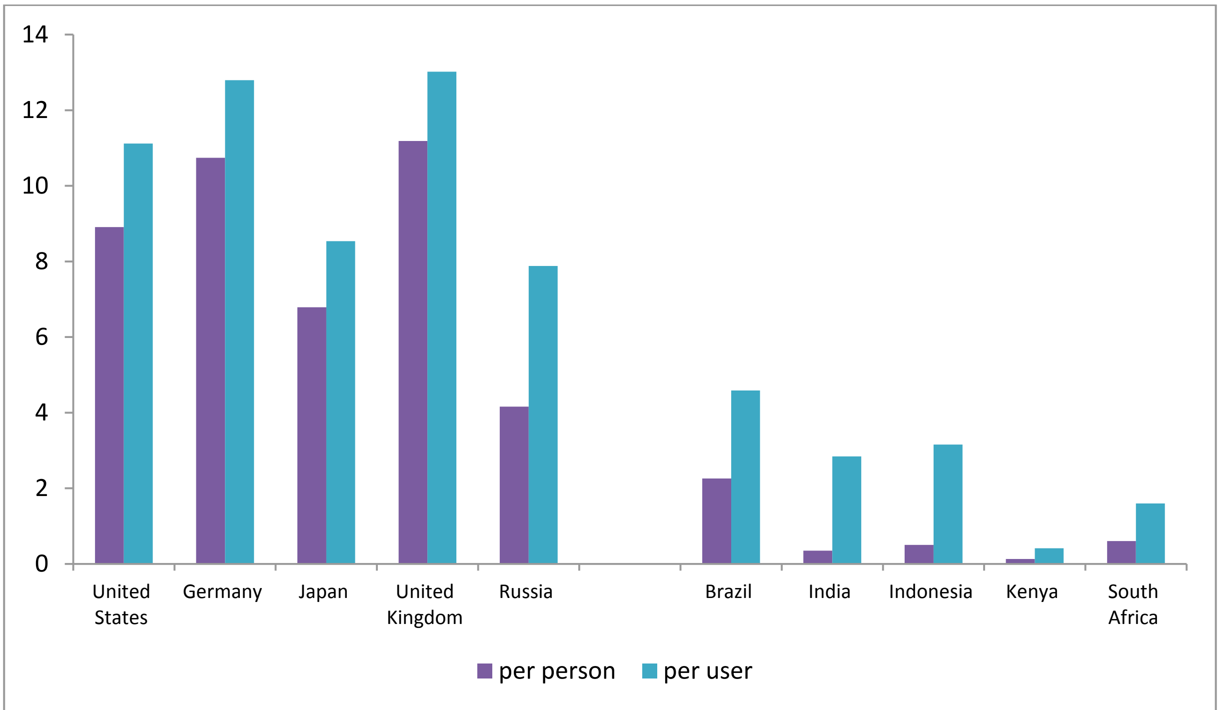
As noted above, Wikimedia data allow comparisons to be drawn between different regions and countries, including the five countries selected for specific attention in this chapter. The distribution of Wikipedia pageviews between different world regions, averaging monthly page views in the first three months of 2014, is set out in Chart 9.16. (Regions used by Wikipedia may differ slightly here from those used elsewhere in this report. Data for global population and estimates of Internet users are also higher than those used elsewhere in this report, but differences in the data sets do not allow these to be adjusted more precisely.) Comparable data for selected leading Internet using countries and for the five countries selected for this chapter are set out in Chart 9.17.

Chart 9.16: Wikipedia monthly pageviews per person/per Internet user, by region, Jan–Mar 2014



Source: Wikimedia data at Wikipedia data at http://stats.wikimedia.org/wikimedia/squids/SquidReportPageViewsPerCountryOverview.htm.

Chart 9.17: Wikipedia monthly pageviews per person/per Internet user, countries, Jan–Mar 2014



Source: Wikimedia data at http://stats.wikimedia.org/wikimedia/squids/SquidReportPageViewsPerCountryOverview.htm.

Other data published by Wikimedia show that significant proportions of users in most countries use English or, to a lesser extent, other international languages when accessing Wikipedia content. In many countries, the proportion of page views in English is around 10 per cent of the total.[73] This could be due to an expectation among users that English language content on most subjects will be more extensive than that in other languages.

In some countries, the proportion of page views in English is very much higher than that in local languages: in Pakistan, for example, in the first three months of 2014, 95 per cent of pageviews were in English, with only 1 per cent in Urdu; in India 74 per cent were in English; in Malaysia 73 per cent were in English, with 13 per cent in Chinese and 6 per cent in Malay; in Ethiopia 91 per cent were in English and only 2 per cent in Amharic; in Tanzania 88 per cent were in English and only 3 per cent in Swahili. French is similarly dominant in Francophone Africa, accounting for 77 per cent of pageviews in Senegal and 77 per cent in Mali, while a further 16 per cent and 14 per cent respectively were in English.[74]

Additional evidence concerning content and language

As discussed above, the five Indicators that were selected for Target 9 in 2011 can provide only a partial account of the development of content and language online since WSIS.

- There are severe limitations to the availability of data, particularly for Indicators 9.1, 9.2 and 9.3.
- Indicator 9.4, as adjusted above, provides useful data concerning the publication of online web content, but not of access to or usage of web content, nor of the publication, access and use of content on social media sites.
- Indicator 9.5 provides comprehensive data concerning content, content creation and usage for one specific form of user-generated content, but does not provide evidence concerning other, more common, forms of social media where content is generated by wider user groups.

The following paragraphs supplement information derived from the indicators above concerning two important aspects of the overall environment for online content and language as it has evolved since WSIS – access and use of websites, and access and use of social media platforms.

Website usage

A number of sources are available that identify the most accessed websites in different countries. The Internet analysis companies Alexa and Comscore research the use of websites globally and in particular countries in order to provide advisory services to online businesses and organisations. Both make use of user samples that provide data through monitoring software (in Alexa's case, a toolbar) together with weighting adjustments. They are not therefore comprehensive and the reliability of their results cannot be guaranteed.

More data are made publicly available by Alexa, which reports on the use of websites in 126 countries.[75] However, Alexa data do not include access through mobile devices,[76] and this is likely significantly to affect findings in countries, such as most of those in Africa, where mobile devices have become the primary platform for Internet access. Some corrective to this can be found in data from the browser company Opera, which monitors access to websites on its mobile browser Opera Mini. However, this browser accounts for a small proportion of the mobile browser market and is particularly popular in certain countries, and so may also be unrepresentative.[77]

Nevertheless, data from Comscore and Alexa are widely used within the industry. Alexa's published findings illustrate in particular:

- the preponderance of a small number of global sites, particularly those providing search and social media content, in the majority of countries surveyed and
- variations between countries in the significance of local websites and sites in local languages.

Table 9.9 lists the most popular websites globally and in a number of leading world countries in early 2014, using visitor data from Alexa. Table 9.10 adds equivalent data for the five countries selected for special observation in this chapter, together with November 2010 data (the latest available) for Opera users in those countries.

Table 9.9: Website popularity, global and selected countries, 2014

	Global	USA	Germany	UK	Spain	China	Japan	Korea, Rep.	Russia
1	Google	Google	Google.de	Google.uk	Google.es	Baidu	Yahoo.jp	Google	Yandex
2	Facebook	Facebook	Facebook	Google.com	Google.com	QQ	Google.jp	Facebook	VK
3	YouTube	YouTube	Google.com	Facebook	Facebook	Taobao	Amazon.jp	Naver	Google.ru
4	Yahoo	Yahoo	YouTube	YouTube	YouTube	Sina.com	Google.com	YouTube	Google.com
5	Baidu	Amazon	Ebay	BBC	Blogspot.es	Hao123	YouTube	Google.kr	Mail.ru
6	Wikipedia	Wikipedia	Amazon.de	Ebay	Twitter	Weibo	FC2	Baidu	YouTube
7	QQ	LinkedIn	Wikipedia	Yahoo	Live.com	Tmall	Facebook	Daum	Odnoklassniki
8	Twitter	Ebay	Spiegel	Amazon	Wikipedia	Sohu	Rakuten	QQ	Facebook
9	Live.com	Twitter	Bild	Wikipedia	Yahoo	360.cn	Wikipedia	Yahoo	Wikipedia
10	LinkedIn	CraigsList	Yahoo	LinkedIn	LinkedIn	163.com	Ameblo	Taobao	LiveInternet
11	Taobao	Bing	Web.de	Live.com	Marca	Soso	Livedoor	Tistory	LiveJournal
12	Amazon	Pinterest	GMX	Twitter	Wordpress	gmw.cn	Nicovideo	Blogspot.kr	Avito
13	Google.in	Blogspot	T-Online	Daily Mail	El Mundo	ifeng	goo.ne.jp	Wikipedia	Rambler
14	Sina.com	Go.com	Xing	Paypal	El Pais	Xinhuanet	Naver	nate.com	rbc.ru
15	Blogspot	CNN	Uimserv	Guardian	Amazon.es	Google.hk	Twitter	sinacom.cn	Twitter
16	Hao123	Live.com	Blogspot	Wordpress	Milanuncios	Alipay	dmm.co.jp	gmarket	RuTracker
17	Weibo	Paypal	Gutefrage	Amazon	Lacaixa	People.com.cn	msn.com	ask.com	ucoz.ru
18	Wordpress	Instagram	Chip.de	Pinterest	Pinterest	China.com	xvideos	hao.123	sberbank.ru
19	Yahoo.jp	Tumblr	xhamster	Tumblr	Ebay.es	Youku	Kakaku	blog.me	AliExpress
20	vk.com	ESPN	focus.de	Telegraph	as.com	Sogou	Baidu	ecplaza	lenta.ru

Source: http://www.alexa.com/topsites, accessed 9 April 2014.

Table 9.10: Website popularity, computer and mobile platforms

	Brazil		India		Indonesia		Kenya		South Africa	
	Alexa 2013	Opera 2010	Alexa 2013	Opera 2010	Alexa 2013	Opera 2010	Alexa 2013	Opera 2010	Alexa 2013	Opera 2010
1	Google.br	Google	Google.in	Google	Google.com	Facebook	Google.com	Facebook	Google.za	Facebook
2	Facebook	Orkut	Google.com	Facebook	Facebook	Google	Facebook	Google	Google.com	Google
3	Google.com	Live.com	Facebook	Orkut	Blogspot	Detik	YouTube	Wikipedia	Facebook	Mxit
4	YouTube	YouTube	YouTube	YouTube	YouTube	YouTube	Yahoo	Wapdam	YouTube	YouTube
5	UOL	Globo	Yahoo	Getjar	Yahoo	Yahoo	Google.ke	YouTube	Yahoo	Wikipedia
6	Globo	Twitter	Blogspot.in	Zedge	Google.id	Wapdam	StandardMedia	Yahoo	Gumtree	Mygamma
7	Yahoo	MSN	Wikipedia	Yahoo	Kaskus	Twitter	Twitter	BBC	LinkedIn	Getjar
8	Live.com	Facebook	LinkedIn	Songs.pk	Wordpress	Wikipedia	Wikipedia	Getjar	Wikipedia	Thumbtribe
9	Blogspot.br	uol.com.br	IndiaTimes	Wikipedia	Detik	Getjar	Nation	My Opera	News24	Zamob
10	Mercadolivre	4shared.com	Flipkart	Vuclip	Twitter	Vivanews	Blogspot	Reference.com	FNB	Yahoo

Source: http://www.alexa.com/topsites, accessed 9 April 2014; Opera, State of the Mobile Web, November 2010, http://www.operasoftware.com/archive/smw/2010/11/index.html.

These data, while imprecise for reasons described above, illustrate a number of important points concerning the development of content since 2003.

- A small number of international websites account for a high proportion of web access both globally and in the majority of countries. These sites include search engines (particularly Google and Yahoo, which have become the principal conduits or portals for Internet users seeking content, often used now as a substitute for entering URLs as well as for pure search), online social networks (particularly Facebook), blog sites (particularly Blogspot and Wordpress), microblogs (particularly Twitter and, in China, Weibo), video file-sharing sites (specifically YouTube), and online reference sites (particularly Wikipedia). In a high proportion of countries monitored by Alexa, Google, Facebook and YouTube feature in the top five positions in the rankings, in some cases through ccTLD rather than gTLD domains. Some additional data on social media websites can be found below.

- There are a small number of countries in which these global sites are not predominant or not so predominant, usually because of the presence of local (or local language) alternatives. This is particularly the case in four countries with large populations, whose languages use non-Latin alphabets – China, Japan, Republic of Korea and Russia. The preponderance of Chinese alternatives to international search and social networking sites is so strong that three of these feature among Alexa's top ten global websites.[78]
- In most countries, some local sites also have audiences within the top ten and certainly within the top 20 websites. As well as social networks, these include e-commerce sites (such as Taobao in China and Mercadolive in Brazil) and mainstream national media (such as the BBC and several newspaper websites in the UK, *Der Spiegel* and *Bild* in Germany, and the *East African Standard* and *Daily Nation* in Kenya).
- Some differences are suggested between computer and mobile access, though data here are unreliable because of the different dates involved and the limited market share of the Opera browser. Nevertheless, mobile usage illustrates the popularity of content platforms that are specific to mobile devices, such as the South African instant messaging service Mxit and the mobile app store Getjar. More analysis is needed of the differential use of content between computer and mobile platforms.

Social media usage

As noted above, social media and other sites offering user-generated content have become very prominent in Internet usage since 2003, and must be included in any current or future assessment of online content and language. These sites include social networks such as Facebook, LinkedIn and RenRen; blog sites such as Blogspot and Wordpress; microblogs such as Twitter and Tencent Weibo; messaging and VoIP sites such as Yahoo Messenger and Skype; and audio, image and video filesharing sites such as Flickr, Instagram and YouTube. They provide new spaces for content creation, sharing and usage, including content intended for both general and specific readerships. As social media content is user-generated, it may be more likely than other online content to be written in users' primary languages, though this is difficult to assess with the limited data that are available at present.

While this chapter is concerned with content on the Internet, it should also be recognised that there has been a correspondingly rapid growth in the volume of content that is specific to mobile phones, originally including SMS messages but more recently including content accessed and shared through mobile apps. Much of this content is also user-generated. While these mobile content platforms have not been discussed in this chapter, they should be included in future assessments of trends in content and language that measure outcomes relating to WSIS Target 9.

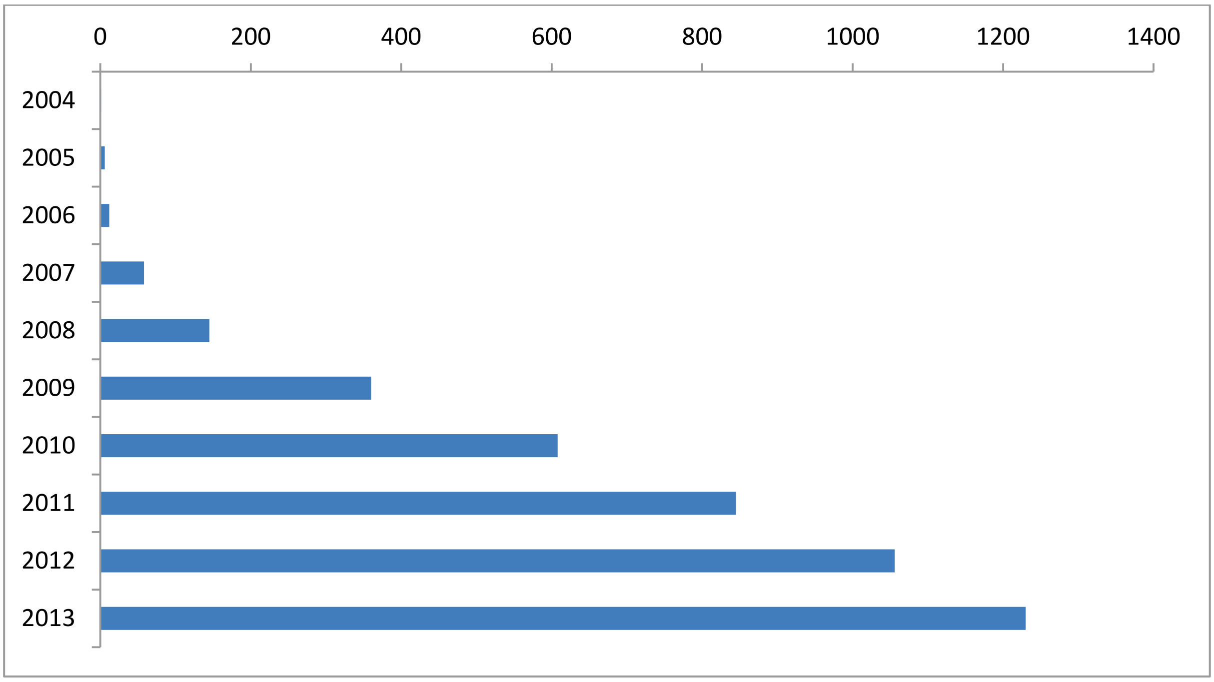
Most prominent social media sites are commercial businesses, whose business models rely on data mining to target advertising at site users. As a result, while they collect extensive data about their users (content creators and readers) and the content they create and access, these data are commercially confidential and not available for public analysis. The following paragraphs provide some information, derived from published sources, which address the impact of these sites on content and language.

It is important when analysing data concerning global social media platforms to remember that they are not universally predominant. Alternative services are popular in a number of countries, including China, Russia, Republic of Korea and Japan. In particular, global social media platforms such as Facebook, Twitter and YouTube are not generally available in China. A report published in 2013 estimated that over 90 per cent of Chinese Internet users then had at least one social media account, with the most popular platforms including Qzone (blogs and photo-sharing), Tencent Weibo (microblog), Sina Weibo (microblog and social network), Wechat (messaging), PengYou and RenRen (social networking) and 51.com (gaming).[79]

The most prominent social network in most countries, but not in China, is Facebook, which was established in 2004. By the end of 2013, Facebook was clearly established as the predominant social network worldwide, dominating the market for social media in most countries and identified as one of the two most popular websites in a substantial majority of countries in Alexa counts of web usage. By the end of 2013, it registered more than 1.3 billion monthly and 757 million daily active users, was available in 70 languages and was accessed by as many as 40 per cent of active Internet users daily. Some ten billion Facebook messages were said to be posted daily.[80]

Detailed (for example, country-level) information on the growth of Facebook is not readily available, but some general data have been published. The growth in the number of those using Facebook at least monthly is illustrated in Chart 9.18.

Chart 9.18: Growth in Facebook monthly active users, 2004–2013, millions of users



Source: The Guardian newspaper website, http://www.theguardian.com/news/datablog/2014/feb/04/facebook-in-numbers-statistics, accessed 6 March 2014. Data sourced from Facebook.

Data published in 2012 showed that the countries with most Facebook users, after the United States, were Brazil and India (with over 50 million users each), followed by Indonesia and Mexico. The most popular languages after English were Spanish (with around 80 million users), followed by Portuguese (principally because of users in Brazil), French, Indonesian and Turkish. The fastest growing languages between May 2010 and November 2012 were Portuguese and Arabic.[81]

However, as with Wikipedia data (above), there were substantial differences between language behaviour in different countries. Data have also been published showing that, while more than 96 per cent of Brazilian Facebook users chose Portuguese as their default language in 2012, almost all of those in India chose English with less than 1 per cent selecting Hindi.[82]

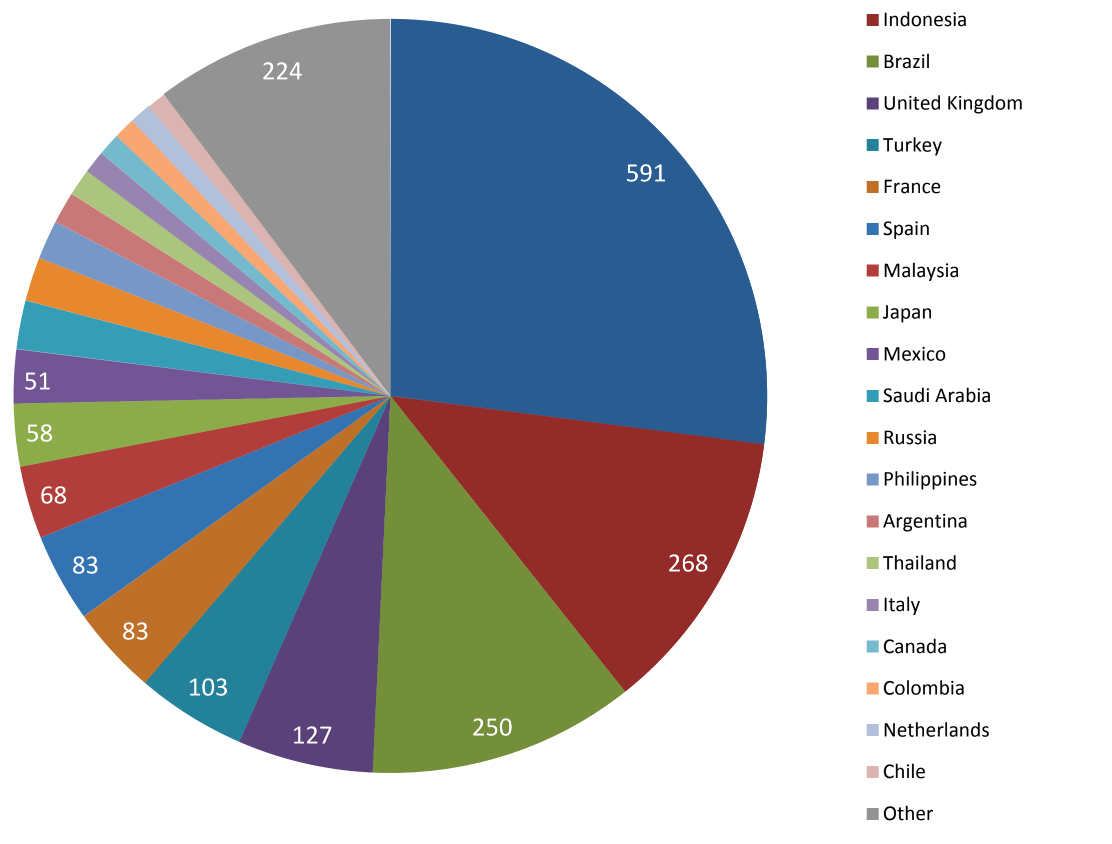
Differences in user behaviour on Facebook are well-illustrated by data on the language distribution of Facebook use in Arabic-speaking countries published by the UN Economic and Social Commission for Western Asia in 2013 (UNESCWA, 2013).[83] These showed the preponderance of Arabic use on Facebook varying from 81 per cent in Yemen to just 4 per cent in Tunisia. English was the predominant user language in six, and French in three, Arabic-speaking countries. The incidence of Arabic usage on Facebook had increased since 2011 in a number of countries in the region, including Iraq, Egypt and Jordan, while significant use in languages other than Arabic, English and French was evident in those countries with large expatriate populations.

Further country and language data are available on commercial terms from Facebook but have not been reviewed for this report.[84]

The most prominent microblog in most countries, though not in China, is Twitter, which had built a user community of some 646 million between its establishment in 2006 and January 2014, 115 million of whom were active at least once a month.[85] The number of 'tweets' – messages of up to 140 characters – posted daily by Twitter users was approximately 58 million. Around 60 per cent of users published tweets, according to published data, the remaining 40 per cent being passive readers.

The DOLLY project[86] at the University of Kentucky measures those tweets that can be geolocated because of settings that have been enabled by terminal users – a total of between 1 per cent and 2 per cent of tweets, mostly created on mobile devices. While not random and so not necessarily representative, this provides a sample of over 2 billion tweets posted during 2013. Chart 9.19 illustrates the geographic distribution of tweets originating in the 20 most popular countries within this sample, using data kindly provided by the project.

Chart 9.19: Geocoded origin of a sample of 2 billion tweets, 2013, million tweets



Source: data supplied by the DOLLY project, University of Kentucky.[87]

Some analysis has also been undertaken of tweets by language. Researchers who analysed 380 million geolocated tweets posted from 191 countries between October 2010 and May 2012 identified at least 78 languages within their dataset, the leading languages being English (by a very substantial margin), Spanish, Malay and Indonesian. As with the data reported above, it is unclear if geolocated tweets are representative of tweets in general. English was used in 10 per cent or more of tweets within this dataset that were posted from other leading European countries (France, Italy and the Netherlands), and in 5 to 10 per cent of those from a number of other countries (including Turkey, Chile and Venezuela).[88] A separate study of over 6 million Twitter users from 246 countries and territories, undertaken in 2010, also found that English was predominant, accounting for 53 per cent of tweets in total, for more than 10 per cent of those from the Netherlands, Indonesia and Mexico, and 9 per cent of those from Brazil (Poblete *et al.*, 2011). As Twitter is a form of publication, this may represent users seeking to maximise their global readership. This linguistic pattern may also have changed significantly since 2010, because of the high rate of growth in the number of Twitter accounts worldwide.

The most prominent video filesharing site in most countries is YouTube, which is owned by Google. YouTube reported in February 2014 that its content receives more than 1 billion unique visitors monthly, those visitors watching approximately six billion hours of content. Its service is localised in 61 countries and available in 61 languages.[89]

There has been similarly strong growth in the posting of image content. It is difficult to confirm the reliability of data, but in March 2014, it was estimated that 200 million users of the photo-sharing website Instagram were adding 60 million items daily to a total already exceeding 20 billion.[90] Flickr was estimated in 2013 to have 87 million users, posting more than 3.5 million images daily to a total exceeding 8 billion.[91]

E-commerce sites and Internet banking represent other forms of content that are local or user-specific in character, access to which should be considered when reviewing content availability and access. Available evidence suggests that participation in e-commerce and Internet banking varies considerably between countries, as a result of economic conditions as well as online behaviour. The Internet research company Comscore found that 29 per cent of Internet users worldwide made use of Internet banking in April 2012, for example, including 45 per cent of Internet users in North America but less than 9 per cent of those in the Middle East and Africa.[92]

Conclusions and recommendations

The measurement of online content and language is far from easy. Nevertheless, it is clear from the evidence presented in this chapter that there has been tremendous growth in the creation, sharing and access of online content in the decade since WSIS, and that there has been growing diversity in the range of languages used for both content creation and content access. While there is still a long way to go before content and language are equally available to all, the trends described in this chapter are broadly positive.

- On the supply side, the number of websites (calculated as the number of allocated URLs) has grown enormously between 2003 and 2013, and the number of webpages even more substantially. Traditional websites have been supplemented by new forms of user-generated content, which are extensively used by individuals, businesses and organisations. Social media such as Facebook, Twitter and Weibo have expanded the range of content available, including local content, and have provided new platforms for both content creation and content access. The volume of video content uploaded to YouTube has also grown enormously since 2003, exemplifying growth in non-text content that is facilitated by the increasingly widespread availability of broadband networks.
- Alongside the Internet, mobile apps have added new opportunities for content creation and access since they first became available in 2008. The number of apps available for Apple iPhones was reported to have exceeded 1 million in October 2013,[93] while the number of Android apps was reported to have exceeded 1 million by February 2014.[94]
- The growth in demand for Internet content has also increased enormously. The number of Internet users has risen from an estimated 1.02 billion in 2003 to an estimated 2.75 billion in 2013, from 16 per cent to 39 per cent of world population.[95] The pace of growth during this period has been particularly marked in developing countries, which accounted for an estimated 31 per cent of total Internet users by 2013.[96]

There has therefore been exceptional growth since 2003 in the volume of content generated, in the numbers of people, businesses and organisations engaged in content creation, in the number of people accessing content, and in the volume of content accessed. There is also now much greater diversity in the range of online content, thanks to the emergence of social media and mobile applications and to the spread of electronic commerce. The availability of development-related content has been facilitated by the emergence of open data and the spread of electronic government and transactions.

In spite of this, the evidence presented in this chapter shows that there remains a powerful digital divide in both content creation and content access between developed and developing countries. Developed countries in Europe, the Americas and parts of Asia continue to generate the majority of web content. Evidence from the registration of TLDs suggests that there is a broad, but by no means precise, association between measures of development (such as GDP per capita and HDI) and Internet content generation. Low-income developing countries tend to have particularly low levels of TLD registration as well as Internet usage.

It is difficult to assess the developmental impact of digital divides in content creation and access, not least because overall data volumes are distorted by the high demands on bandwidth generated by video content, the majority of which is likely to be for entertainment use. However, the evidence in this chapter tends to confirm the finding of UNESCO, the OECD and the Internet Society that there is a virtuous circle between infrastructure supply, affordability of access and the development and use of local content. Societies that enjoy high quality broadband access at low prices are likely to see greater Internet use, increasing demand for local content that is then supplied by governments, businesses, independent organisations and individual users of the Internet exploiting the potential of social media platforms.

An important policy implication of this is that one of the ways in which governments can most effectively stimulate the market for local content is through the enabling environment for investment in communications networks and services. However, infrastructure is insufficient to address all of the disadvantages that affect content creation and access in developing countries. A number of international reports have addressed aspects of the social and economic context in developing countries that also inhibit content production and use.

On the supply side, these include the small size of many developing country content markets for information and cultural goods, the existence of global services (such as search engines and social media platforms) that facilitate free access to information and information sharing that might otherwise provide a basis for local service development, and complex arrangements for the registration of new businesses, which inhibit service innovation. The growth of cloud computing may reduce some of the financial and administrative costs involved in innovation, encouraging more diverse content generation at local level, but evidence on this is not yet clear.[97]

On the demand side, as well as limited infrastructure capacity and cost, access and use of content are constrained by illiteracy and the lack of media and information literacy skills.

Governments can stimulate content generation and access to content by addressing these constraints. Government websites and open data policies provide an example to other potential content providers as well as offering content that is of direct relevance to local users. Governments can also use social media platforms to disseminate public information, though this should not diminish the use of traditional media. In the longer term, efforts by governments to address media and information literacy, through education and lifelong learning, should raise the proportion of citizens with the skills and confidence needed to access and exploit the online content resources available to them.

Language is a critical dimension of this. As this chapter has emphasised, it is very difficult reliably to measure online content and access to that content by language, though it is possible to establish trends in language use of online services such as Wikipedia, where data are published. Other online service providers gather comparable data for use in their commercial development but these are not available for independent analysis. The following conclusions are suggested by the evidence:

- There is increasing diversity in the range of languages available and used online. The predominance of English, which was very pronounced in the early period of the Internet, has now reduced, though it is still estimated that more than half of the top ten million websites use English as at least one of their content languages.[98] There has been a marked increase in the web presence of some languages using non-Latin scripts, especially Chinese, though South Asian languages and Arabic have shown less dynamic growth.
- Language is less of a constraint on social media sites, where content is user-generated, than it is on conventional websites. The number of languages available on social media sites has grown significantly, with almost 300 now available on Wikipedia and around 100 each on Google and Facebook. Users are able to post information in the language of their choice, which may or may not be their primary language, though this will be partly determined by the audience they seek to reach as well as by personal language preferences and capabilities. Unfortunately, very little statistical information is publicly available about the languages used in social media and how these are changing over time.
- It is too early at present to assess how much impact the introduction of IDNs will have on linguistic diversity on the Internet, though early evidence suggests that this has not been as significant as had been anticipated. The role of IDNs should continue to be monitored.
- It is clear that there is still a long way to go before content is as readily available in national and local languages as it is in global languages, particularly English. The clearest exception to the continued leading presence of English online is the Chinese Internet market, which is dominated by Chinese language sites that have benefited from constraints on access to global social media platforms in their primary market. In some developing countries, Wikipedia evidence suggests that existing Internet users are more likely to access content in English than in local languages, though this is partly because Internet access has not yet penetrated deeply into social groups that do not have English as a secondary language.

The most significant emerging trend in this field concerns automated translation. Although there will always be quality and reliability challenges, this has the potential to allow end-users to access content written in languages with which they are unfamiliar, when that content would otherwise be inaccessible to them. While the challenge of automated or machine translation has been addressed by computer scientists and linguists since the 1950s, the search for effective and reliable translation mechanisms has become more substantial since the Internet became widespread, focusing on statistical and example-based methodologies. However, dependence on analysis of existing manual translations in developing translation algorithms means that automated translation is likely to be more successful between major languages and offers less of a solution for minority languages that are rarely translated or written. Translation between languages with very different structures and characteristics, such as Latin languages and Chinese, is also problematic.

By 2013, the leading online translation service Google Translate was available in 80 languages, with a free plug-in in 60 languages available to content developers.[99] The capabilities of Google Translate, Bing Translator and similar services will be enhanced by the growth of capacity in cloud data centres that have the computing power to explore very large sets of manually-translated originals. Continued efforts to improve translation capabilities will be the most effective way in which computing and Internet professionals can advance linguistic diversity on the Internet, particularly in facilitating the reach of content into minority language communities.[100]

The growth in content, including local content, over the past decade, which is described above, and the related spread of language diversity online have resulted primarily from developments in the communications market rather than from interventions by governments and international agencies. Increased access to the Internet, the increased capacity of networks to carry high content volumes, and the low cost of publication online have accelerated the growth in web content, while new platforms such as social media and microblogs have enabled all Internet users to contribute their own content at minimal cost and inconvenience.

Internet businesses have responded to this growth in content by providing new platforms for content distribution and extending the range of languages in which content can readily be published.

Governments have supported content growth by facilitating the enabling environment for Internet investment and services, while, in most countries, imposing few restrictions on content access.

The Internet professional community has contributed to greater linguistic diversity by enabling IDNs and fostering the development of automated translation software and services.

The spread of online content and linguistic diversity are critical aspects of the "… people-centred, inclusive and development-oriented Information Society" envisaged in the WSIS outcome documents. It is therefore important to understand trends in both of these aspects of WSIS implementation. However, it is difficult to establish quantitative targets for them, both because there is no stable or finite limit to their potential achievement, and because of severe limitations in the data sets that are currently available. If the target is to be retained for measurement post-2015, revisions will need to be made in the current indicators, and these will need to be supplemented by a wider range of evidence in order to achieve a representative understanding of relevant trends and developments in different countries and regions. The recommended changes are as follows:

- Indicator 9.1 should be retained, but suspended until data of sufficient quality become more comprehensively available as a result of national statistical offices incorporating relevant data collection into national censuses and household surveys.
- Indicators 9.2 and 9.3 should be withdrawn as it is not currently possible to obtain reliable data, and unlikely that this situation will change at least in the short or medium term.
- Indicator 9.4 should be retained in revised form, including gTLDs and IDNs as well as ccTLDs in national counts of domain names, and subject to mechanisms being put in place to secure access to comprehensive data sets from either national registries or independent analysts.
- Indicator 9.5 should be retained but developed to include Wikipedia contributors (content creation) and pageviews (access and use) as well as articles.
- Additional indicators should be developed to replace indicators 9.2 and 9.3. These should be concerned with measuring the volume and linguistic diversity of content on one or more social

networks and on mobile apps. The emergence of further new platforms for content creation, dissemination and access may require further adjustments to indicators in due course.

An alternative or supplementary approach would involve gathering a wider variety of quantitative and qualitative data on a number of specific countries and territories that are selected to be representative of the world community. While this would not have the same statistical value as monitoring of other WSIS targets, it would enable a more substantive qualitative assessment to be made of trends that are taking place in content and language, alongside those statistical indicators that do prove to be viable. Additional statistical evidence from diverse sources could be incorporated in this monitoring and measurement, along the lines suggested in this chapter.

The periodic publication of time series data in tables and figures is only one way of illustrating the spread of online content and language. Consideration could be given to the potential of mapping and other techniques to add insight to those data that are available in this area of WSIS outcomes.

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Endnotes

[1] The term ‘world languages’ is understood here to mean all languages used in the world today, rather than the small number of languages which are extensively used worldwide.

[2] Sam Costello, ‘How Many Apps Are in the iPhone App Store’, http://ipod.about.com/od/iphonesoftwareterms/qt/apps-in-app-store.htm, accessed 5 March 2014.

[3] See http://www.appbrain.com/stats/number-of-android-apps, accessed 5 March 2014.

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[9] The full remit for Action Line C8 can be found in World Summit on the Information Society, Geneva Plan of Action, 2003, para. 23, http://www.itu.int/dms_pub/itu-s/md/03/wsis/doc/S03-WSIS-DOC-0005!!PDF-E.pdf.

[10] WTDR, 2010, p. 189, http://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtdr2010.aspx.

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[14] WTDR 2010, p. xxxi.

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[16] WTDR 2010, p. 178.

[17] For example, by the market research firm the International Data Corporation – see John Gantz and David Reinsel, 2011.

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[26] Information from browser websites.

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[29] Examples of this kind of work at the Oxford Internet Institute can be found at http://geography.oii.ox.ac.uk.

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[31] *ibid*.

[32] Report (to ECOSOC) of the Partnership on Measuring Information and Communication Technologies for Development, March 2012, para. 28, http://unstats.un.org/unsd/statcom/doc12/2012-12-ICT-E.pdf.

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[41] Data from the web technology analyst Web3Tech, covering the top ten million websites, reported at http://w3techs.com/technologies/overview/content_language/all, viewed 7 April 2014. The methodology behind this and other language figures reported is unclear.

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[43] Information from Daniel Pimienta.

[44] Data from ZookNIC, see below.

[45] UNESCWA, 2013, p. 106.

[46] As reported at http://ptgmedia.pearsoncmg.com/images/9780789747884/supplements/9780789747884_appC.pdf. Data from June 2010.

[47] This section of the chapter has been written in conjunction with Matthew Zook of ZookNIC.

[48] Details of this indicator can be found in the 2011 WSIS statistical framework, p. 84.

[49] The registration process is often conducted though intermediary organisations or businesses known as registrars, which are accredited by the relevant registry.

[50] Data from CENTR, Domain Wire, edition 6, December 2013, available at https://centr.org/system/files/agenda/attachment/domainwire_stat_report_2013_3_0.pdf.

[51] Not always as some countries have both Latin and IDN ccTLDs.

[52] These are AfTLD (Africa), APTLD (the Asia-Pacific region), CENTR (Europe), LACTLD (Latin America and the Caribbean).

[53] Current data are published at http://www.whois.sc/internet-statistics/country-ip-counts/.

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[56] *ibid*.

[57] A list of other ccTLDs marketed in this way can be found in http://geography.oii.ox.ac.uk/#geography-of-top-level-domain-names.

[58] CENTR, *op. cit*.

[59] These are listed at http://en.wikipedia.org/wiki/List_of_Google_domains.

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[61] Information from ZookNIC.

[62] See http://en.wikipedia.org/wiki/List_of_Internet_top-level_domains.

[63] Information from ZookNIC.

[64] The assistance of Erik Zachte and Tilman Bayer, Data Analyst and Senior Operations Analyst, respectively, for the Wikimedia Foundation, is acknowledged in the preparation of this subsection.

[65] The indicator is described in the 2011 WSIS statistical framework, p. 85.

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[67] See http://stats.wikimedia.org/EN/TablesPageViewsMonthlyCombined.htm and http://stats.wikimedia.org/EN/TablesArticlesTotal.htm. Data on the popularity of websites globally and by country are published by the web information company Alexa at http://www.alexa.com/topsites/global and http://www.alexa.com/topsites/countries. Alexa uses a selective toolbar-based methodology for data-gathering which has significant limitations.

[68] This information is available on a variety of sites, a useful portal being http://stats.wikimedia.org/EN/Sitemap.htm.

[69] The most recent data can be found at http://meta.wikimedia.org/wiki/List_of_Wikipedias. The figures in this paragraph were viewed on 19 March 2014.

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[74] Wikipedia data from http://stats.wikimedia.org/wikimedia/squids/SquidReportPageViewsPerCountryOverview.htm.

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[86] Digital OnLine Life and You.

[87] Some data from the DOLLY project are published at http://www.floatingsheep.org/p/dolly.html.

[88] Delia Mocanu *et al.*, 'The Twitter of Babel: Mapping World Languages through Microblogging Platforms', PLOS ONE, available at http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0061981.

[89] See https://www.youtube.com/yt/press/en-GB/statistics.html.

[90] See http://expandedramblings.com/index.php/important-instagram-stats/#.Uw-IiPl_vNk, viewed 7 April 2014.

[91] See http://www.theverge.com/2013/3/20/4121574/flickr-chief-markus-spiering-talks-photos-and-marissa-mayer.

[92] Data from Comscore at http://www.comscoredatamine.com/2012/06/1-in-4-internet-users-access-banking-sites-globally/. Usage rates for the total population are, therefore, even lower in the Middle East and Africa than in North America and Europe because of the lower proportions of the total population in the former regions that are currently online.

[93] Sam Costello, 'How Many Apps Are in the iPhone App Store', http://ipod.about.com/od/iphonesoftwareterms/qt/apps-in-app-store.htm, accessed 5 March 2014.

[94] See http://www.appbrain.com/stats/number-of-android-apps, accessed 5 March 2014.

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[96] *ibid*.

[97] For a discussion of this, see UNCTAD, 2013.

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[99] Information on Google Translate from http://translate.google.co.uk/about/intl/en_ALL/ and http://translate.google.com/manager/website/?hl=en.

[100] As automated translation becomes more widespread, increased care will be needed to ensure that algorithms do not treat existing automated translations as equivalent source material to manual translations.

ENSURE THAT MORE THAN HALF THE WORLD'S INHABITANTS HAVE ACCESS TO ICTs WITHIN THEIR REACH AND MAKE USE OF THEM

Target 10: Ensure that more than half the world's inhabitants have access to ICTs within their reach and make use of them[1]

Executive summary

Target 10 is the only (original) WSIS target with a numerical objective and arguably offers the most objective and quantifiable indication of progress towards a global information society. It is clear that significant progress has been made towards achieving Target 10 and the main agent for growth is the mobile cellular telephone, the penetration of which has increased phenomenally. In this respect, Target 10 has been achieved – and surpassed – in most countries. In terms of access to, and use of, the Internet, the target has not been achieved. Although significant progress has been made in the last decade or so, there is an important digital divide in terms of Internet access and use.

The five indicators for Target 10 are focused on two ICTs – telephones (both fixed and mobile) and the Internet. The word "access" in the wording of the target is not quite clear and leaves room for ambiguity. The current indicators focus on mobile-cellular subscriptions[2] per 100 inhabitants, household access to telephones and the Internet and individuals' use of mobile telephones and the Internet. In respect of mobile-cellular penetration, the target has been achieved and surpassed, with global mobile-cellular penetration of 96 subscriptions per 100 inhabitants by 2013. This equates to nearly one subscription for every inhabitant of the world (though it does not mean that 96 per cent of the world's inhabitants have, or use, a mobile phone). Indicator 10.2 measures the proportion of households with telephone and suffers from limited data. For most countries for which data are available, the target has been reached, with at least 50 per cent (and generally over 80 per cent) of households having access to telephone (fixed or mobile). Indicator 10.3 measures the proportion of individuals using a mobile phone. While data are also limited for this indicator, all countries with available data reported that at least 50 per cent (and generally over 80 per cent) of individuals are using a mobile phone. A caveat on this optimistic assessment of Target 10 is that household survey data on telephone access and individual phone use were not available for the large majority of the least developed countries (LDCs) and for many other developing countries. Nevertheless, mobile-cellular subscription data from LDCs and developing countries suggest that substantial progress has been made and that Target 10 has been (or is being) swiftly achieved.

The proportion of individuals using the Internet (Indicator 10.4) was estimated to be 39 per cent globally by 2013 but with differences between countries and regions. In developing countries, only one in three people were online and, in LDCs, only about one in twelve people were using the Internet. While growth was slower than the growth in mobile phone subscriptions, the proportion of individuals using the Internet still more than doubled between 2003 and 2013. Indicator 10.5 covers the proportion of households with access to the Internet, by type of access. This indicator was not achieved globally by 2013, with household access to the Internet estimated to be 41 per cent. However, growth has been reasonably impressive, with the proportion more than doubling from 16 per cent in 2003. By 2013, 78 per cent of households in developed countries had Internet access at home compared to 28 per cent in developing countries. The number of Internet subscriptions offers another way of viewing household access to the Internet. In terms of broadband penetration by access type, global wireless broadband penetration stood at 30 subscriptions per 100 inhabitants, while fixed broadband penetration was 10 by the end of 2013. Global wireless broadband penetration (in terms of number of subscriptions) overtook fixed broadband penetration in 2008.

To accelerate progress towards Target 10, two sets of recommendations are offered – the first pertains to possible types of indicators for a target on access to, and use of, ICTs post-WSIS and the second pertains to intensifying public-private sector partnerships and increasing demand for ICT services.

Should there be a target on access to, and use of, ICTs post-WSIS, the current indicators should be retained as they track access to mobile phones – by now the most diffused communication tool – and to the Internet – a technology that potentially enables full participation in the information society. Additionally, the current indicators are collected by ITU and their availability is increasing. However, Indicator 10.3 could be amended to 'individuals who own a mobile phone' as current trends are moving from usage to ownership. Additions to the current set of indicators could include measures of the quality of access (such as broadband speed) and more use indicators such as tracking mobile phone and Internet activities, and equality of ICT use (perhaps including barriers to Internet use).

The second set of recommendations pertains to policy responses through expanding infrastructure, market liberalization and helping citizens move into the information society. First, attention could be directed to bringing basic mobile telephony to the inhabitants of the LDCs. Regulators could provide private operators with subsidies through universal access funds or through licence conditions, with the goal of providing the unserved and underserved segments of their populations with mobile phone access. Second, ensuring more market competition is a key way of narrowing the connectivity gap for mobiles. The relatively high cost of Internet access in developing countries should also be addressed. Appropriate regulatory remedies need to be adopted when there is significant market power over key facilities. Work to improve cross-border infrastructure should be undertaken, where appropriate, to deliver better quality of service and meet growing consumer demand.

Finally, efforts can also be made to increase demand for ICT services. More opportunities to experience the Internet can be offered in schools (targets 2 and 7) and public access locations (targets 1 and 4). At the same time, digital literacy skills can be taught in schools for both school-age and adult learners to enable full participation in the information society (Target 7). For the benefits of these efforts to be fully realized, there should also be relevant content and services that citizens want to access digitally. As such, provision of public and social services online (Target 6) is important and should lead to an increase in the demand for broadband services. In terms of content, global demand for Internet video has been growing substantially and could drive broadband uptake, especially if there is relevant local content that citizens want to access (Target 9).

Introduction

Target 10 tracks the extent to which the world's inhabitants have access to ICTs and use them. Target 10 is the only (original) WSIS target with a numerical objective[3] and arguably the most objective and quantifiable measure of progress made towards a global information society. This chapter will report the significant progress that has been made towards the achievement of this objective. Indeed, for mobile phones, and particular countries and regions, Target 10 has already been achieved. The progress made thus far provides cause for optimism that the target could be entirely achieved in the near future, if current momentum is sustained and more efforts are channelled to countries and regions that are lagging behind.

Target 10 did not originally include the phrase "and make use of them". It is clear that the benefits of having ICTs within reach will only be realized if they are used and the target was reworded by the Partnership on Measuring ICT for Development to include actual use of ICT. Two indicators measuring ICT use were accordingly added to the 2011 WSIS statistical framework (*Partnership*, 2011).

The target does not specify ICTs and the 2011 WSIS statistical framework recommended focusing on telephones (mobiles and fixed) and the Internet. Access to radio and TVs are covered by Target 8. Computers have not been included as they typically need an Internet connection for full functionality and the Internet is increasingly being accessed through mobile phones (*Partnership*, 2011). Five indicators were suggested for the measurement of Target 10 and all are based on existing core ICT indicators developed and implemented by the *Partnership*. The indicators are:

Indicator 10.1: Mobile-cellular telephone subscriptions per 100 inhabitants

Indicator 10.2: Proportion of households with telephone, by type of network

Indicator 10.3: Proportion of individuals using a mobile cellular telephone

Indicator 10.4: Proportion of individuals using the Internet

Indicator 10.5: Proportion of households with Internet access, by type of access.

Of the five indicators used to assess Target 10, two (10.2 and 10.4) are Millennium Development Goal (MDG) indicators. They are included in MDG Goal 8 (Develop a global partnership for development), Target 8F (In cooperation with the private sector, make available the benefits of new technologies, especially information and communications).[4]

Three of the five indicators (10.1, 10.2 and 10.5) track ICT access and two track ICT use. Taken together, the indicators reflect two important dimensions of an information society that are articulated in the target – ICT access and ICT use. Both dimensions are critical for participation in the information society.

Box 10.1 presents an evaluation of the *One Laptop Per Child* program and highlights two relevant considerations:

- Why tracking actual use is so important.
- Access without other enabling conditions, such as digital literacy and training, limits the benefits that intended audiences will gain from mere access to ICTs.

Box 10.1: Use is just as important as access – a case study from the OLPC program

The One Laptop per Child (OLPC) program is one of the most ambitious educational reform initiatives to date. The program aims to provide laptops to millions of children around the world, including those in the most impoverished nations. The OLPC developed its own laptop called the XO which had its own software interface. Over two million children and teachers in 42 countries are reported to be using the XO laptops today (OLPC, 2013). Uptake is strongest in Latin America, with the largest national partners being Uruguay (the first country in the world to provide every elementary school child with a laptop), Peru, Argentina and Mexico.

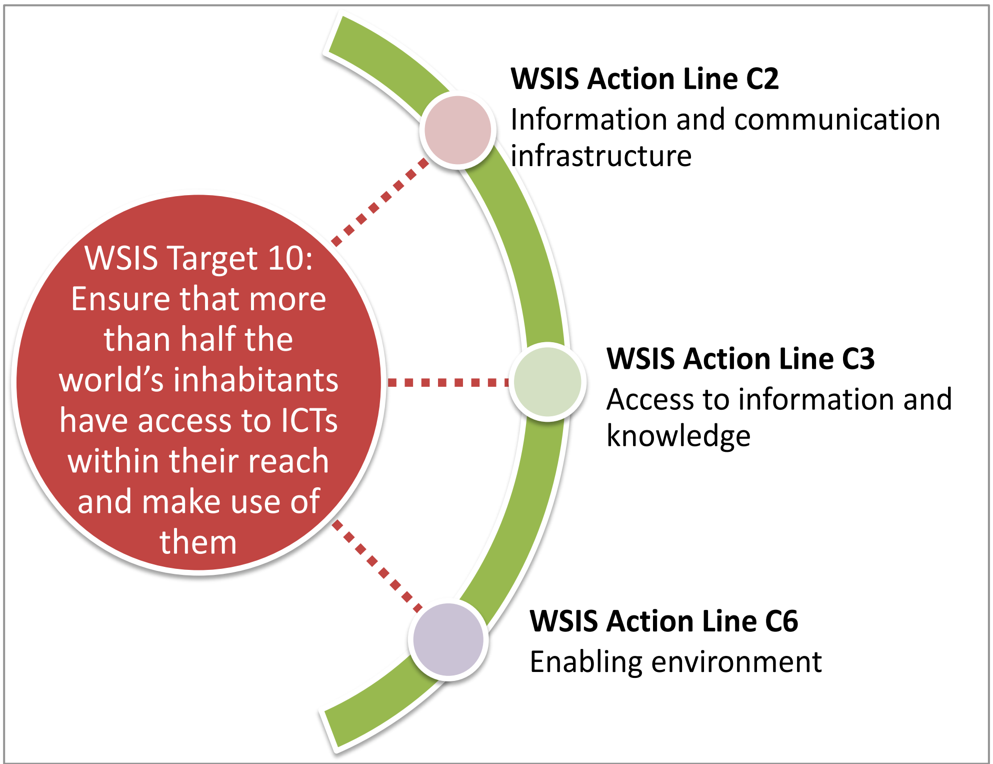
An evaluation of the program published in the Journal of International Affairs in 2010 (Warschauer and Ames, 2010) presented a wide-ranging critique of the OLPC initiative. In one case study, the evaluation of the program in Peru carried out by the Inter-American Development Bank (IDB) (Santiago *et al.*, 2010) in 2010 reported that the OLPC program had encountered initial infrastructure difficulties. A number of the country's rural schools lacked electricity and those that did have electricity typically had only one outlet in the principal's office, making charging the laptops a barrier to use. Most schools lacked Internet access, further limiting how the laptops could be used. Only one in ten teachers received technical support and even fewer received pedagogical support for use of the laptops. The lack of teacher training also meant that access to the XO laptops did not translate to use because there were mismatches between the laptops and the school curriculum, pedagogy and assessment. The evaluation concluded that middle- and high-income countries may benefit from educational use of laptops if they devote substantial effort and funding to areas such as teacher training, curriculum development, assessment reform and formative evaluation (that is, ongoing assessment during the learning process so that teaching activities can be adjusted to improve learning outcomes). Clearly, access to laptops without meaningful use of them cannot secure the educational and social futures of children in the poorest countries.

These evaluation's findings resonate with the addition of actual ICT use to Target 10. Both emphasize that the benefits of ICTs can only be fully realized when people are using them. While beyond the scope of the current report, the purposes for which citizens are using ICTs and the subsequent social and economic outcomes of that use are of much interest to policy-makers and ICT champions around the world.

Source: ITU research.

Target 10 is related to all of the WSIS action lines as access and use of ICTs are the foundations of building an information society. In particular, Figure 10.1 illustrates the direct linkages to action lines C2, C3 and C6.

Figure 10.1: Relevance of Target 10 to WSIS action lines



Action Line C2 (Information and communication infrastructure) is a basic requirement for providing access to ICTs. Action Line C2 emphasizes that "Infrastructure is central in achieving the goal of digital inclusion, enabling universal, sustainable, ubiquitous and affordable access to ICTs by all ..." This principle highlights the importance of infrastructure to the goal of ensuring that half the world's inhabitants have access to ICTs. Action Line C2 also addresses the usage dimension by emphasizing the need to "Encourage and promote joint use of traditional media and new technologies."

Action Line C3 (Access to information and knowledge) is highly relevant to Target 10, as access to ICTs is a prerequisite for "... people, anywhere in the world, to access information and knowledge almost instantaneously. Individuals, organizations and communities should benefit from access to knowledge and information." Action Line C3 also emphasizes actual ICT use in its recommendation that "Governments should actively promote the use of ICTs as a fundamental working tool by their citizens and local authorities."

Action Line C6 (Enabling environment) recommends that "Governments should foster a supportive, transparent, pro-competitive and predictable policy, legal and regulatory framework, which provides the appropriate incentives to investment and community development in the Information Society." Action Line C6 has a significant 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 extending access to more people.

In order to make use ICTs, people need to have the necessary skills, confidence and incentives. As such, Target 10 is also related to 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). Efforts channelled towards these action lines will also enhance progress made towards the achievement of Target 10.

Data availability and scope

The *World Telecommunication/ICT Development Report 2010: Monitoring the WSIS Targets, A mid-term review* (WTDR) (ITU, 2010) noted that the wording of Target 10 is vague in that it calls for populations to have ICTs "within their reach". The concept of "within reach" is subjective and cannot be defined in absolute terms of distance or time. For instance, a public access computer in the local library can be a short walk away for an urban resident but a cyber café may be many kilometres away for a rural resident. In both cases, the Internet is arguably "within reach" but the investment in time to access the facilities varies considerably. Thus far, there is no way to track the target in absolute terms of time and distance as countries typically do not measure this. The indicators presented in this chapter have operationalized "within reach" in terms of household access, and subscriptions, to ICTs.

Target 10 indicators are all *Partnership* core ICT indicators, for which comprehensive statistical standards and established data collection practices exist (*Partnership*, 2010). Table 10.1 maps Target 10 indicators to their respective core indicator/s and presents the data sources used in this report for measuring Target 10. For Indicator 10.1, the original data sources are telecommunications operators. In almost all countries, data are aggregated at the national level by telecommunication/ICT regulators and ministries, which provide information annually to ITU. For indicators 10.2 to 10.5, the data are collected by ICT household surveys, usually conducted by national statistical offices (NSOs). Indicator 10.4 is supplemented with ITU estimates.

Table 10.1: Data sources for indicators for measuring Target 10

Indicators		Partnership core indicator	Data availability[5]
10.1	Mobile-cellular telephone subscriptions per 100 inhabitants	A2	Very high data availability (90 per cent of countries provide data for this indicator; ITU estimated data for a further 8 per cent of countries).
10.2	Proportion of households with telephone, by type of network	HH3	Low data availability (14 per cent of countries).
10.3	Proportion of individuals using a mobile cellular telephone	HH10	Relatively low data availability (23 per cent of countries).
10.4	Proportion of individuals using the Internet	HH7	High data availability (39 per cent of countries provide these data) Estimates are included for the remaining countries.[6]
10.5	Proportion of households with Internet access, by type of access	HH6	Very high data availability (48 per cent of countries).
		HH11	Low to very low data availability (9 per cent of countries provide data on households accessing the Internet by mobile broadband, 23 per cent on households accessing by narrowband and 26 per cent on households accessing by fixed broadband).

Source: ITU.

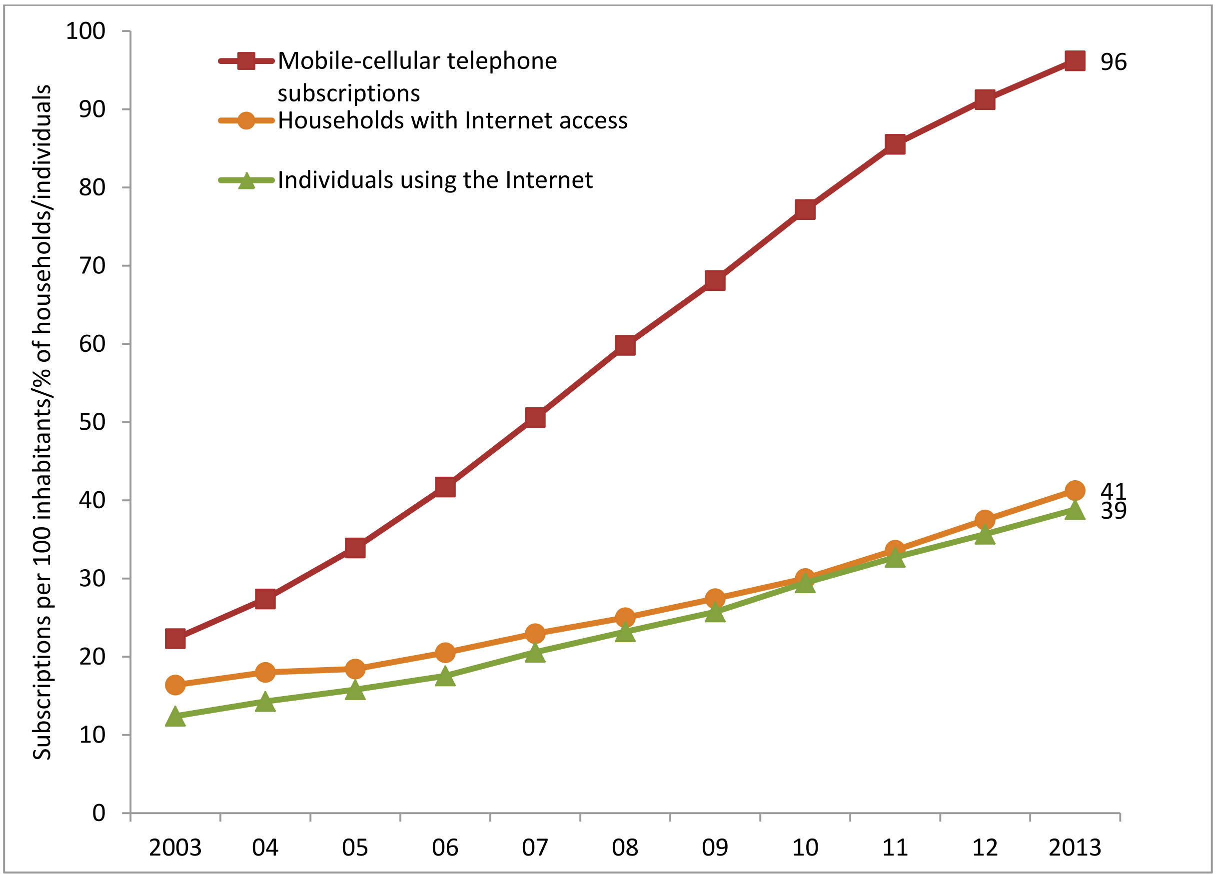
The indicators used for the current review are *Partnership* core ICT indicators (described in *Partnership*, 2010). Revisions of the household indicators were finalized in 2013, with some changes to HH3, HH10 and HH11. Changes to the indicators on ICT infrastructure and access were also finalized in 2013, with no changes to A2. See ITU (2014) for more information.

Achievements against Target 10

The trends reported in the WTDR 2010 have persisted in the years since it was published. Since the mid-term review, overall penetration of ICT services has continued to grow (see Chart 10.1). The most significant area of growth was in mobile-cellular phone subscriptions, where penetration has increased phenomenally. At the end of 2013, there was nearly one mobile-cellular subscription for every person in the world and an estimated four in every ten people (39 per cent) had used the Internet. The proportion of households with broadband (fixed or mobile) had increased to about four in ten (41 per cent) These trends show that more people are using ICTs and thus participating in the information society.

The rest of this section will provide detailed analysis of the five indicators measuring progress for Target 10.

Chart 10.1: Global ICT development, 2003–2013[7]



Source: ITU World Telecommunication/ICT Indicators Database.

Note: Global ICT data are published on the ITU website, http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx.

Mobile-cellular subscriptions

Indicator 10.1 refers to the number of mobile-cellular phone subscriptions in a country for each 100 inhabitants. This indicator has the advantage over signal coverage indicators (see Target 1) that it provides information on the reach of the mobile phone in terms of subscriptions. (The reach of coverage indicators refer to radio signals that may or may not be picked up by people depending on whether they have the means.) Furthermore, up-to-date mobile-cellular subscription data are widely available for nearly all countries in the world. In particular, data from least developed countries (LDCs), which are typically scarce, are more available for this indicator, compared to the others (see Chart 10.3). Box 10.2 shows the methodological limitations of data on mobile-cellular subscriptions.

Box 10.2: Limitations of data on mobile-cellular telephone subscriptions

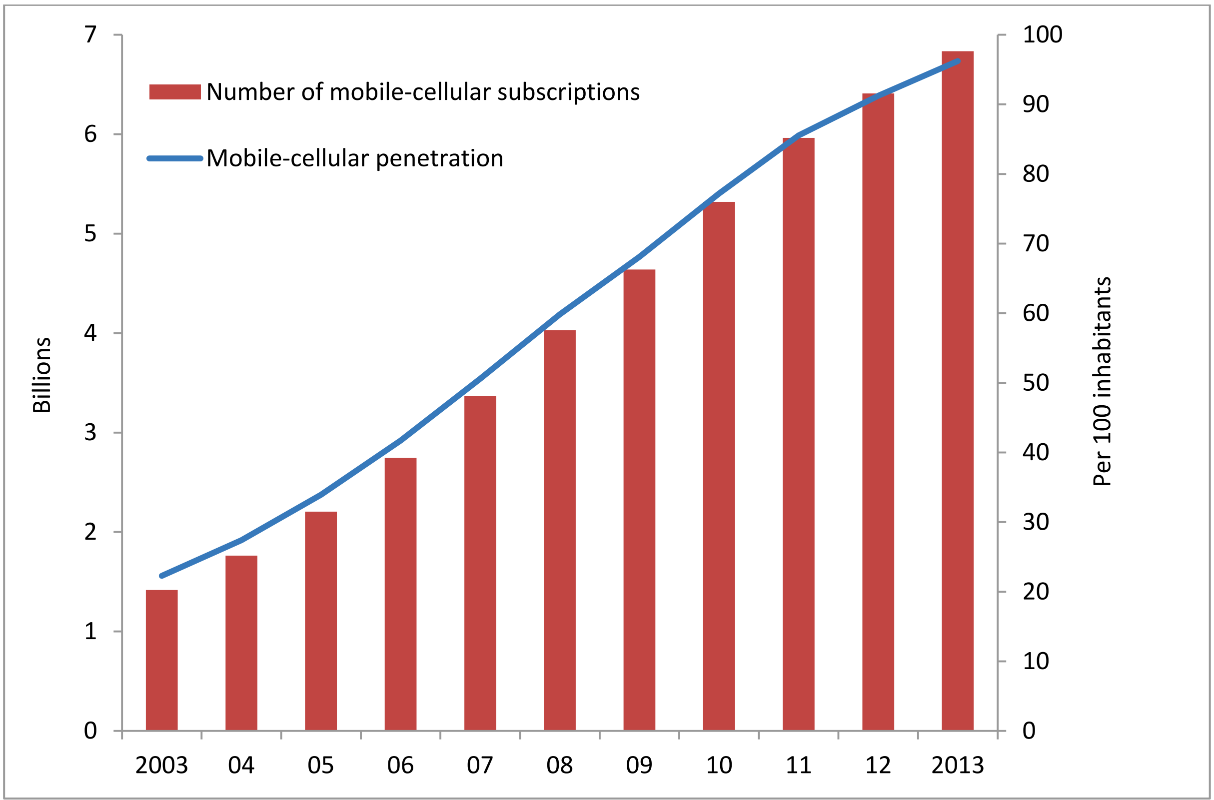
The WTDR 2010 noted two methodological limitations with mobile-cellular subscriptions – over-estimation due to duplicate subscriptions and underestimation because of shared access to mobile phones:

- Over-estimation due to duplicate subscriptions: mobile phone users can have more than one subscription for different reasons. They might have different numbers for work and for personal life; they might use different SIM cards to obtain full network coverage; or they may wish to optimize tariffs from different operators. Mobile phones with dual or multi-SIM functions also fuel this trend towards multiple subscriptions. In fact, all countries (both developed and developing) for which there are available data have more subscribers than users (see Chart 10.8). This trend was highlighted in the mid-term review and, at the end of 2013, appeared to be more pronounced. The WTDR 2010 also discusses inactive subscriptions, which contribute to the over-estimation of mobile-cellular penetration.
- Under-estimation due to sharing of mobile phones: an underestimation occurs when one subscription is shared by more than one individual, as is the case in many developing countries. For instance, in Malawi, subscription penetration was 26 per cent at the end of 2011 and household access was 36 per cent. This suggests that people in Malawi may have been sharing their mobile phones with other family members. The Grameen Village Phone Project (Grameenphone, 2010) in the late 1990s is an example of shared access and shows how the reach of the mobile phone can be underestimated when only subscriptions are considered. In the case of the Grameen Village Phone Project based in Bangladesh, women entrepreneurs purchased GSM mobile phones using microcredit and sold airtime to villagers who did not have a mobile-cellular subscription.

Source: WTDR 2010 (ITU, 2010).

In terms of mobile-cellular penetration, Target 10 was achieved by 2008 (see Chart 10.2). With a penetration rate of 96 subscriptions per 100 inhabitants by 2013, the mobile-cellular phone epitomizes an ICT that is "within reach". By comparison, in 2003, there was about one mobile-cellular subscription for every five inhabitants and by 2009, there were slightly over two mobile-cellular subscriptions for every three people. In 2013, there were 6.8 billion subscriptions for the world's population of 7.1 billion people.

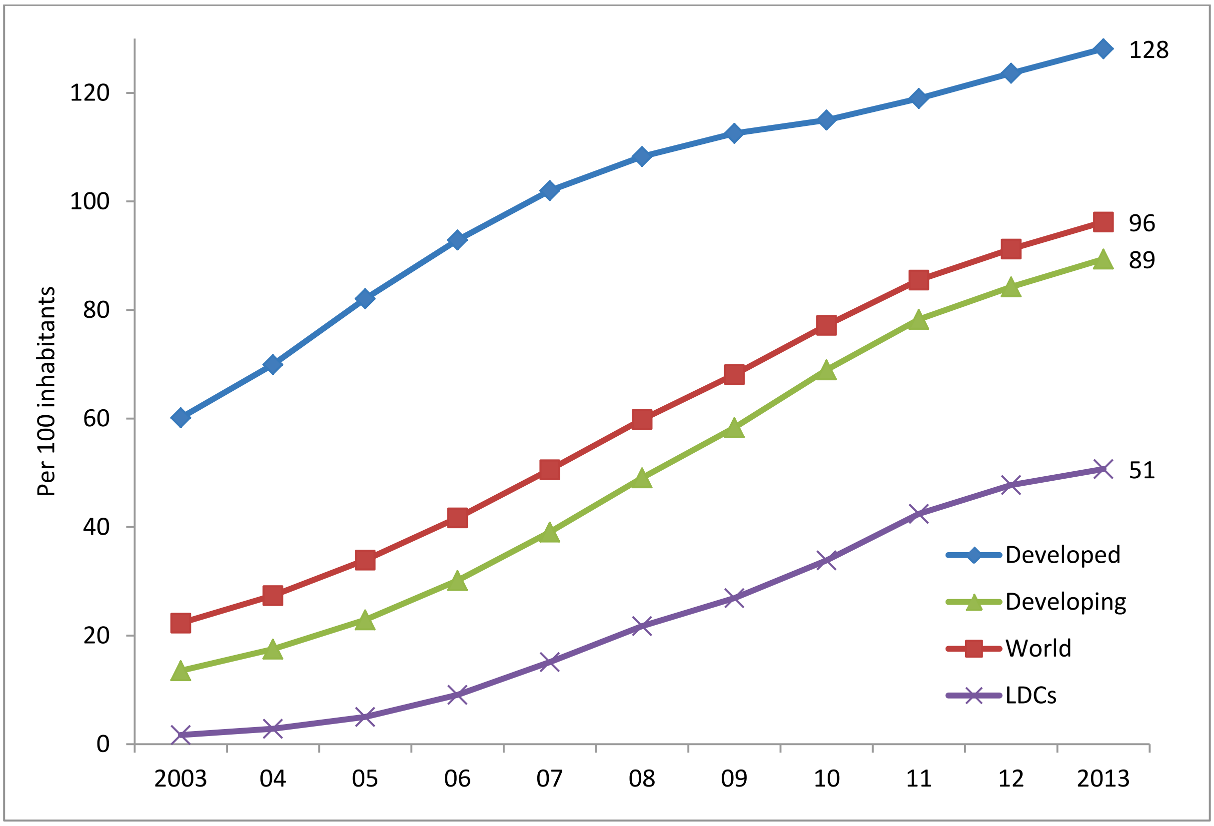
Chart 10.2: Global mobile-cellular subscriptions, 2003–2013



Source: ITU World Telecommunication/ICT Indicators Database.

Chart 10.3 shows global mobile-cellular subscriptions by level of development from 2003 to 2013. Developed countries had an estimated penetration rate of 128 mobile-cellular subscriptions per 100 inhabitants by the end of 2013. Developed countries had achieved Target 10 in respect of mobile-cellular penetration by 2003, while developing countries achieved it by 2009 (58 subscriptions per 100 inhabitants).[8]

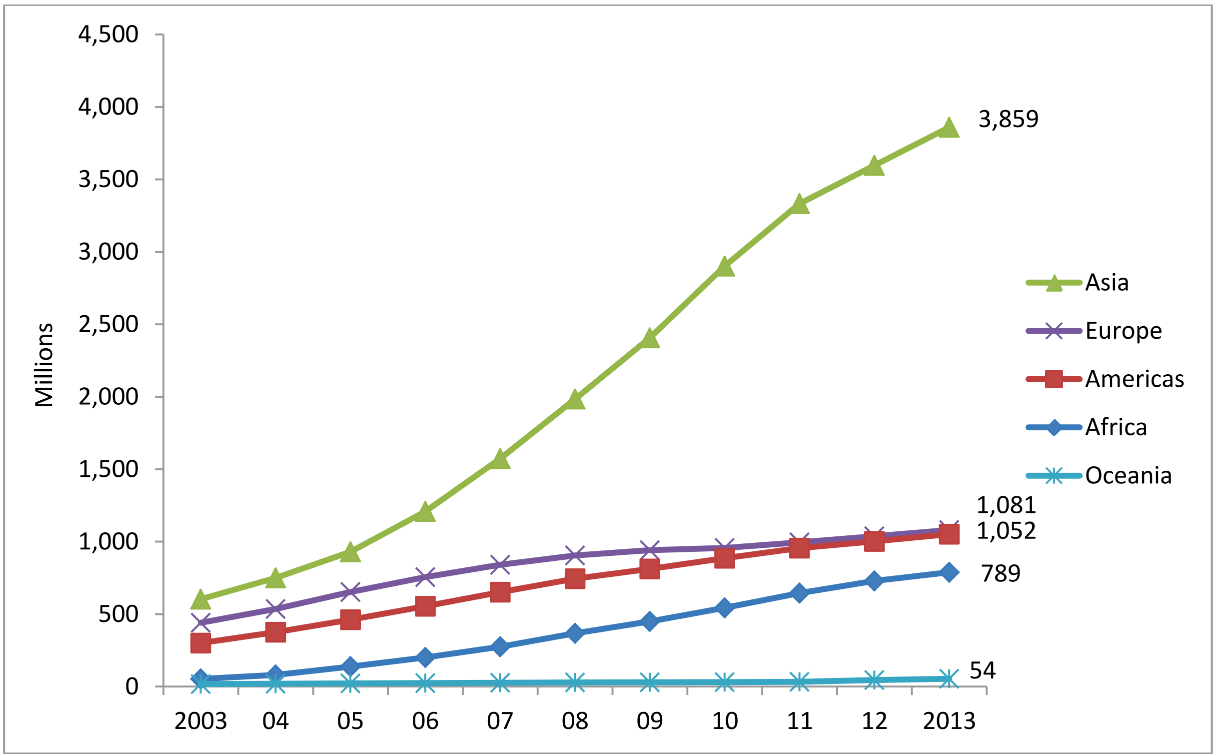
Chart 10.3: Mobile-cellular subscriptions, by level of development, 2003–2013



Source: ITU World Telecommunication/ICT Indicators Database.

Chart 10.4 shows the number of mobile-cellular subscriptions by region, while Chart 10.5 shows mobile-cellular penetration (subscriptions per 100 inhabitants) by region. With its high population, Asia accounts for more than half of the mobile-cellular subscriptions globally at the end of 2013 (3.9 billion out of 6.8 billion subscriptions globally). China and India together accounted for about half of the subscriptions in Asia by 2013; India's share was 860 million and China's share 1.1 billion. In contrast, Oceania accounted for about 8 per cent of global subscriptions.

Chart 10.4: Number of mobile-cellular subscriptions, by region, 2003–2013



Source: ITU World Telecommunication/ICT Indicators Database.

It is evident from Chart 10.4 that growth in global mobile-cellular subscriptions was mainly fuelled by Asia. Growth in Europe slowed between 2003 and 2013, reflecting the high level of penetration. The Americas and Europe each had about one billion subscriptions by the end of 2013 but it is likely that the Americas will overtake Europe in absolute numbers, given that the region has a larger population and current growth rates are higher.

By the end of 2013, the Americas and Europe had surpassed the mobile-cellular penetration rate of 100 subscriptions per 100 inhabitants (Chart 10.5). Oceania (91) and Asia (90) were slightly below the global rate of 96, while Africa had the lowest penetration, at 72 subscriptions per 100 inhabitants. Chart 10.5 shows increases in penetration rates across all regions. While the regional penetration rate in Oceania is comparable to that in Asia, this figure is skewed because of the contributions of Australia and New Zealand. Many of the small island developing countries in Oceania still lag in mobile-cellular penetration, though there has been some improvement, with monopolistic markets in countries like Samoa and Vanuatu opening up to competition and the successful implementation of universal access policies.[9] Box 10.3 presents a summary of the growth of mobile phone ownership and the significant progress made by the Pacific Island nations in Oceania.

Box 10.3: Mobile phones in the Pacific Islands developing countries

Although the mobile-cellular penetration rate in Oceania was 91 subscriptions per 100 inhabitants by the end of 2013, Australia and New Zealand accounted for most of the subscriptions. Many of the Pacific Island developing countries still reported fewer than 60 subscriptions per 100 inhabitants. For instance, mobile-cellular penetration was about 53 in the Solomon Islands. This number, while below the global and Oceania average, is noteworthy given that penetration rates were under 20 subscriptions per 100 inhabitants in 2008.

A report by the Lowy Institute for International Policy identified a number of factors that are driving this growth. The Pacific Islands' telecommunications sectors have undergone deregulation and reform, driving down prices and fuelling a boom in mobile phone use. The growth is also a reflection of the region's demographic profile – one fifth of the Pacific Islands' population, approximately two million people, is aged 15 to 24. As in other parts of the world, youth now are typically 'digital natives',[10] who are early adopters of technologies.

The increase in mobile uptake is helping the inhabitants of the region overcome some of the geographic and economic challenges of the Pacific Islands. The region comprises remote and small economies dispersed across a large geographical area. Many countries within the region, particularly those in Melanesia (Papua New Guinea, Fiji, Solomon Islands, Vanuatu and New Caledonia), suffer high unemployment and a lack of basic education and health services.

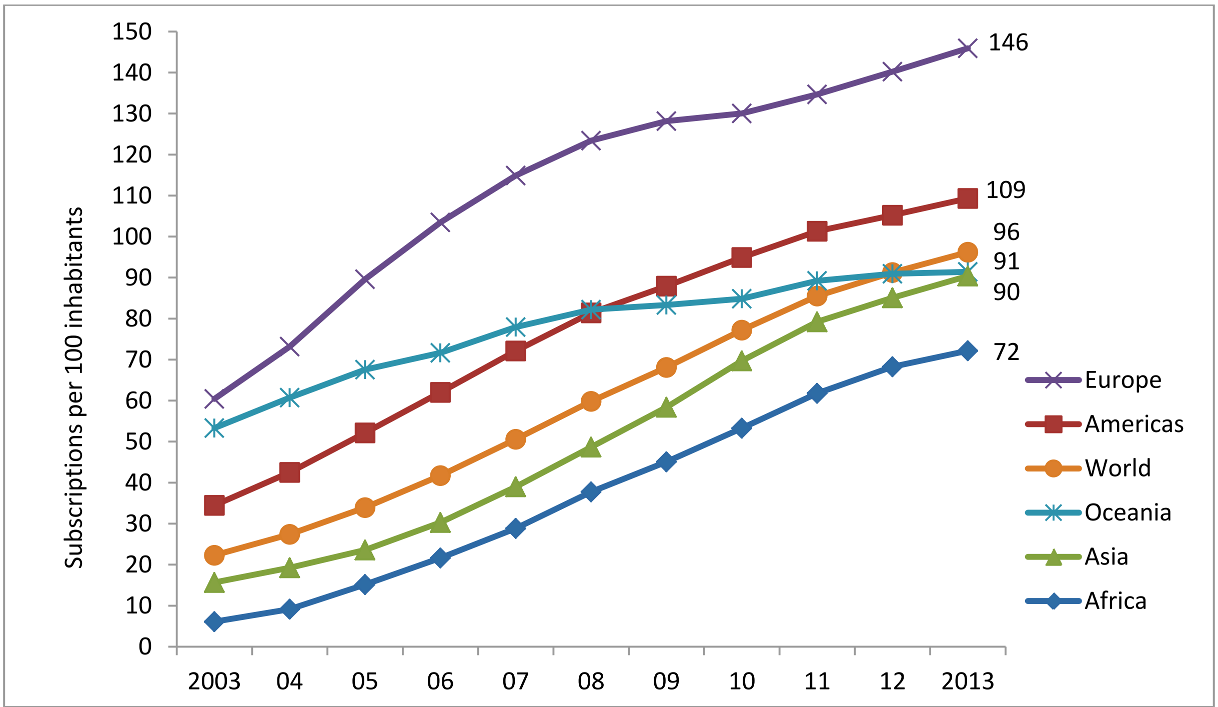
Mobile phones are now being used to access the Internet, listen to radio, receive SMS text information services, take and send photos and video, access social networking sites, download music and even watch television. A June 2012 study, undertaken by ABC International and Intermedia, showed that 53 per cent of Papua New Guineans who accessed radio do so by listening via their mobile phones.

Mobile phones are also used for 'mobile money'. The mobile money market is relatively developed in the Pacific Islands and major mobile phone providers and banking institutions offer mobile banking options. For example, Digicel's *Mobile Money* service offers customers a range of mobile financial services, including the ability to transfer money to friends and family nationwide and pay utility bills through mobile phones. First launched in Fiji in July 2010, *Mobile Money* has now expanded to Tonga, Samoa, Papua New Guinea and Vanuatu. In Samoa, Fiji and Tonga, an international service has been added, which Digicel claims has slashed the cost of inter-country remittances.

Nevertheless, the Lowy study concluded that apart from mobile banking, mobile application options are still very limited and more could be done to use ICT as a key tool for the development, governance and sustainable livelihood of the people of the Pacific. To fully realize the potential of ICTs, a more focused effort and greater resources are required from governments, donors and the private sector.

Source: Lowy Institute for International Policy (2012).

Chart 10.5: Mobile-cellular penetration, by region, 2003–2013



Source: ITU World Telecommunication/ICT Indicators Database.

Box 10.4 highlights another motivation for extending the reach of mobile phones – that of increasing transparency and accountability in governance.

Box 10.4: Access to mobile phones can improve governance

Increasingly, governments and private organizations are recognizing the role of mobile phones and other technology in improving governance. Government systems can be made more open and transactions more efficient in a number of ways. Governments make information available so that citizens can retrieve the information relevant to them using mobile phones or the Internet. Citizens can in turn participate in the system by reporting and adding to the information that is publicly available. Three such systems from India, Kenya and Zimbabwe are described below.

In India, mobile phones systems are improving the delivery of public services. The use of mobiles improves the citizen-government interface and helps government agencies serve the people by, for instance, holding government auctions online or offering telemedicine services. In many states, emergency response systems based on mobile technologies are used to provide rescue and relief. The Indian Ministry of Communications and Information Technology has attributed the saving of lives in natural disasters to mobile connectivity. When Cyclone Phailin hit Odisha on the east coast of India in October 2013, hundreds of thousands of people were saved because people had access to mobile phones and therefore the government was able to quickly provide them with information.[11]

In Kenya, the Kenyan Budget Tracking Tool has been implemented by various ministries to put budgetary data online in a way that would be useful for citizens. The Budget Tracking Tool also has a script to handle simple SMS queries, so that anyone with a mobile phone can text in and find out how much money has been allocated for various projects in their area. The system currently gets between 4 000 and 4 500 queries per month (Sasaki, 2010). In the case of the Kenyan Budget Tracking Tool, ministries were willing to make their data accessible but lacked the necessary technical skills to make their databases navigable until the developers of the tool provided the technical expertise.

Transparency International Zimbabwe (TI-Zimbabwe) harnesses SMS to solicit citizen reports of experiences with corruption. According to the organization, witnesses of corruption send text messages to the SMS platform to report cases of bribery and cheating. The information received is used to help craft anti-corruption strategies and provide assistance for witnesses and victims.[12]

Source: ITU Research.

Overall, Indicator 10.1 shows the tremendous progress made in the achievement of Target 10. There was nearly one mobile-cellular subscription for every person in the world by the end of 2013. In developing countries, the penetration rate was close to 90 subscriptions per 100 inhabitants and, in LDCs, penetration was 51 subscriptions per 100 inhabitants. However, on its own, the indicator does not provide a complete assessment of Target 10 with respect to mobile phones, given the statistical limitations described in Box 10.2. Analysis of Indicator 10.1 by region indicates that there is still much to be done in terms of extending the reach of mobile phones to people in Africa and Asia.

Households with telephone

Indicator 10.2 refers to telephone access at home by in-scope households. The indicator is split into four parts:

- Proportion of households with any telephone access
- Proportion of households with fixed telephone only
- Proportion of households with mobile cellular telephone only
- Proportion of households with both fixed and mobile cellular telephone.

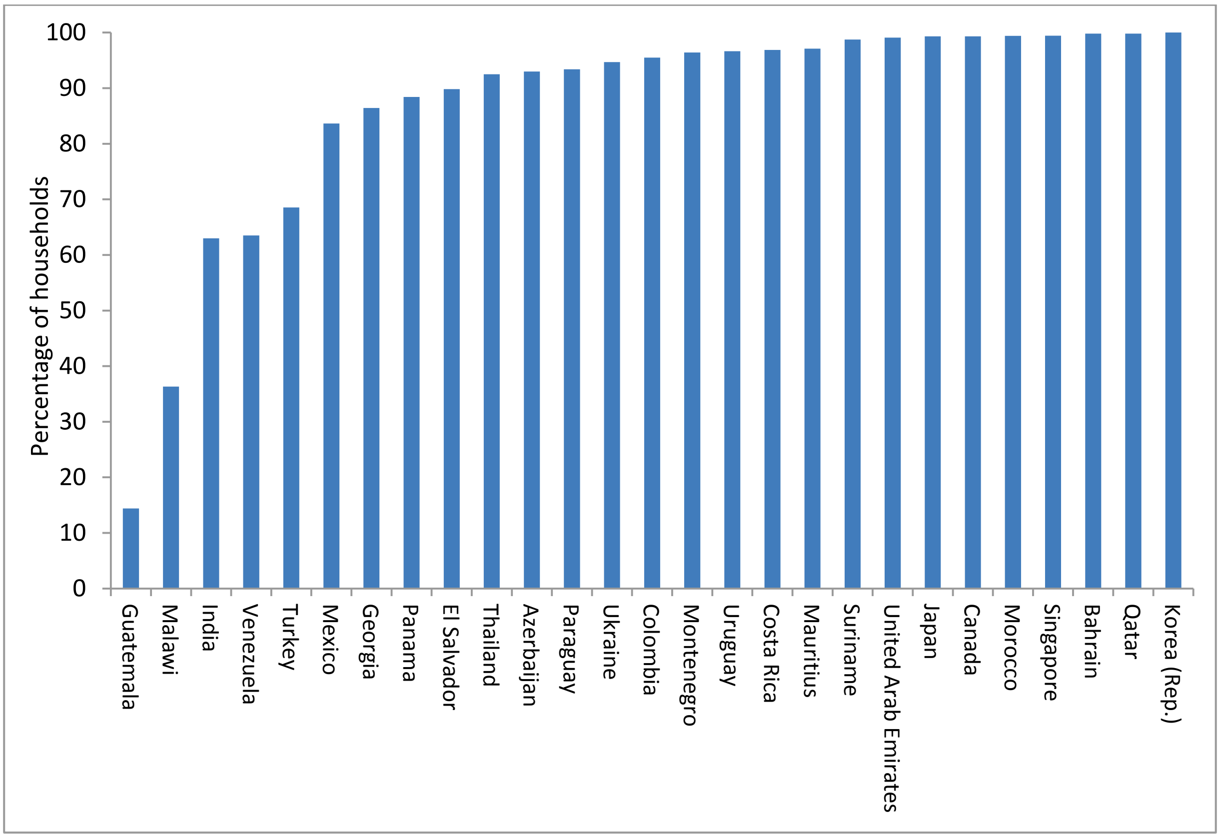
Household access to telephony takes into account shared access to devices that coverage or subscription indicators cannot capture. Information on household access is collected through national household surveys, usually conducted by national statistical offices (NSOs). Although data availability has increased since the mid-term review in 2010, the information is far from complete and data availability is not sufficient to enable regional or global estimates.

It is important to note that countries apply different concepts in measuring ICT household access. Some countries consider a household to have access to ICTs if any (individual) member has access to ICTs. Other countries apply the 'traditional' concept established in household surveys about household goods availability and would generally consider a household as having access to ICTs if these ICTs are generally available for use by all members of the household at any time. The latter is the concept recommended by the 2014 ITU *Manual for Measuring ICT Access and Use by Households and Individuals*. Because two different approaches are applied in measuring ICT household access, data are not always comparable between countries (ITU, 2014).

Chart 10.6 shows the proportion of households with any telephone access (fixed or mobile) for the 27 countries with available data in 2012 or 2011. The percentage of households with any telephone access ranged from 14 per cent in Guatemala to over 90 per cent in most other countries.

Developing countries in the Americas performed well for this indicator; Colombia, Costa Rica, Suriname and Uruguay all had telephone penetration of 95 per cent or more. Two countries had telephone penetration that was below 50 per cent. Malawi had a penetration of 36 per cent and was the only least developed country (LDC) with data available. It is likely that other LDCs, if they had data available, would also show low household penetration rates. Guatemala had the lowest telephone penetration of 14 per cent. Overall, data that are available for Indicator 10.2 are consistent with Indicator 10.1 with regard to the significant progress made towards Target 10. However, this optimistic view of progress needs to be considered in the context of poor data availability.

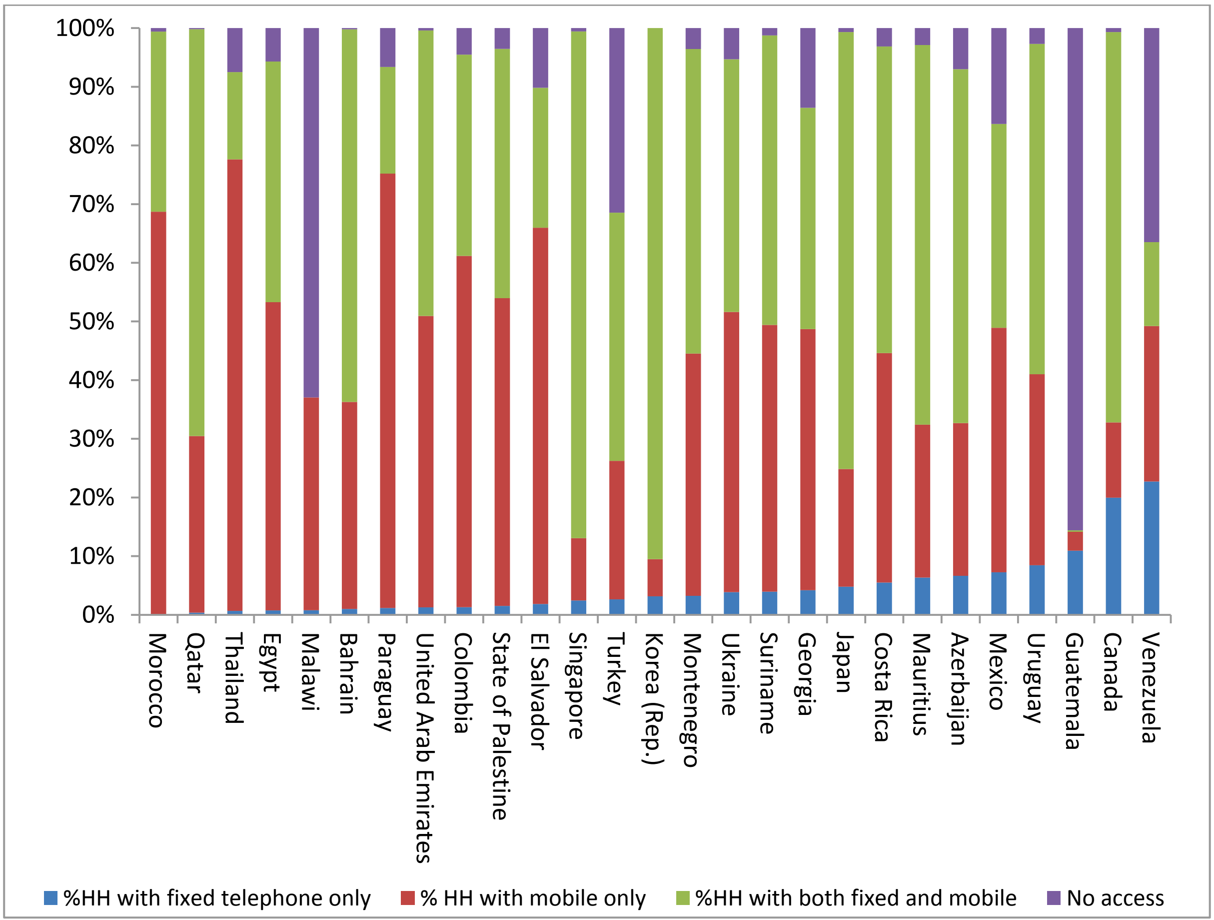
Chart 10.6: Households with any telephone access, 2012 or 2011[13]



Source: ITU World Telecommunication/ICT Indicators Database.

Chart 10.7 shows the proportion of households by the different types of telephone access for 28 countries. This chart provides insights that corroborate other observations made in this chapter. The chart breaks down household telephone access by households with: mobile phone only, fixed telephone only, both mobile and fixed, and no access. Broadly, two groups of countries emerge from this chart – countries with households that are highly-connected (access to both fixed and mobile phone), and countries with predominantly mobile phone access only. Of the 28 countries with available data, 11 had 50 per cent or more of their households with both fixed and mobile phone access. Countries that fall into this group include Azerbaijan, Bahrain, Canada, Costa Rica, Japan, Republic of Korea, Mauritius, Montenegro, Qatar, Singapore and Uruguay. Eight countries had 50 per cent or more of their households with mobile phone access only: Colombia, Egypt, El Salvador, Morocco, the State of Palestine, Paraguay, Thailand and the United Arab Emirates. Connectivity levels were low in Guatemala, Malawi, Turkey and Venezuela, at between 31 and 86 per cent of households having no telephone access.

Chart 10.7: Households by type of phone access, 2012 or 2011



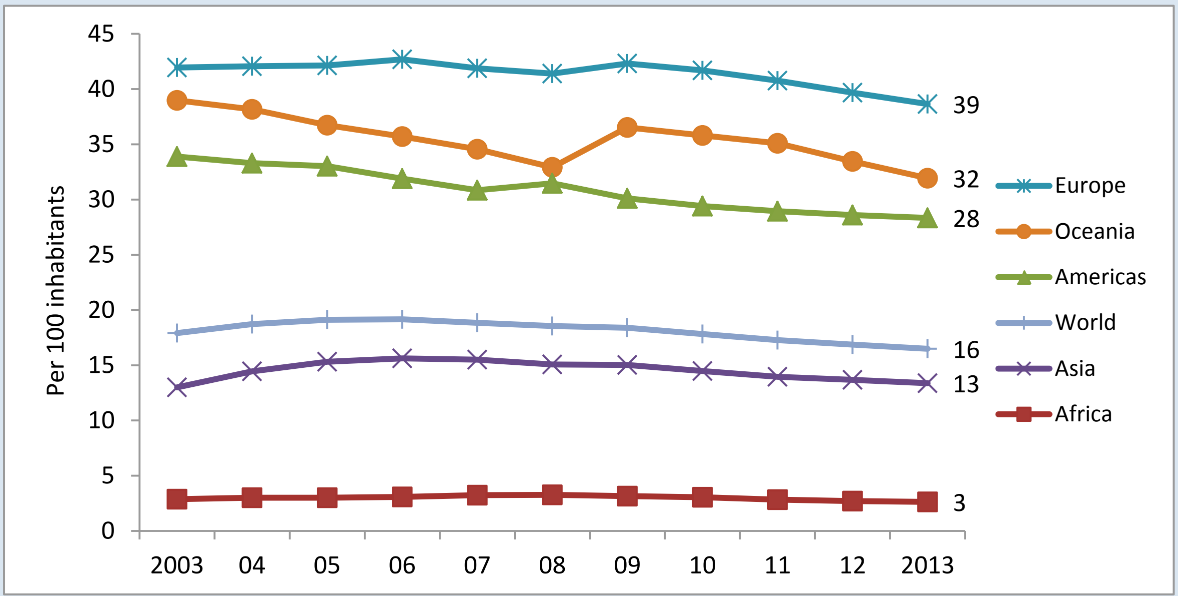
Source: ITU.

Overall, the results of Indicator 10.2 are promising for most of the countries with available data. For the majority of those countries, household access was more likely to be through mobile phone only or both fixed and mobile phone. For most countries, the proportion of households with access via fixed phone only was relatively small. This observation is consistent with the global decline in fixed phone subscriptions described in Box 10.5. The caveat to the optimistic evaluation based on Indicator 10.2 is that fewer than 30 countries had data available in 2012 or 2011 and that the LDCs are all but absent from the analysis. It is likely that household penetration for these countries is lower than those covered in the current review of Indicator 10.2.

Box 10.5: Decline in fixed-telephone subscriptions

The different components of Indicator 10.2 provide insights about the two modes of telephone access (fixed and mobile) and their respective reach at the household level. In terms of penetration rates, two trends are evident from the data over time. One is the increasing penetration of mobile-cellular phones discussed earlier; the other is that fixed-telephone subscriptions have been on a steady decline (see Chart Box 10.5). Since 2003, global fixed-telephone penetration has declined from 18 subscriptions per 100 inhabitants to 16 at the end of 2013. The greatest changes were in Oceania, the Americas and Europe, which showed declines of 7, 6 and 3 subscriptions per 100 inhabitants, respectively. Fixed-telephone penetration in Africa and Asia has been relatively stable over the period, at 3 and 13 subscriptions per 100 inhabitants, respectively. According to the Federal Communications Commission (FCC), in the United States, fixed-telephone subscriptions decreased from 133 million in 2009 to 101 million in 2012 (FCC, 2013). The FCC noted that the decline in subscribers to traditional wired telephone services corresponded with a growth in subscribers to both mobile telephony services and Voice over Internet Protocol (VoIP).[14]

Chart Box 10.5: Fixed-telephone subscriptions (per 100 inhabitants), by region, 2003–2013



Source: ITU World Telecommunication/ICT Indicators Database.

Market research has suggested that more users around the world are adopting VoIP. For example, research conducted by Infonetics (Infonetics Research, 2013) found that residential and business adoption of VoIP grew by about 3 per cent in the first quarter of 2013 and is expected to continue rising. The research by Infonetics also found that residential VoIP subscriptions topped 203 million worldwide in the same period. Although VoIP is not a new technology, it has been growing steadily over time and now constitutes a relevant share of access to telephone services.

Source: ITU research.

Mobile cellular telephone users

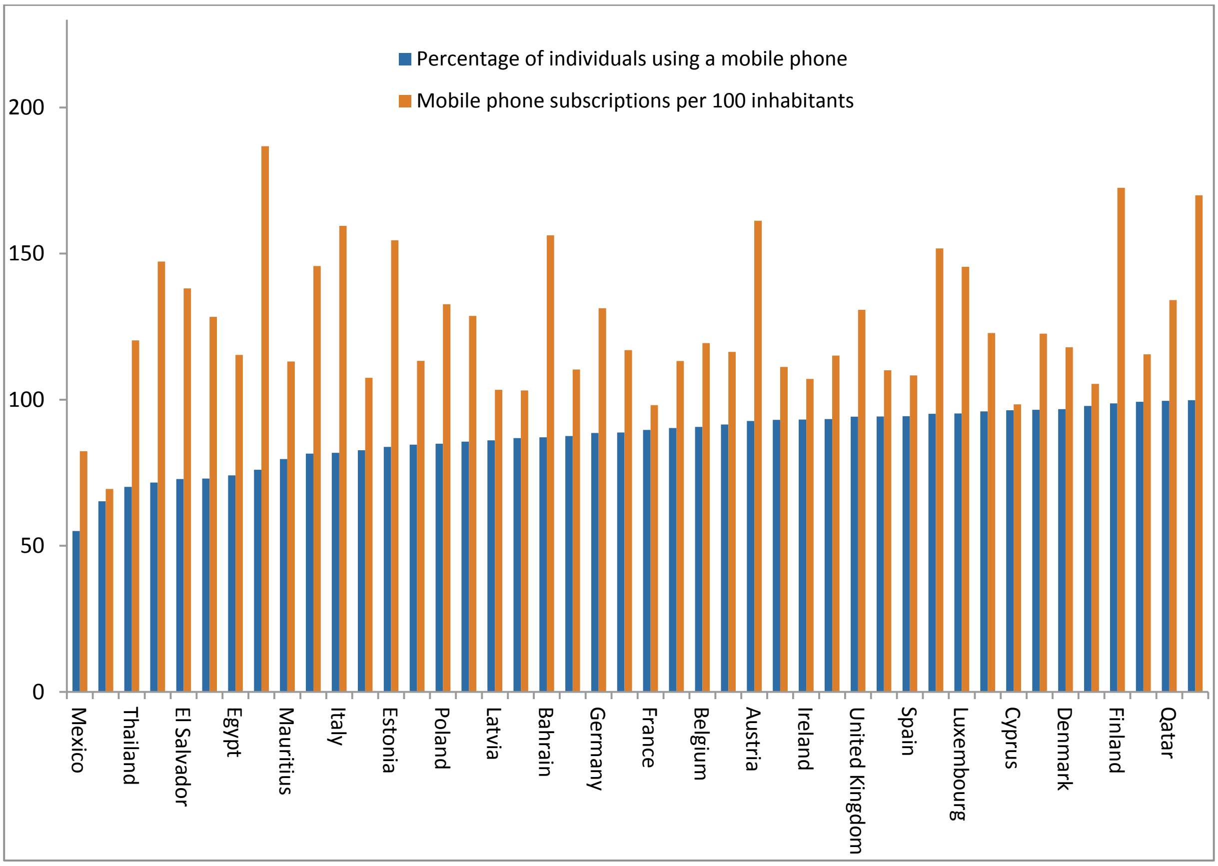
Indicator 10.3 refers to mobile cellular telephone use by in-scope individuals. The indicator tracks use of telephone services at the individual level, regardless of whether the user owns a phone or pays for the services. The mobile phone may be available through work, a friend or family member. It may be owned collectively by several individuals or the use could be purchased from a public telephone call service (*Partnership*, 2011).

Indicator 10.3 is collected through ICT household surveys, usually conducted by NSOs and compiled at the international level by ITU. Data availability was slightly better than for Indicator 10.2, with 44 countries having data available in either/both 2012 or 2011. However, as for Indicator 10.2, few LDCs had data on Indicator 10.3; it is presumed that these economies have lower penetration rates.

Chart 10.8 shows the 'proportion of individuals using a mobile cellular telephone' and 'mobile-cellular subscriptions per 100 inhabitants', for the subset of countries with both indicators available in the same year. In terms of progress made towards Target 10, for all 44 countries with available data, over 50 per cent of individuals were using a mobile phone.[15] This figure was over 90 per cent for half of the countries. Mexico had the lowest proportion of users at 55 per cent in 2011, while two countries (Qatar and United Arab Emirates) reported that 100 per cent of individuals used a mobile phone.

Chart 10.8 clearly shows the difference between mobile phone usage rates and penetration rates (Indicator 10.1). For all countries shown, the number of subscriptions per 100 inhabitants exceeds the proportion of individuals using a mobile phone. The reasons for this were explored in Box 10.2. For some countries, the differences were particularly high, with six countries showing a difference of over 70. The highest difference was in Panama, where mobile-cellular penetration was 187 per 100 inhabitants and the proportion of mobile users was 76 per cent, meaning that nearly a quarter of inhabitants did not use a mobile phone despite the high subscription numbers.

Chart 10.8: Mobile telephone users versus mobile-cellular subscriptions, 2012 or 2011



Source: ITU World Telecommunication/ICT Indicators Database.

Indicators 10.1, 10.2 and 10.3 focus on access to, and use of, the telephone. Collectively, available data for the three indicators show that Target 10 has been achieved for almost all countries. However, it should be emphasized that data from LDCs and most other developing countries were very limited for indicators 10.2 and 10.3. Data for Indicator 10.1 show that LDCs are making good progress (see Chart 10.3), with strong growth from 2 mobile-cellular subscriptions per 100 inhabitants in 2003 to 51 in 2013.

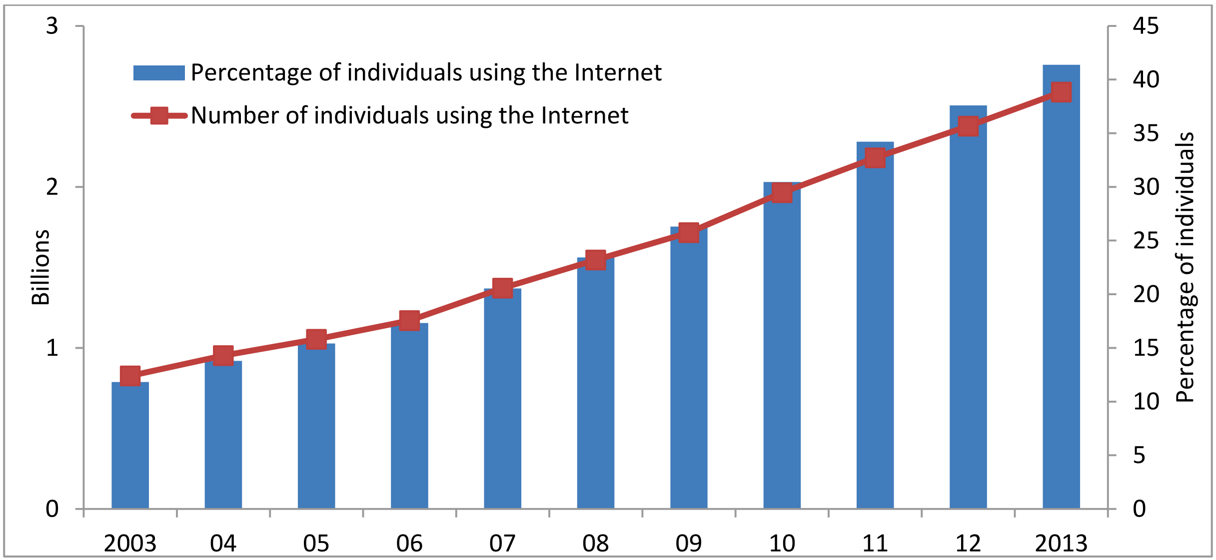
Internet use by individuals

Indicator 10.4 refers to the use of the Internet by in-scope individuals. Measuring the use of the Internet is vitally important in the assessment of advancement towards the information society because Internet access opens up opportunities in nearly every aspect of daily life – including communication, access to information and services, and economic opportunities. Internet use is inextricably intertwined with participation in the information society. For this reason, Internet use is included as an indicator in ITU's ICT Development Index (IDI) and global indices and rankings produced by the World Bank and the World Economic Forum.

Internet use here refers to Internet access via any device (for example, computers and mobile phones) and use from any location. The indicator is the *Partnership* core ICT indicator, HH7, 'proportion of individuals using the Internet'. HH7 is collected through ICT household surveys, usually conducted by NSOs. Given the importance of this indicator, ITU estimates Internet use for countries that do not collect data through official household surveys. Approximately 39 per cent of countries provide these data for the years 2011 and/or 2012; ITU estimates for the remaining countries.[16] ITU reports data on Internet users in the annual report *Measuring the Information Society*.

Use of the Internet was far less widespread than mobile communications when the mid-term review was conducted and this was still the case in 2013. Chart 10.9 shows the number of Internet users from 2003 to 2013. In 2013, there were 2.76 billion Internet users globally or 39 per cent of the world's population. This is still 11 percentage points away from the 50 per cent set by Target 10. The growth rate of the number of users between 2003 and 2013 was about 3 percentage points per annum. Therefore, if Internet use increases by another six per cent from 2014 to end 2015, Target 10 in terms of Internet use will be close to being achieved. Compared to the explosive growth of mobile communication, the growth in Internet penetration has been relatively sluggish. Nevertheless, the progress made over time is quite significant. In 2007, only 21 per cent of the world's population used the Internet and this proportion nearly doubled to 39 per cent in the six years to 2013.

Chart 10.9: Global Internet users, 2003–2013

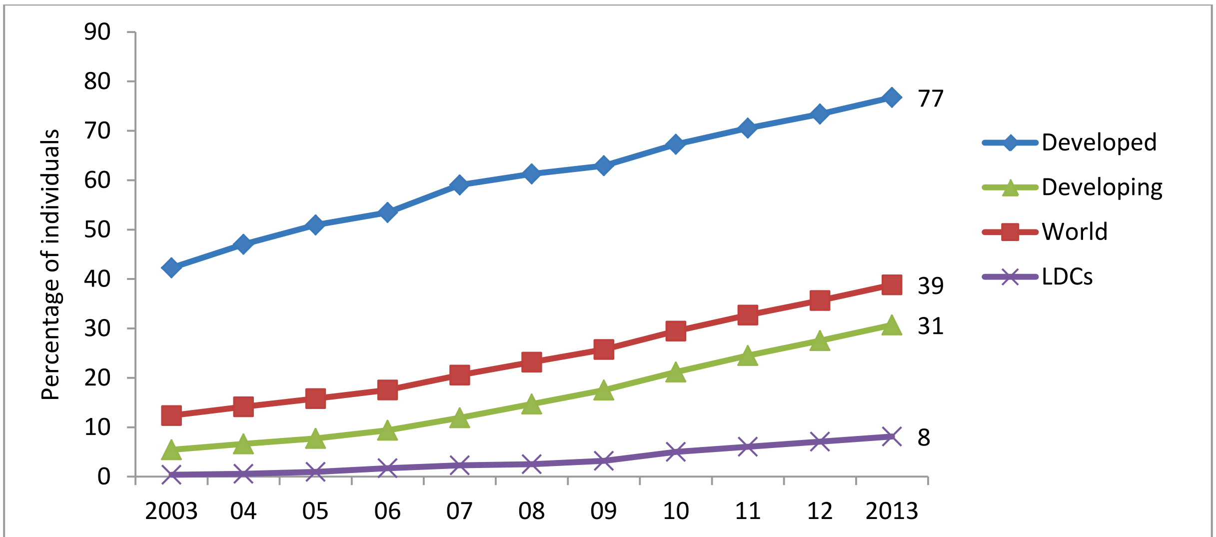


Source: ITU World Telecommunication/ICT Indicators Database.

The progress made thus far has many implications for the world's population. For example, many more people now have access to Internet-based applications that can improve their economic and social conditions. Box 1.6 (in Target 1) highlighted opportunities in Internet applications in telemedicine, financial services and agriculture for people in developing countries. When people use the Internet for communication purposes, such as e-mail and social networking, they are also acquiring important skills in digital literacy and participating in the information society.

Chart 10.10 shows the proportion of Internet users by level of development from 2003 to 2013. By 2013, Internet use in developed countries (77 per cent) was more than twice that in developing countries (31 per cent). In 2003, these figures were 42 per cent in developed countries and 5 per cent in developing countries. For least developed countries, ITU data suggest that by 2013, less than 10 per cent of the population was using the Internet. However, this represents a significant increase compared with 2003, when it was estimated than less than 1 per cent of the population was using the Internet.

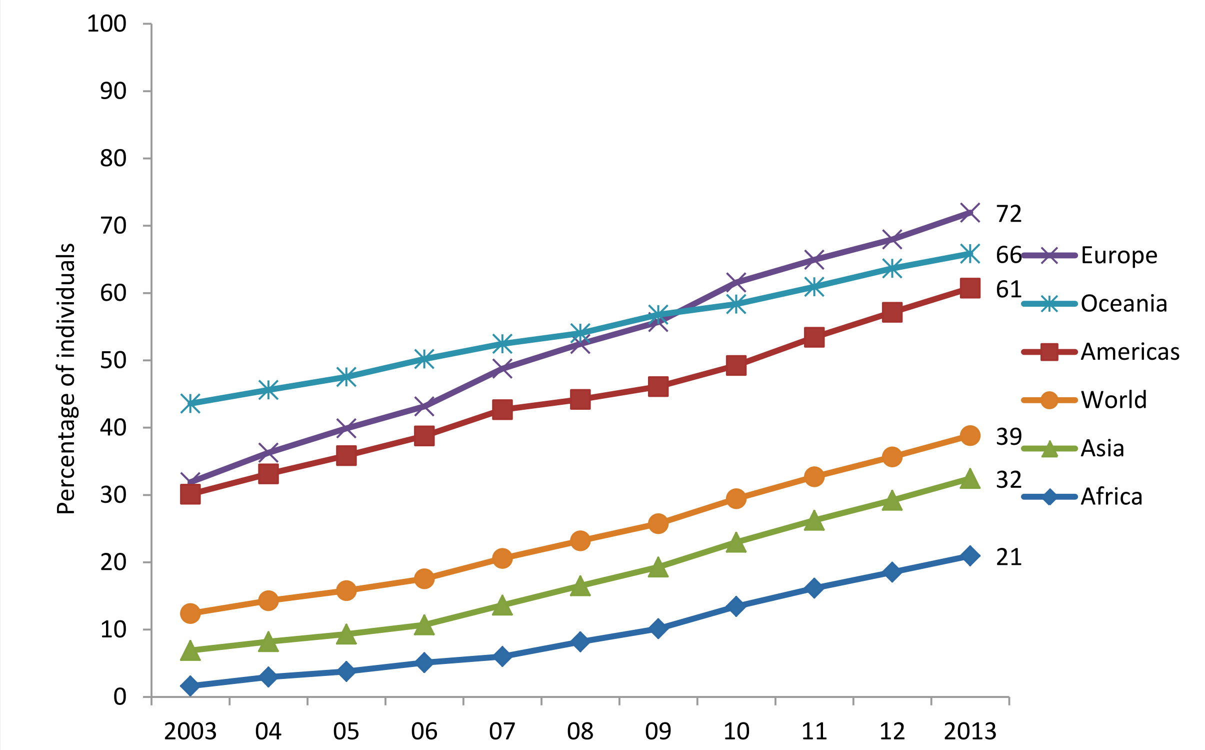
Chart 10.10: Internet users, by level of development, 2003–2013



Source: ITU World Telecommunication/ICT Indicators Database.

Chart 10.11 shows Internet users by region. Three regions have already achieved Target 10 in respect of Indicator 10.4. Europe achieved the target by 2009 and the Americas were on the cusp of reaching the target in 2009. By 2013, penetration in Europe had increased to 72 per cent, Oceania 66 per cent and the Americas 61 per cent. Asia was close to the global average at 32 per cent and Africa was lagging at 21 per cent.

Chart 10.11: Internet users, by region, 2003–2013



Source: ITU World Telecommunication/ICT Indicators Database.

Overall, Target 10 in terms of individuals using the Internet has not been achieved for either the developing world or globally. At 2013, an estimated 31 per cent of individuals in developing countries were using the Internet. Globally, it was 39 per cent of individuals – still 11 percentage points away from the 2015 target of "half the world's inhabitants".

Households with Internet access

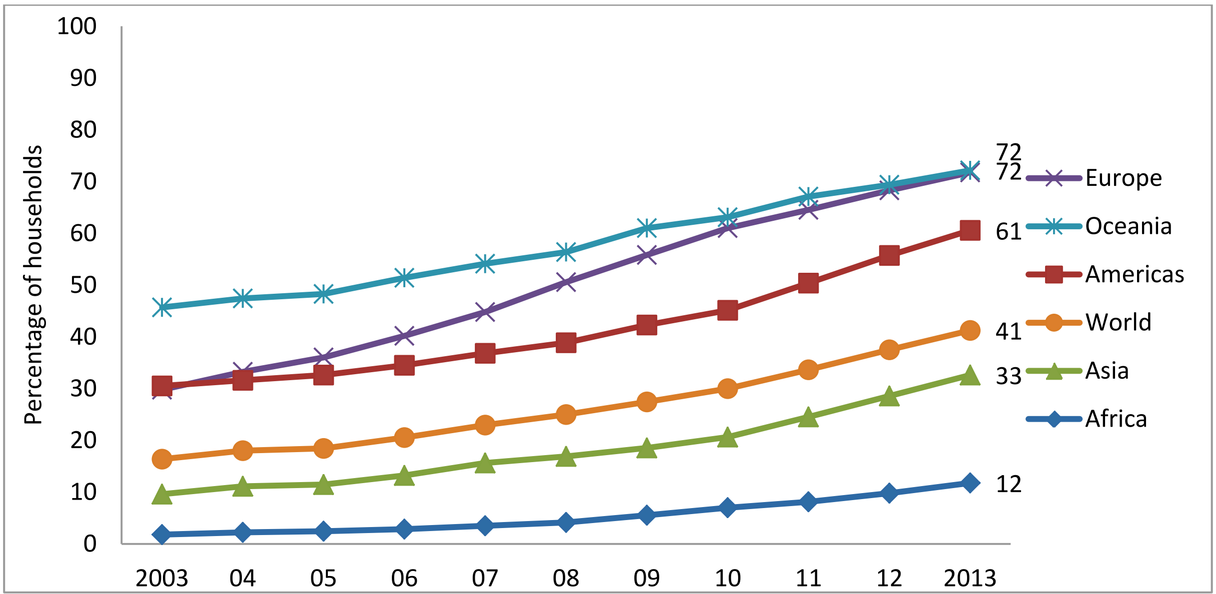
Indicator 10.5 refers to access to the Internet at home by in-scope households and the types of Internet access service/s they have. Tracking household Internet access is important because one Internet subscription to the home can be shared among all household members, allowing the entire household to access information and digital services. Home Internet access is usually more available than public access, which may offer limited access time and be inconveniently located.

Indicator 10.5 consists of the *Partnership* core ICT indicators, HH6, 'proportion of households with Internet access' and HH11, 'proportion of households with access to the Internet by type of access'. Data for these indicators are typically collected by NSOs through household ICT surveys. As with Indicator 10.4, ITU estimates household Internet access for countries that do not collect data through official household surveys. For the proportion of households with Internet access (HH6), about 48 per cent of countries provide data to ITU. In terms of the type of Internet access (HH11), only 9 per cent of countries provide data on households accessing the Internet by mobile broadband, 23 per cent on households accessing by narrowband and 26 per cent on households accessing by fixed broadband. ITU does not estimate for this indicator.

Chart 10.12 shows the proportion of households in the world with Internet access from 2003 to 2013. Globally, household access to the Internet was 41 per cent at by 2013, more than doubling from 16 per cent in 2003.

By region, the Americas, Europe and Oceania have all surpassed 50 per cent of households with Internet access. Oceania and Europe both had 72 per cent of households with Internet access by 2013, while the Americas had 61 per cent. Asia had 33 per cent of households with Internet access and Africa had 12 per cent. The last two figures are interesting when compared to the number of Internet users – Asia had 32 per cent Internet users and Africa had 21 per cent. Likely reasons for the lower figure in Africa include lack of infrastructure and/or high costs. As a consequence, individuals are more likely to use the Internet outside of the home, at places such as work, school or public locations.

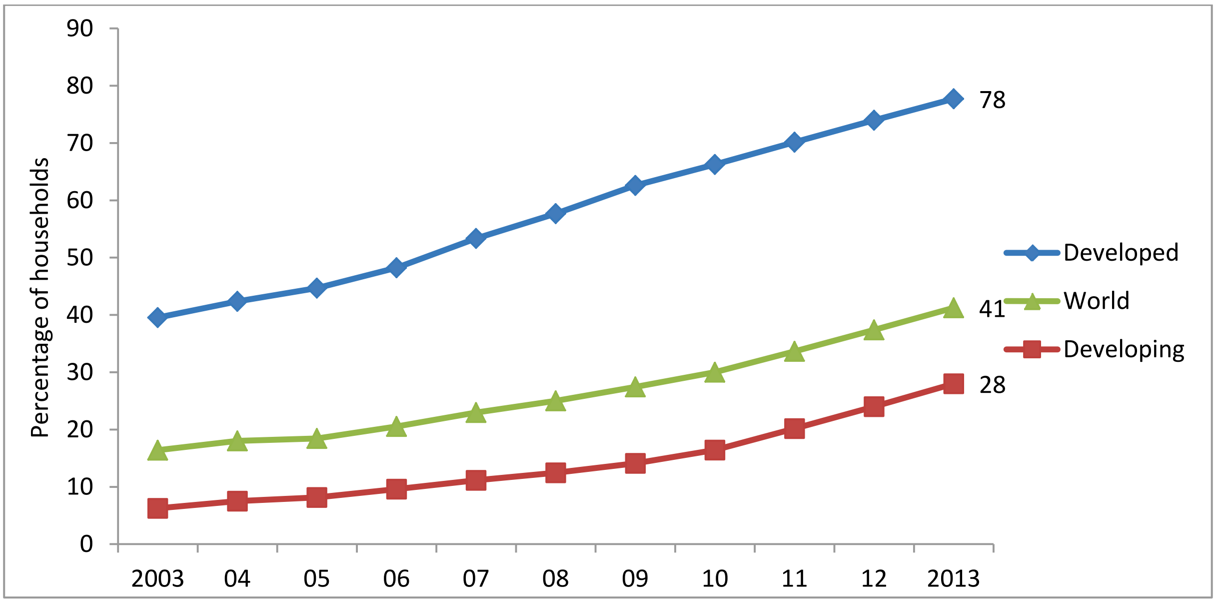
Chart 10.12: Households with Internet access, by region, 2003–2013



Source: ITU World Telecommunication/ICT Indicators Database.

Chart 10.13 shows the proportion of households with Internet access by level of development from 2003 to 2013. By 2013, 78 per cent of households in developed countries had Internet access at home compared to 28 per cent in developing countries. In 2007, developed countries had a level of 53 per cent, thereby achieving Target 10 in respect of household Internet access. In 2013, developing countries were considerably below the target and, at the current rate of adoption, will not achieve the target by 2015.

Chart 10.13: Households with Internet access, by level of development, 2003–2013



Source: ITU World Telecommunication/ICT Indicators Database.

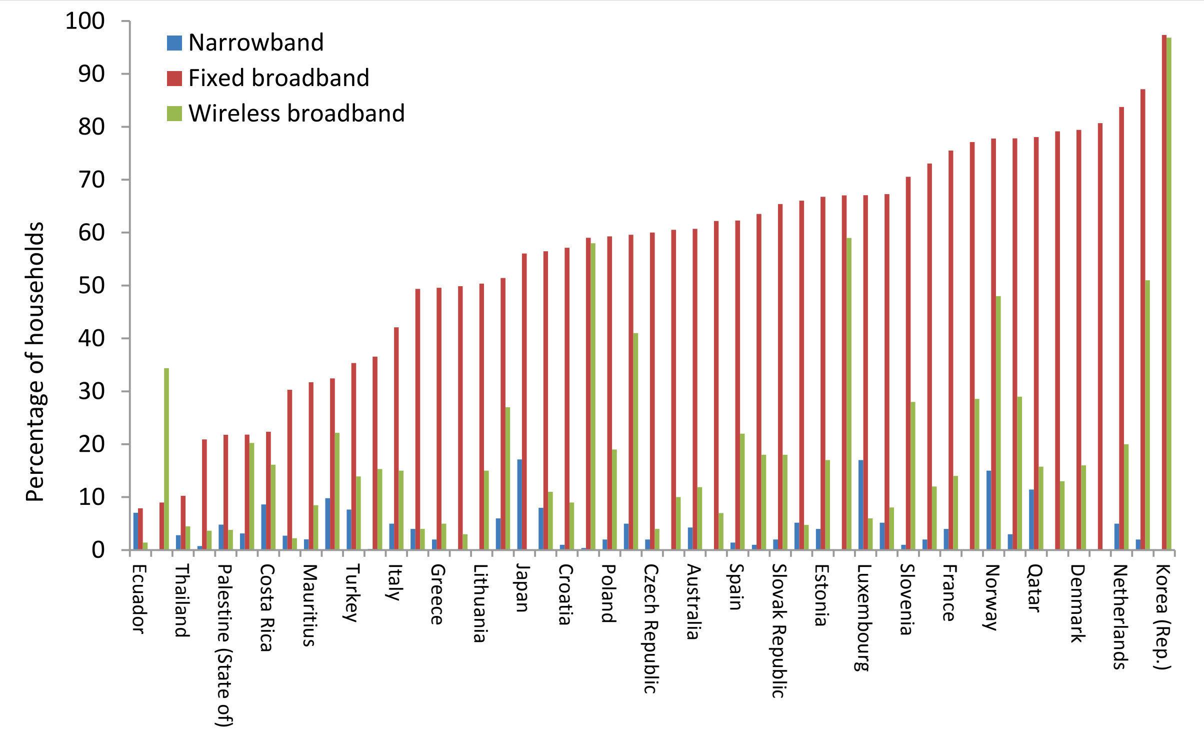
Chart 10.14 disaggregates the proportions of households with Internet access by different types of access – narrowband, fixed broadband and wireless broadband. Data availability for the disaggregation was lower than for *any* Internet access, with 49 countries having some data available on types of Internet access. The different types of access are defined (*Partnership*, 2011) as follows:

- Narrowband includes analogue modem (dial-up via standard phone line), ISDN (Integrated Services Digital Network), DSL at advertised download speeds below 256 kbit/s, and mobile phone and other forms of access with an advertised download speed of less than 256 kbit/s. Narrowband mobile phone access services include CDMA 1x (Release 0), GPRS, WAP and i-mode.
- Fixed broadband refers to fixed (wired) high-speed access to the public Internet (a TCP/IP connection) at downstream speeds of at least 256 kbit/s. This can include cable modem, DSL and fibre-to-the-home/building.
- Wireless broadband refers to wireless high-speed access to the public Internet (a TCP/IP connection) at downstream speeds of at least 256 kbit/s. This can include satellite Internet, terrestrial fixed wireless and fixed WiMax. It also includes broadband terrestrial mobile wireless access, which includes the following two types of subscriptions:
    - Standard mobile subscriptions with active use only, which includes mobile-cellular subscriptions with advertised data speeds of at least 256 kbit/s and which have been used to make an Internet data connection via IP in the previous three months.
    - Subscriptions to dedicated data services over a mobile network that are purchased separately from voice services either as a stand-alone service (modem/dongle) or as an add-on data package to voice services, which requires an additional subscription.

It is clear from Chart 10.14 that household access to the Internet is predominantly by fixed broadband. Of the 49 countries, with data on the type of Internet access, 35 reported that at least 50 per cent of households had fixed broadband. In terms of wireless broadband, four countries reported household access levels of 50 per cent or above. The Republic of Korea reported that 97 per cent of households had wireless broadband and 97 per cent of households had fixed broadband. The highest level of narrowband access reported was 17 per cent (by both Japan and Luxembourg).

The caveat to the conclusions drawn from these observations is that the Africa region was only represented by Morocco and Mauritius. In the case of Morocco, household access to Internet was mostly via wireless broadband. Fixed- and mobile-broadband subscription numbers for African countries suggest that the situation in Morocco could apply to many African countries – that is, that primary access to broadband Internet is by wireless (specifically mobile) broadband rather than fixed line. Thus, if data were available from these countries, Chart 10.14 would look very different from what is presented here.

Chart 10.14: Households with access to the Internet, by type of access, 2012 or 2011



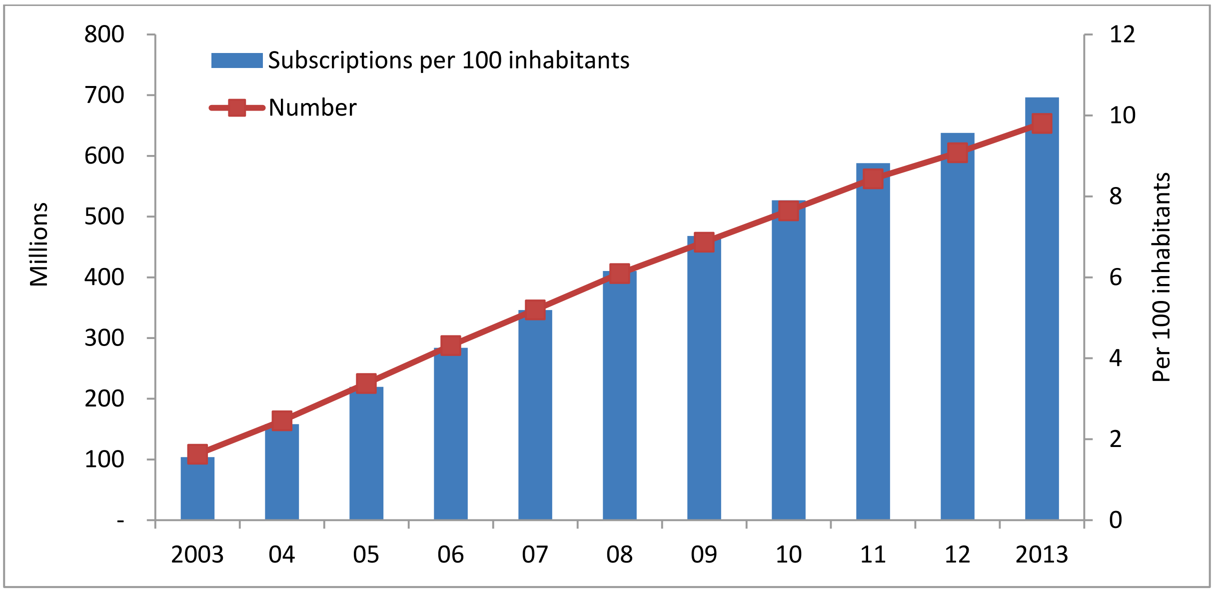
Source: ITU.

The number of Internet subscriptions offers another way of looking at household access to the Internet. While subscriptions data are not equivalent to usage data, information on the number of Internet subscriptions is more widely available and thus useful for tracking global trends on Internet access. Charts 10.15 and 10.16 show trends in global fixed-wired broadband penetration and global wireless broadband penetration, respectively. Globally, the penetration of fixed broadband was about 10 subscriptions per 100 inhabitants at the end of 2013. It has increased slowly but steadily since 2003, when it was 1.6 subscriptions per 100 inhabitants. There are several reasons for the slow growth rate. More mature markets such as North America and Europe have reached market saturation for Internet subscriptions. In developing countries, limited competition and scarce international Internet bandwidth often keep prices high and therefore unaffordable to large segments of the population. Also, using the Internet requires more literacy skills (both traditional and digital) than using the mobile phone.

The penetration of wireless broadband services was about 30 subscriptions per 100 inhabitants at the end of 2013 compared to 10 for fixed broadband, even though wireless broadband is a more recent technology. Growth rates for wireless broadband have varied from 2 to 7 subscriptions per 100 inhabitants per annum since 2007[17] when it was at 4 subscriptions per 100 inhabitants. Mobile

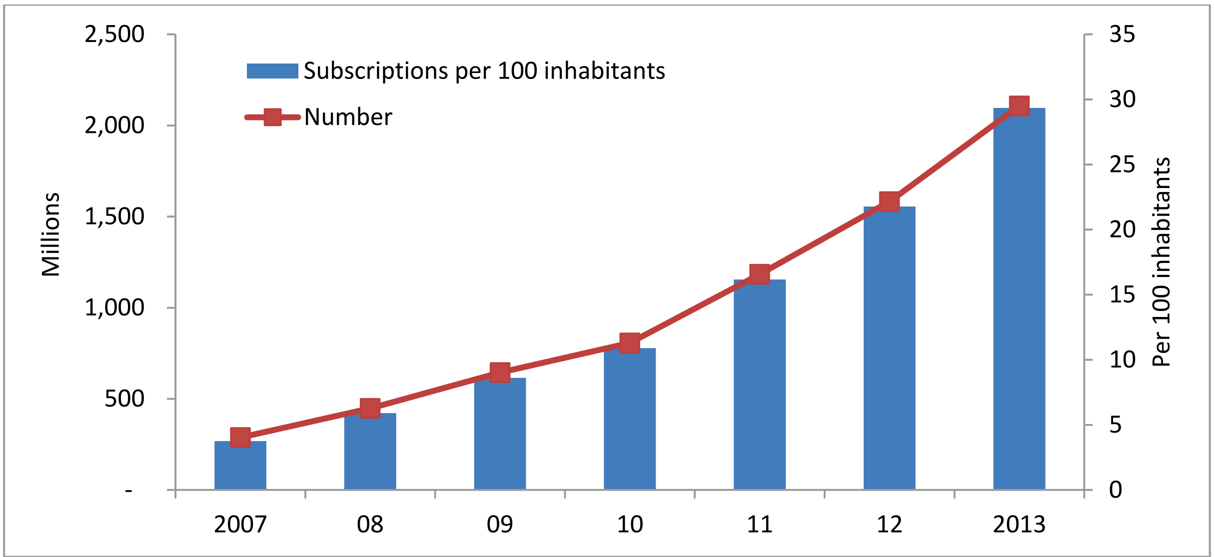
Internet appears to be doing a better job connecting individuals to web-based services than fixed-line connections, although it should be noted that mobile broadband is typically for personal use and one person may have several subscriptions, whereas fixed broadband connections are often shared and a single subscription may have several users. In 2009, wireless broadband penetration (9 subscriptions per 100 inhabitants) overtook fixed broadband penetration (7 subscriptions per 100 inhabitants). The future of growth in broadband penetration appears to be in wireless access. Indeed, a Cisco report[18] forecast that Internet traffic from wireless and mobile devices will exceed traffic from wired devices by 2016, with the growth appearing to be largely fuelled by Internet videos. If Target 10 is to be brought back on track, it would most likely be through growth in mobile Internet. Box 10.6 describes the growth of mobile Internet in Zimbabwe, one of the most dynamic countries in the ICT Development Index 2012 (see ITU, 2013a).

Chart 10.15: Fixed (wired)-broadband subscriptions, 2003–2013



Source: ITU World Telecommunication/ICT Indicators Database.

Chart 10.16: Wireless-broadband subscriptions, 2007–2013



Source: ITU World Telecommunication/ICT Indicators Database.

Box 10.6: Growth of mobile Internet in Zimbabwe

According to the ICT Development Index 2012, published by ITU (2013a), Zimbabwe is a dynamic country, moving up four places in the overall IDI ranking, to 115th position. The country made significant progress on both the access and the use sub-indices of the IDI. Most progress was made in mobile and wireless indicators. In terms of wireless broadband, penetration doubled from 15 subscriptions per 100 inhabitants in 2011 to 30 in 2012. By the end of 2012, Zimbabwe had the second-highest mobile-cellular penetration rate in Africa, just after Ghana (34 subscriptions per 100 inhabitants). Two developments are contributing to the increase in penetration rates: competition among Internet operators and a conducive regulatory environment.

Broadband service providers in Zimbabwe have been offering more affordable packages in recent years. In 2013, Zimbabwe's largest provider of telecommunications services, Econet, relaunched its mobile WiMAX broadband services with a reduced price of USD 45 for the WiMAX USB modem and Internet access for USD 0.025 per MB. The previous price for the same modem was USD 175 two years ago (with a cost per MB of USD 0.15).[19] In 2013, another broadband provider, Dandemutande (Utande/uMAX), announced the introduction of a monthly 20 GB data bundle for USD 75 inclusive of setup equipment fee, with actual download speed of 1 Mbit/s. The new subscription plan is roughly 30 per cent of the cost of the 12 GB plan offered previously at USD 240.[20]

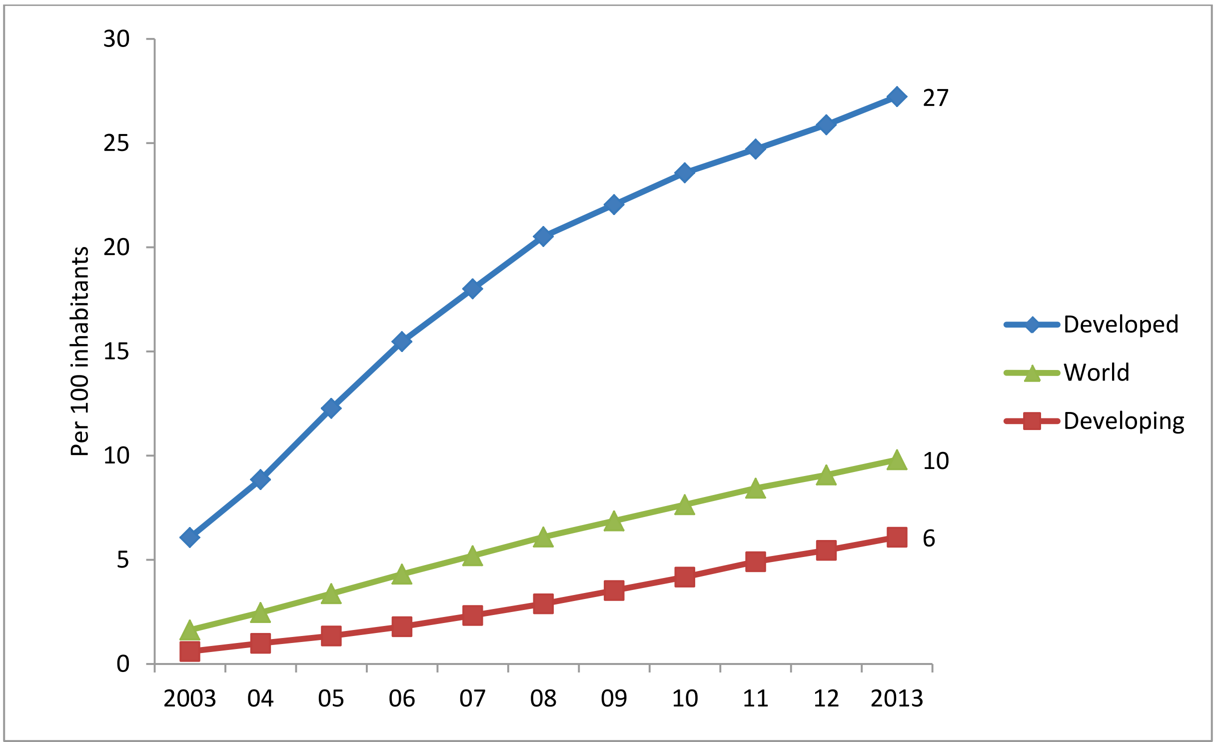
Other developments in telecommunication policy in Zimbabwe might also contribute to the increase in broadband penetration if they come to fruition. According to the country's regulator, Postal and Telecommunications Regulatory Authority (POTRAZ), new stipulations for telecommunications licenses are planned so as to allow operators to diversify their products. Amendments to the Postal and Telecommunications Act are also planned to include the compulsory sharing of infrastructure between operators in order to produce cost savings for both the operators themselves and for consumers.[21]

More affordable mobile broadband plans have provided many benefits to Zimbabweans. Mobile Internet has enabled subscribers to stay in touch with family and friends, and has been especially important for staying connected with Zimbabwe's diaspora (AudienceScapes, 2011). Mobile data plans also come bundled with apps such as m-health and mobile money transfer, making it easy for subscribers to access these services.

Source: ITU research.

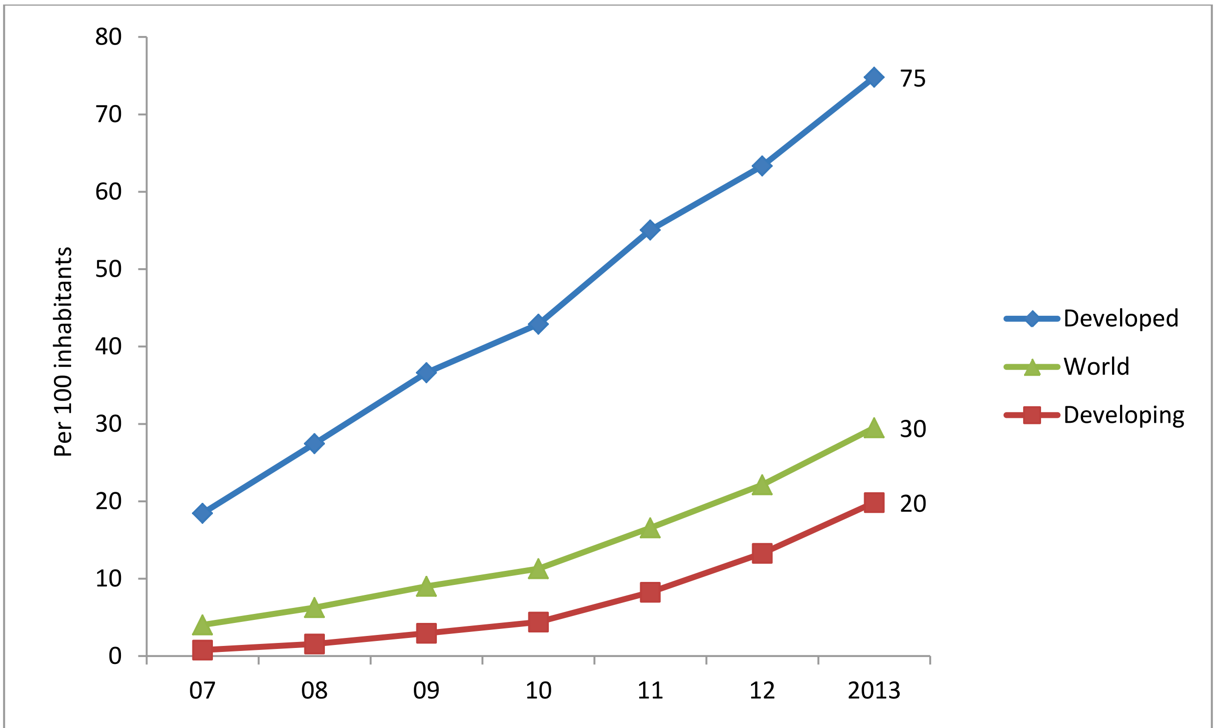
Chart 10.17 shows fixed (wired)-broadband penetration by level of development from 2003 to 2013. As expected, developed countries had a much higher penetration than developing countries. At the end of 2013, fixed (wired)-broadband penetration was 27 subscriptions per 100 inhabitants in developed countries compared to 6 in developing countries, a difference of 21. Chart 10.18 shows wireless-broadband penetration by level of development, from 2007 to 2013. In developed countries, wireless-broadband penetration was 75 subscriptions per 100 inhabitants by the end of 2013, compared with 20 in developing countries, a difference of 55.

Chart 10.17: Fixed (wired)-broadband subscriptions, by level of development, 2003–2013



Source: ITU World Telecommunication/ICT Indicators Database.

Chart 10.18: Wireless broadband penetration, by level of development, 2007–2013



Source: ITU World Telecommunication/ICT Indicators Database.

Overall, data show that Target 10 has not been achieved in respect of household Internet access. Currently, 41 per cent of households globally are estimated to have Internet access. Developed countries surpassed this component of Target 10 in 2007, while developing countries are still a considerable way from achieving it (28 per cent in 2013). In respect of countries with available data, household access to the Internet was mainly through fixed broadband. However, it should be noted that data from LDCs on the type of Internet access were scarce and that the types of access may be different for African countries (noting the case of Morocco, described above). The number of Internet subscriptions offers another way of measuring household access to the Internet. Data on the number of Internet subscriptions at the national level are widely available and are thus useful for aggregating and tracking global Internet access. Data on Internet subscriptions show that wireless broadband is playing a bigger role in connecting subscribers to the Internet than fixed (wired) broadband.

Conclusions and recommendations

Target 10 is the only (original) WSIS Target that has a quantifiable goal, although the term "access" is not quite clear and leaves room for ambiguity. The five indicators recommended in the 2011 WSIS statistical framework provided a variety of ways to assess progress made towards Target 10. Two specific ICTs are tracked by Target 10 – telephones and the Internet. The indicators were for the most part relevant and appropriate to the task. Limitations in data availability were evident for survey-based household indicators.

The first indicator for Target 10 is 'mobile-cellular telephone subscriptions per 100 inhabitants'. It has already been achieved and surpassed, with global mobile-cellular penetration at 96 subscriptions per 100 inhabitants by the end of 2013. This is nearly one subscription for every person in the world. Both developed and developing countries have achieved this indicator, although the level for least developed countries is considerably lower, at an estimated 51 subscriptions per 100 inhabitants by the end of 2013. Data for the second indicator, 'proportion of households with telephone', are promising for most countries with available data. Household access was more likely to be through mobile phone only or through both fixed and mobile phone. This figure does not reflect the proportion of individuals actually using mobile phones, which is the focus of the third indicator, 'proportion of individuals using a mobile cellular telephone'. For all countries with available data, mobile subscriptions exceed mobile phone users. Nevertheless, for most countries with available data, more than 80 per cent of individuals used a mobile phone during the reference period.

It can be argued that for full participation in the information society, individuals need to be using the Internet. In terms of Internet penetration, Target 10 is unlikely to be achieved; the fourth indicator focuses on the proportion of individuals using the Internet, which globally stood at 39 per cent by 2013. Growth was slower than the growth in mobile phone users, though the proportion of individuals using the Internet more than doubled between 2003 and 2013. The Americas, Europe, and Oceania have reached 50 per cent penetration; Asia and Africa are lagging behind. While developed countries have easily surpassed the target, only one in three persons in developing countries was online by 2013. For LDCs, the figure was much lower – about one in twelve.

The fifth indicator focuses on the proportion of households with access to the Internet by type of access. The indicator measures the uptake of broadband Internet access, which is essential for people to benefit fully from the opportunities the Internet offers. In terms of household access to the Internet, Target 10 has not yet been achieved. Globally, household access to the Internet was 41 per cent at the end of 2013, more than doubling from 16 per cent in 2003. For countries with data available, the most common means of access was generally fixed broadband. By 2013, an estimated

78 per cent of households in developed countries had Internet access at home compared to 28 per cent in developing countries.

The number of Internet subscriptions offers another way of viewing trends in household access to the Internet. In terms of broadband penetration by access type, globally, wireless broadband penetration stood at 30 per cent while fixed broadband penetration was 10 per cent by the end of 2013. Global wireless broadband penetration (in terms of the number of subscriptions) overtook fixed broadband penetration by 2008. To accelerate progress towards Target 10, more effort needs to be made in terms of connecting households with Internet.

Looking forward, any future ICT monitoring framework should include a target on access to ICTs and the current indicators could be retained as they track access to mobile-cellular phones – historically the most-diffused ICT – and to the Internet – the ICT that enables full participation to the information society. The five indicators on access to, and use of, ICT are tracked by ITU. More specifically, Indicator 10.3 could be amended to 'individuals who own a mobile phone' since current measurement trends are moving from usage to ownership (Hafkin, 2013). Additions to current indicators could include measuring the quality of access (such as broadband speeds). New indicator types could include tracking mobile phone and Internet activities as well as equality of ICT use (perhaps tracking household barriers to Internet use).

Beyond measurement, several specific policy recommendations can be made to further expand access to ICTs in the future. First, more efforts need to be made to expand telecommunication infrastructure.

At the time of writing, the government of the Republic of Korea has just announced plans[22] for investing USD 1.5 billion in a 5G network that will make mobile communications in the country 1 000 times faster than 4G technology. Even as highly-connected countries, such as the Republic of Korea, expand their infrastructure, attention could be directed to bringing basic mobile telephony to the inhabitants of the LDCs. In these countries, building telecommunications infrastructure is a vital task and requires concerted efforts by both regulators and the private sector. Regulators can provide incentives to private operators, with subsidies through universal access funds or through licence conditions, with the goal of providing the unserved and underserved segments of their populations with mobile phone access. Where building out last-mile wired-broadband infrastructure is not viable, national ICT champions could consider wireless options like WiMAX to deliver broadband into remote homes. Recommendations made for Target 1 – Connect all villages with ICTs and establish community access points – would be relevant here.

A second recommendation concerns market liberalization. The mobile phone is the main agent for the tremendous progress made towards the achievement of Target 10. Success factors for countries that have achieved the target include robust market competition, affordable pricing, liberalized regulation and bottom-up innovation. Taking a lesson from successful countries that tend to have these market conditions, encouraging more competition is one key way of narrowing the connectivity gap for mobile services.

Compared to the declining cost of mobile services, broadband uptake has generally been held back by high consumer costs in many developing countries. More competition in the telecommunications markets would help lower the cost of broadband access,[23] which is still prohibitively high in monopolistic or duopolistic markets in some of the LDCs. Countries that have yet to allocate spectrum could consider auctioning the spectrum to new operators in order to increase competition.

The relatively high cost of Internet access in developing countries (ITU, 2013a) should also be addressed. In many developing countries, the only comprehensive fixed-wired broadband infrastructure is owned by incumbent operators and infrastructure sharing is seldom regulated. As such, Internet service providers are simple resellers with little margin for real competition. Another bottleneck to Internet connectivity in many developing countries is in wholesale provision, such as 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. Work to improve cross-border infrastructure, like international optical fibre networks should be undertaken, where appropriate, to deliver better quality of service and meet growing consumer demand.

The first two recommendations focused on improving supply of mobile and Internet services to unserved and underserved populations. Efforts can also be made to increase demand for ICT services. Academic research has found that prior Internet experience provides impetus for subsequent broadband adoption and use (LaRose *et al*., 2012). As such, national ICT champions can look into creating opportunities for citizens to experience the Internet, on the assumption that once citizens try it, they are more likely to subscribe to it. Opportunities to experience the Internet can be offered in schools (targets 2 and 7) and public access locations (targets 1 and 4). At the same time, digital literacy skills can be taught in schools for both youth of school age and adult learners, thus enabling full participation in the information society. This is related to Target 7, which focuses on adapting school curricula to meet the challenges of the information society. Opportunities to experience the Internet and acquire digital literacy skills can also be offered via public access computers in public libraries, post offices and other public locations (Target 4). For the benefits of these efforts to be fully realized, there should also be relevant content and services that citizens want to access digitally. As such, provision of public and social services online (Target 6) is important and should lead to an increase in the demand for broadband services. In terms of content, global demand for internet videos has been growing substantially[12] and could drive broadband uptake, especially if there is relevant local content that citizens want to access (Target 9).

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Endnotes

[1] The original WSIS indicator was worded somewhat differently "Ensure that more than half the world's inhabitants have access to ICTs within their reach".

[2] Mobile phone subscriptions.

[3] In 2011, the Partnership on Measuring ICT for Development amended the WSIS targets and added the word "all" to several targets including Targets 1, 2, 3, 4 and 5. The word "all" was already in the original Targets 6, 7 and 8.

[4] See http://www.itu.int/en/ITU-D/Statistics/Pages/intlcoop/mdg/default.aspx.

[5] Includes ITU member states with available data for the years 2011 or 2012. Estimations are either done by countries or ITU.

[6] In the absence of official household surveys, ITU estimates the percentage of individuals using the Internet (Internet users as a percentage of total population) using hot-deck imputation. Hot-deck imputation uses data from countries with 'similar' characteristics, such as GNI per capita and geographic location. In some cases, when it is not possible to find an adequate imputation based on similar cases, regression models based on a set of countries with relatively similar characteristics are applied.

[7] Chart 10.1 illustrates Indicators 10.2, 10.3 and 10.4 in the same figure (10.1 and 10.5 are household indicators).

[8] Though it should be noted that these data refer to subscriptions, not users.

[9] For countries with data available, the most common means of access was fixed broadband.

[10] Chapter 4 of Measuring the Information Society 2013 (ITU, 2013) focuses on measuring the world's digital natives.

[11] See http://articles.economictimes.indiatimes.com/2013-10-17/news/43144239_1_icann-assigned-names-internet-corporation.

[12] See https://www.theengineroom.org/11-new-initiatives-using-technology-to-advocate-for-greater-transparency-accountability/.

[13] Countries with available data for 2012 or 2011.

[14] VoIP is different from Internet Telephony. VoIP is Internet Protocol telephony which the principal transmission network or networks are private, managed IP-based networks (of any type). Internet Telephony is Internet Protocol telephony in which the principal transmission network is the public Internet (examples include Skype and VoIP buster). See www.itu.int/osg/spu/ni/iptel/workshop/iptel.doc.

[15] Country age scope varies, therefore data comparability between countries may be affected to the extent that different subpopulations behave differently.

[16] ITU produces aggregate-level estimates using survey data and estimates.

[17] Data for wireless broadband penetration were only available from 2007 onwards.

[18] See http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-481360.pdf.

[19] See http://www.telegeography.com/products/commsupdate/articles/2012/07/16/econet-relaunches-mobile-wimax/.

[20] See http://www.telegeography.com/products/commsupdate/articles/2013/04/26/umax-becomes-zimbabwes-lowest-priced-broadband-isp/.

[21] See http://www.telegeography.com/products/commsupdate/articles/2013/03/05/potraz-plans-universal-service-licence-and-shared-infrastructure/.

[22] See http://edition.cnn.com/2014/01/22/tech/mobile/south-korea-5g/.

[23] Chapter 3 of MIS (ITU, 2013) focuses on measuring the cost and affordability of broadband. The ICT Price Basket in 2013 focuses on fixed-broadband and mobile-broadband prices in response to current demand for data and benchmarks to support evidence-based policies and regulatory decisions concerning broadband prices.

CONNECT ALL
BUSINESSES
WITH ICTs

Proposed Target 11: Connect all businesses with ICTs

Executive summary

Since 2003, the application of ICT to business has evolved in unexpected ways, and e-business has grown exponentially. The use of ICT in the business sector has become vital to developing the information society. Despite this fact, the WSIS Geneva *Plan of Action* does not have any targets related to ICT and businesses. On the other hand, the use of ICTs by businesses is addressed in WSIS Action Line C7 (ICT applications: benefits in all aspects of life), which discusses the importance of businesses as providers and users of ICT and "calls upon governments to promote the use of e-business, especially in developing countries" (ITU, 2005).

In addition to Action Line C7, the private sector and public/private partnerships are explicitly mentioned in six other action lines. This report therefore proposes that a new target be added: "Connect all businesses with ICTs" (proposed Target 11). Data on ICT use by businesses can support policy measures to promote ICT for development, build confidence in the use of ICT and encourage the creation of local content.

The proposed Target 11 can be tracked by three indicators to measure use of ICTs by business, namely through their use of computers, Internet (by type of access) and mobile telephony. Use of computers and Internet are already collected by UNCTAD as part of the compilation of the *Partnership*'s core ICT indicators. The use of mobile phones as an indicator has been proposed in response to the growing importance of mobile phones in developing countries, in particular their use by microbusinesses and small and medium-sized businesses.

While there has been undoubted progress in worldwide business connectivity, the progress in its measurement has been mixed. Unfortunately, there is little internationally comparable data, especially for indicators 11.1 and 11.3.

The use of computers by businesses, particularly in developing countries, can indicate the level of informatization of the business sector. The computer is still one of the main devices to access and use the Internet, particularly in a business setting, where more advanced applications and services are typically needed. However, data on this basic connectivity measure are not available for most developing countries.

In terms of use of the Internet by type of access, there is a growing divide in broadband access between businesses in developed and developing countries. Business size, economic activity and location determine the extent to which businesses use broadband Internet. This affects the way that businesses can benefit from applications and systems. Broadband can enhance communication in supply chains and between businesses, customers and government. It is also a critical enabler of cloud computing solutions, which can reduce operating costs for businesses. However, several developing countries are still unable to produce data by type of access, or data collection is so recent that there are no time series. The official threshold for defining broadband speeds (256 kbit/s or more) has also been largely overcome by the realities of the technology.

While there are almost no internationally comparable data on the use of mobile phones by businesses in developing countries, studies show that mobile phones have become the most commonly used ICT tool among micro and small businesses, and in the informal sector. Mobile phones are increasingly leveraged by businesses in low-income countries for non-voice uses, such as text and picture messaging, Internet access and mobile money.

This report shows that despite growth in worldwide business connectivity, data on business connectivity from developing countries are still insufficient to guide policy-making to bridge the digital divide. Given the limited achievements made on measuring proposed Target 11, the following recommendations are made should there be a post-WSIS target dealing with e-business:

1. To include appropriate targets related to e-business in any action plans beyond 2015, and to define relevant indicators for monitoring. In addition to basic connectivity, the ways that businesses use ICT could be considered. Other relevant indicators for monitoring progress towards e-business related targets could refer to e-commerce, the ICT sector, or gender aspects of the information economy.

2. The Partnership on Measuring ICT for Development should support monitoring efforts in the framework of continued methodological work to define and collect data on the core indicators on ICT use by businesses.

3. Policy-makers and the statistical community should work together to ensure the integration of data collection on ICT use by businesses into national statistical plans, while considering international comparability. Firm-level data provide more meaningful information for designing and evaluating information economy policy.

Introduction

Despite the fact that the use of ICT in the business sector is vital to developing the information society, the WSIS Geneva *Plan of Action* does not have any targets related to ICT and businesses. However, the use of ICTs by businesses is addressed in WSIS Action Line C7 (ICT applications: benefits in all aspects of life), which discusses the importance of businesses as providers and users of ICT and “calls upon governments to promote the use of e-business, especially in developing countries” (ITU, 2005).

The Action Line C7 e-business component was co-facilitated by ITC, UNCTAD and UPU, who organized several facilitation meetings at the WSIS Forum (see Box 11.1).[1] One of the challenges faced in facilitating the action line on e-business was a lack of a relevant target.

Box 11.1: The C7 action line business components

The C7 action line refers to E-business as follows:

"a) Governments, international organizations, and the private sector are encouraged to promote the benefits of international trade and the use of e-business, and promote the use of e-business models in developing countries and countries with economies in transition.

b) Through the adoption of an enabling environment, and based on widely available Internet access, governments should seek to stimulate private sector investment, foster new applications, content development and public/private partnerships.

c) Government policies should favour assistance to, and growth of SMMEs, in the ICT industry, as well as their entry into e-business, to stimulate economic growth and job creation as an element of a strategy for poverty reduction through wealth creation."

Several action line events related to e-business have taken place in the framework of the WSIS Forum:

2006: E-Business and E-employment (with e-employment action line)

2007: ICTs, Global Supply Chains and Development (with e-employment action line)

2008: E-Commerce as a Key Facilitator for SME Competitiveness

2009: E-Business and Poverty Alleviation

2010: ICT and Rural Enterprise (with e-agriculture action line)

2011: The Promise of Mobile Technology (with e-agriculture action line)

2012: Promoting the Domestic ICT Sector

2013: E-Commerce and Development

Source: ITC, UNCTAD and UPU, 2014.

In addition to Action Line C7, the private sector (that is, businesses) and public/private partnerships are explicitly mentioned in action lines C1, C2, C5, C6, C8 and C11. This report therefore proposes that a new target be added: “Connect all businesses with ICTs.” A target on connecting businesses to ICT could be mapped as per Figure 11.1, with direct linkages to action lines C1, C5, C7 and C8. For the purposes of this report, such a target is being called proposed Target 11.

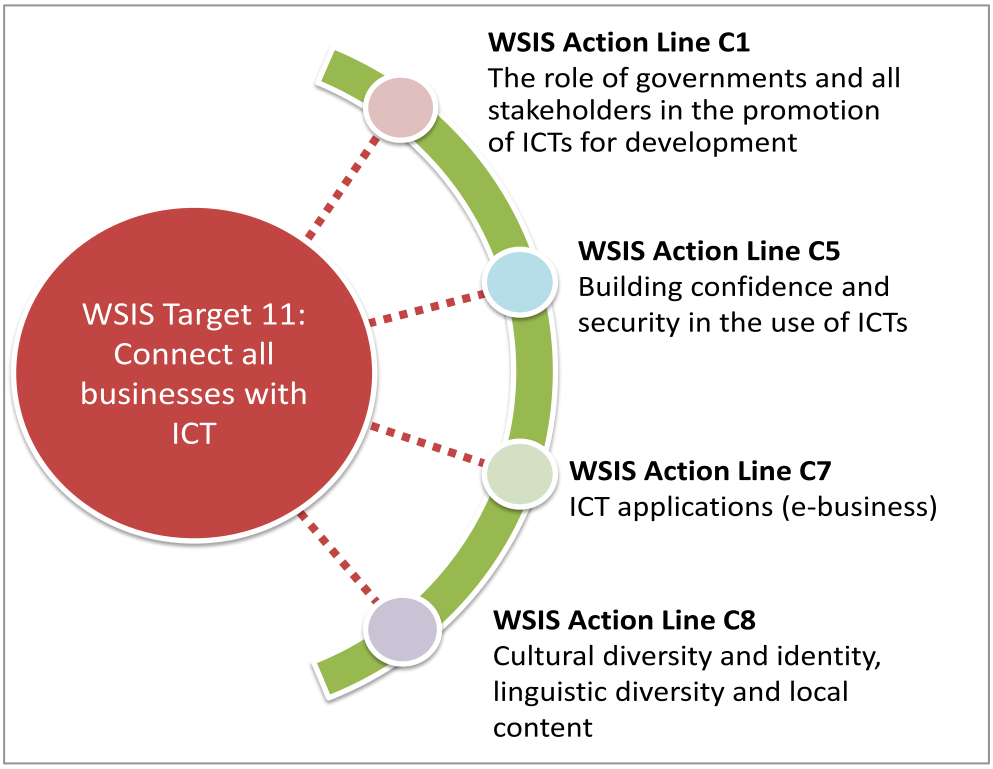
Action Line C1 states that "The private sector should be engaged in concrete projects to develop the Information Society at local, regional and national levels." The use of ICT by businesses can indicate the level of informatization of an economy that will enable its businesses to engage in such projects.

Action Line C5 (Building confidence and security in the use of ICTs) calls for Governments, in cooperation with the private sector, to "… prevent, detect and respond to cyber-crime and misuse of

ICTs …". It also calls for encouraging "… further development of secure and reliable applications to facilitate online transactions." Online transactions (e-commerce) are part of e-business.

Action Line C8 (Cultural diversity and identity, linguistic diversity and local content) states that "… public/private partnerships, foster the creation of varied local and national content … and give recognition and support to ICT-based work in all artistic fields." It also states that "Governments, through public/private partnerships, should promote technologies and R&D programmes …".

Figure 11.1: Relevance of proposed Target 11 to WSIS action lines



ICTs have enormous potential to "… reduce business costs, promote transparent, rules-based systems, and improve communication between the public and private sector." (ITC, UNCTAD and UPU, 2014). A target and related goals on e-business would recognize the growing importance of the information economy and help guide countries in monitoring their adequate integration to that economy, including through policies targeting poverty reduction and private sector development. The least developed countries (LDCs), in particular, face significant challenges in their transition to the information economy. Furthermore, businesses interact with the entities covered by the original ten targets to form the information society.

Since the first WSIS in 2003, the application of ICT to business has evolved in unexpected ways, and e-business has grown exponentially. Automated business processes are the norm in large and medium-sized businesses worldwide and in almost all businesses in high-income countries. But the most significant change is the current widespread and growing use of mobile phones by small businesses in developing countries.

Recent research has shown that the ICT dimension is frequently absent from private sector development strategies, and neither policy-makers nor small business owners in developing countries are harnessing these new possibilities to the fullest (UNCTAD, 2011). The software industry and mobile telephony are combining to offer new business opportunities and source of employment in developing countries (UNCTAD, 2012a). Cloud computing is the newest manifestation of how ICTs can change the game plan for businesses in countries at all levels of development. Moreover, ICTs offer women new opportunities to start and grow businesses (UNCTAD, 2014).

The *World Telecommunication/ICT Development Report 2010: Monitoring the WSIS Targets, A mid-term review* (WTDR) (ITU, 2010) proposed that a new target to “Connect all businesses with ICTs” be added, while the Framework (*Partnership*, 2011) proposed three indicators, the purpose of which is track access to ICT by businesses (level of connectivity); the indicators are: [2]

Indicator 11.1: Proportion of businesses using computers

Indicator 11.2: Proportion of businesses using the Internet, by type of access (narrowband and broadband)

Indicator 11.3: Proportion of businesses using mobile cellular telephones.

These are 'e-business' indicators in so far as they show the use of ICT by businesses for business purposes. The first two of indicators are already collected by UNCTAD as part of the *Partnership*’s core ICT indicators (see Box 11.2), and the third one had been proposed by UNCTAD (UNCTAD, 2009) in response to the growing importance of mobile phones in developing countries, in particular their use by micro, small and medium-sized businesses. The unit of measurement is the business (enterprise), and the data are usually available through business surveys containing questions on use of ICT.

Box 11.2: ICT and business statistics in UNCTAD

Since 2004, UNCTAD has collected data from developing countries on the use of ICT by businesses and on the ICT (producing) sector, based on the core list of ICT indicators. Within the framework of the *Partnership*, UNCTAD has contributed to the development of the core list of ICT indicators and is currently responsible for the global collection of data on the information economy:

- ICT use by businesses
- the ICT sector and
- international trade in ICT goods.

The results from UNCTAD's annual data collection are used in their research and analysis, such as the *Information Economy Report* series (http://unctad.org/ier), and are published through its statistics portal (http://unctadstat.unctad.org/). The UNCTAD *Manual for the Production of Statistics on the Information Economy* (UNCTAD, 2009) provides guidance to countries on how to produce the core ICT business indicators. UNCTAD provides technical assistance to developing countries also in the form of training courses and advisory services. Since 2013, it has started work to develop indicators on trade in ICT services, and gender-related ICT indicators. More information on UNCTAD's work on ICT for development is available at http://unctad.org/ict4d.

Source: UNCTAD.

In order to ensure comparability and a harmonized understanding within the *Partnership*, the definitions of computers, Internet by type of access, and mobile cellular telephones underlying the indicators correspond to the same definitions of technology used for the core household indicators. While ITU published a recently revised definition of computer that includes tablets (ITU, 2014), this chapter refers to data and indicators that used the previous definition.

The choice of indicators for the proposed new target aims at measuring the basic requirements for a business to use and benefit from ICT. A basic list of indicators also facilitates the production of internationally comparable data by countries at all levels of development.

For indicator 11.1, a computer remains one of the main devices to access and use the Internet, in particular in a business setting, where more advanced applications and services are typically needed. Classificatory variables such as business size (micro, small, medium, large) and economic activity (based on the ISIC classification) can help guide targeted policies to increase connectivity and ICT skills, and to enhance use.

For indicator 11.2, information on whether businesses use the Internet, and what type of access they have, allows monitoring of broadband uptake. The connection quality and speed determine the types of activities that businesses can carry out and the applications or systems they can implement. For example, it can improve the efficiency of the supply chain, enable businesses to better plan resources, and enhance the interaction of businesses with consumers and government. Broadband is a critical enabler of cloud computing solutions, which can reduce operating costs for businesses. UNCTAD has noted that cloud computing accentuates the quality dimension of the digital divide when it comes to broadband services (UNCTAD, 2013). In addition, broadband access has been recognized as a vital element of new sustainable development goals (Broadband Commission for Digital Development, 2013).

Finally, indicator 11.3 responds to the astounding progress in mobile telephone connectivity that has transformed the livelihoods of millions of people in the developing world in the past ten years. The use of mobile phones is increasingly changing the way that small businesses in developing countries are conducting their operations, in particular when fixed telephone lines are not available. Although collecting indicators on mobile phone use by businesses is a new area that is so far untested by most national statistical offices, the potential impact of mobile phones on business performance cannot be ignored and should be monitored. Available information suggests that mobile phones have become the most commonly used ICT tool among micro and small businesses in low-income countries. The level of use has been found to be consistently high also in the informal sector.

Data availability and scope

The nature of ICT is cross-cutting and it is important to ensure that all producers of data on ICT use by businesses work in coordination, including the focal points for the WSIS process as well as national statistical offices and other relevant stakeholders. Data availability on ICT use by businesses is patchy at best, but the methodological framework to guide data production on ICT use by businesses has come a long way since 2003.

The *Partnership* has made available core indicators and associated statistical standards on ICT use by businesses, on the ICT sector and on international trade in ICT goods. It has carried out statistical capacity building, and obtained the endorsement of the highest statistical body of the international community, the UN Statistical Commission. Developing countries have started to collect and publish the data, and most importantly use it to evaluate their ICT policies. However, time series still need to be established and good practices need to be shared, such as the case of Brazil, which has now the benefit of several years of data.

Table 11.1 presents the data sources for the e-business indicators. Data for indicators 11.1 and 11.2 are already collected by UNCTAD annually. Computer use data are scarcer in recent years because many developed countries have stopped tracking that indicator. Data for indicator 11.3 are not yet available from most developing countries. Developed countries such as in Europe have now some data on mobile connectivity for businesses but that is not comparable to 11.3 (Eurostat collects data related to business enterprises using a mobile connection rather than a mobile phone, and on businesses providing staff with portable devices for business use).

The use of mobile phones by small businesses in developing countries is now widespread and continues to expand, but the use of computers and the Internet remains more limited, especially in microbusinesses. Available data show that levels of ICT use vary widely depending on business size and on economic activity, and in some cases on geographic location. This means that international comparability of totals is problematic, mostly due to the composition of the sample or population surveyed. These indicators are best analysed by disaggregating data further by business size and economic activity, and sometimes geographical location. For indicators 11.1 and 11.2, this information is available in the UNCTAD Statistics Portal.[3]

Table 11.1: Data sources for e-business indicators, 2008–2012

Indicators	Data sources	Data availability
11.1 Proportion of businesses using computers	*Partnership* core indicator B1, reported by national statistical offices and sometimes by ministries of telecommunications. Collected through dedicated ICT business surveys, ICT questions in existing business surveys, or economic censuses.	Data are available for 64 countries for at least one year between 2008 and 2012.
11.2 Proportion of businesses using the Internet, by type of access (narrowband and broadband)	*Partnership* core indicators B3 and B9, reported by national statistical offices and sometimes by ministries of telecommunications. Collected through dedicated ICT business surveys, ICT questions in existing business surveys, or economic censuses. Some data reported by ministries of telecommunications.	Data are available for 67 countries for at least one year. However, some countries collect data only on the use of Internet, and not on the type of access disaggregated by narrowband and broadband.
11.3 Proportion of businesses using mobile cellular telephones	Proposed new indicator. Could be collected through business surveys.	Data are available for 11 countries that responded to the *Partnership*'s 2013 WSIS targets questionnaire, for at least one year.

Source: UNCTAD.

To improve data availability in the future, WSIS stakeholders and the *Partnership* must continue raising awareness of the importance of firm-level data on use of ICT to obtain statistics that are meaningful for policies to develop the information economy. In particular, encouraging national statistical offices to carry out surveys and governments to provide the necessary resources to those entities. Statistics on ICT use by businesses need to be included in national statistical plans and agencies should take international comparability into account, including by making use of the methodological guidance provided by the *Partnership*.

Achievements against proposed Target 11

Use of computers by businesses

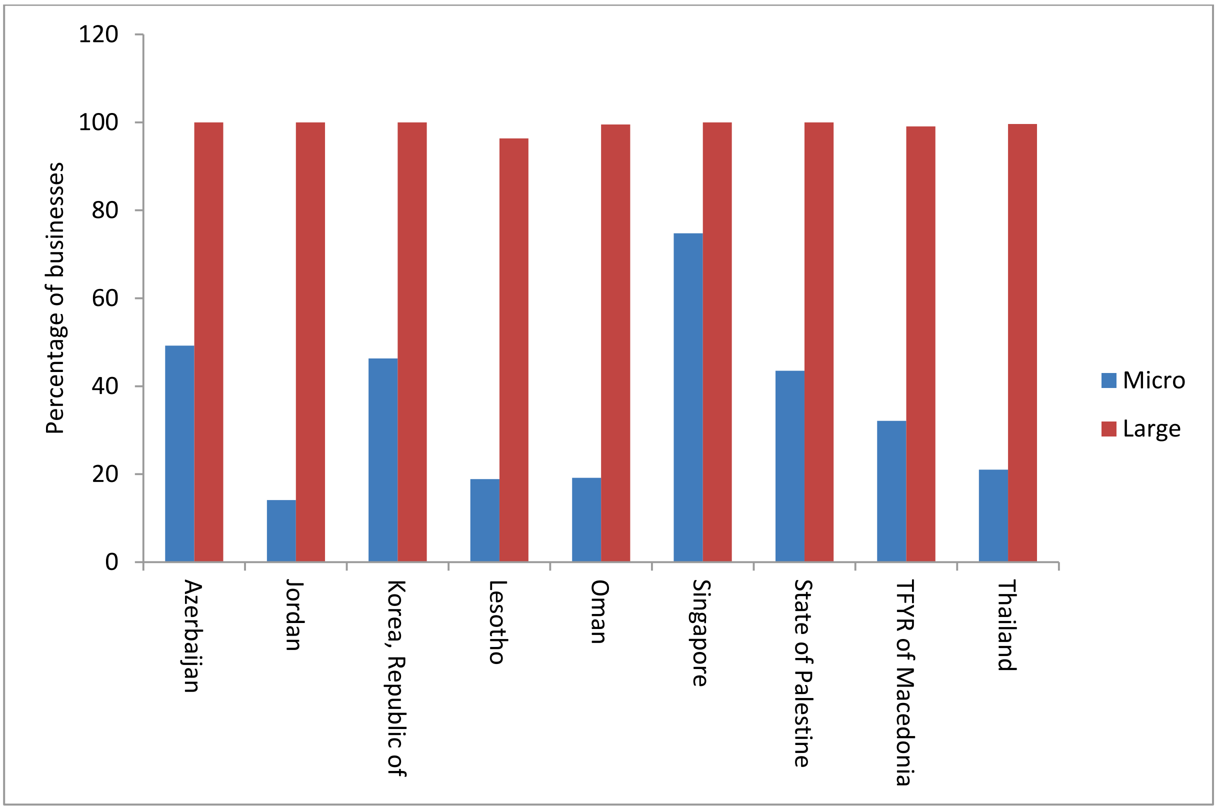
Indicator 11.1 refers to the use of computers by businesses. Since 2003, computerization of business administration is now the norm in large and medium-sized businesses worldwide and in almost all businesses in high-income countries. While in recent years, developed countries such as those in Europe have stopped collecting this indicator, it is still of vital importance in many developing countries. As noted before, totals are not fully comparable between countries and averages can hide wide differences in access to computers by different sized businesses, businesses in primary, secondary or tertiary sectors, or located in more or less urbanized areas. To illustrate this, Table 11.2 shows the total share of businesses using computers for selected countries, where the average is about 49 per cent. However, Chart 11.1 shows the same information for microbusinesses (0–9 employees) and large businesses (more than 250 employees) and shows the wide difference when data are classified by business size.

Table 11.2: Businesses using computers, LYA,[4] percentage

Country	%	Year
Azerbaijan	69	2011
Jordan	18	2008
Korea, Rep.	50	2008
Lesotho	34	2008
Oman	27	2011
Singapore	79	2010
Palestine	47	2011
TFYR of Macedonia	89	2011
Thailand	24	2010

Source: UNCTAD Information Economy Database, 2014, unctadstat.unctad.org.

Chart 11.1: Micro and large businesses using computers, LYA,[4] percentage

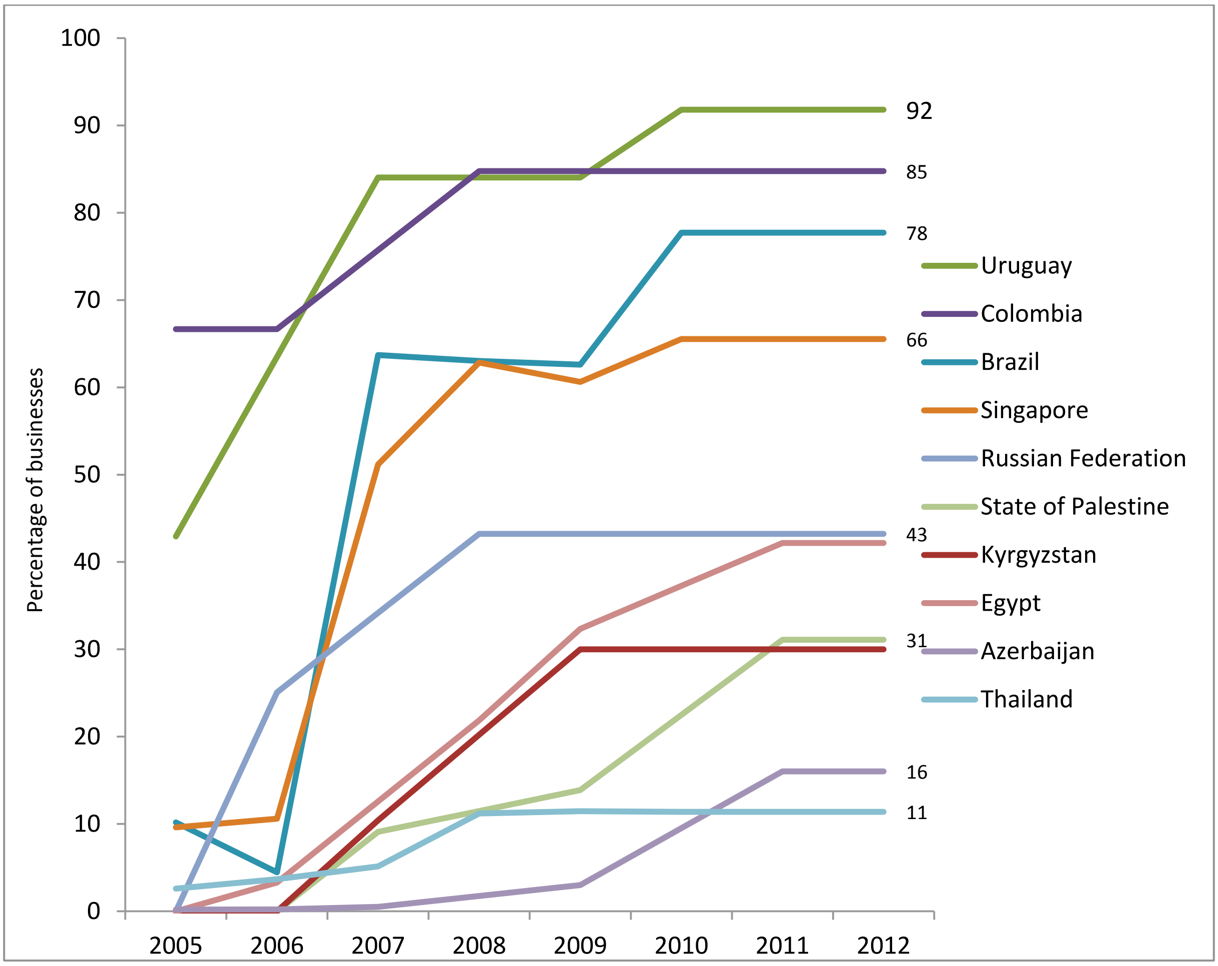


Source: UNCTAD Information Economy Database, 2014, unctadstat.unctad.org.

Use of Internet by businesses, by type of access

Indicator 11.2 refers to the use of Internet by businesses, by type of access (narrowband and broadband). As with indicator 11.1, the extent to which businesses in selected countries are using the Internet varies greatly according to their size, economic activity and location. Some countries are still unable to collect data by type of access, but ask only about the connection of Internet. In several developing countries, data collection is so recent that there is only one reference year and thus no time series. The definition of type of access can pose problems to those countries that no longer consider the speed of 256 kbit/s to be a suitable threshold for broadband. Since broadband connectivity is closely tied to the development of ICT infrastructure, changes tend to be significant once new infrastructure is operational. Chart 11.2 shows the evolution in the proportion of businesses using the Internet by fixed broadband in selected countries where data for several years are available.

Chart 11.2: Growth in fixed broadband access by businesses using the Internet, percentage



Source: UNCTAD Information Economy Database, 2014, unctadstat.unctad.org.

Use of mobile cellular telephones by businesses

Indicator 11.3 refers to the use of mobile cellular telephones by businesses. There were too few country responses to the *Partnership*'s 2013 WSIS targets questionnaire on this indicator (only 11 countries, see Table 11.3) to make any general statements. Furthermore, the figures provided are not comparable with each other, and the level of representativeness with respect to the total business population can be questioned. All in all, this is an untested indicator that is being collected at the initiative of individual countries.

Table 11.3: Share of businesses using mobile phones, LYA,[4] percentage

Country	%	Year
Brazil	71	2012
Ecuador		2011
Mexico	76	2008
Uruguay	61	2009
Nigeria		
Akwa Ibom State	100	2013
Edo State	82	2013
Kaduna State	80	2013
Nasarawa State	70	2013
Azerbaijan	100	2013
Bhutan	100	2013
Iran, Islamic Rep.	90	2013
Lao PDR	100	2013
Nauru	100	2013
Philippines	19	2010
UAE	100	2011

Source: Partnership on Measuring ICT for Development WSIS Targets Questionnaire, 2013 (*Partnership*, 2013).

However, available information suggests that mobile phones have become the most commonly used ICT tool among micro and small businesses in low-income countries, and in the informal sector. Mobile phones are increasingly leveraged by businesses for non-voice uses, such as text and picture messaging, Internet access and mobile money (see Box 11.3). Innovative mobile applications can help raise productivity and reduce information search and communication costs, providing better price information and reducing the need for travel (UNCTAD, 2010).

Data from developed countries in Europe are not fully comparable for indicator 11.3, as they focus rather on the business use of portable devices, with a subgroup that includes smartphones and personal digital assistant phones (non-computer portable devices).[5] However, those data do provide an insight into the importance of mobile use by businesses. In 2012, 39 per cent of European business enterprises provided non-computer portable devices to their staff. Among large businesses, almost 90 per cent allowed a mobile connection to the Internet, while the share for small and medium-sized businesses was 43 per cent and 71 per cent respectively. European data also show the purposes for portable device use: mobile access to e-mail (88 per cent) and to access and amend documents (56 per cent). Eurostat also collected data on barriers to mobile connectivity by businesses, which included network coverage or speed, subscription costs, security concerns and technical obstacles to integrate mobile devices with the business's existing business applications.

Box 11.3. The case for data on business mobile phone use – mobile money in the EAC

On the back of the rapid uptake of mobile telephony in developing countries, many wireless applications of relevance for small businesses have emerged. Among these, mobile money applications are a remarkable example of the potential of mobiles to address the needs of small businesses in developing countries. As of February 2014, there were well over 200 known mobile money deployments, the vast majority of which in low- and middle-income countries.[6] Africa, in particular the East African Community (EAC), is leading the trend. Yet, no EAC countries were able to provide data on indicator 11.3 through the *Partnership*'s 2013 WSIS targets questionnaire.

Considering that in June 2013, 27.3 million transactions totalling USD 998m were processed across mobile money platforms (for example, bill payments, bulk payments, merchant payments, international remittances, transfers between mobile money accounts and bank accounts), it would be relevant to measure the use of mobile phones by businesses. The largest mobile money service provider, Kenya's Safaricom, indicates that business-to-person (B2P) and person-to-business (P2B) transactions are currently driving growth.[7] Merchants and retailers accept mobile money payments in exchange for different products and services, while other businesses use mobile money as a means to deliver their services, that is, financial institutions, insurance providers, as well as large-scale disbursers and bill issuers.

More in-depth data on the types of services being accessed or delivered by businesses through mobile phones could guide SME development policies and applications. National statistical offices and the telecommunications sector can collaborate to produce the relevant data.

Sources: GSMA, 2014 and UNCTAD, 2012b.

Conclusions and recommendations

If total business connectivity is a target, we could state that data indicate steady progress towards that end, albeit at different speeds for different technologies. Business connectivity worldwide has undoubtedly grown in the past few years, with mobile telephony contributing in great part to reducing the basic connectivity gap. However, although data from developing countries are still far from comprehensive, it is clear that within developing countries themselves, there are wide differences in ICT use between large and small companies, between businesses in different industries, and between rural and urban businesses.

In addition, there is a growing divide in broadband access between businesses in developed and developing countries, which has an impact on the way that they can benefit from applications and systems. The broadband connectivity gap highlights the need for further improvements in the ICT infrastructure for developing countries, which in turn should have a positive impact on current problems of cost, latency and quality of services. The divide in ICT use between different-sized businesses seems to point at other critical factors that can be measured through other targets and indicators, such as education and skills development. Despite the recognition that the mobile revolution has made e-business more inclusive, through basic connectivity as well as through innovative mobile applications, the WSIS targets have not tracked progress in this area.

The e-business action line remains highly relevant for the implementation of WSIS-related work beyond 2015. Therefore, appropriate targets related to e-business should be included in any action plans beyond 2015, and relevant indicators should be defined for monitoring.

The *Partnership* recommends the setting of a new target: "Connect all businesses with ICTs" and its three related indicators:

- Indicator 11.1: Proportion of businesses using computers
- Indicator 11.2: Proportion of businesses using the Internet, by type of access (narrowband and broadband)
- Indicator 11.3: Proportion of businesses using mobile cellular telephones.

Indicators on the ways that ICTs are used could be proposed in addition to the ones on basic connectivity listed above. However, the fact that data availability for even these three indicators is lacking, begs the question of the feasibility of obtaining data for additional indicators. A proposal on new indicators would depend on the setting of new targets related to the post-2015 agenda and could be developed at a later stage in the framework of the core indicators on ICT use by businesses set by the *Partnership*.

To make the data as useful as possible, both to guide national policies and to provide international comparability, data collection has to be integrated into national statistical plans in order to ensure continuity (and meaningful time series) and the highest technical standard of official statistics.

The information economy is an integral part of the information society, and other aspects of business connectivity to ICT are also highly relevant to the overall WSIS agenda of universal access. Monitoring the connectivity and use of ICT by businesses will support the wider evaluation and formulation of ICT for development policies. For example, in respect of Target 6, e-government encourages an effective use of ICT by businesses in all sectors and the development of a domestic ICT-producing sector. As noted by the e-business action line co-facilitators "a vibrant ICT sector underpins productive use of ICTs and stimulates sustainable growth, job creation, trade and innovation as part of broader strategies for poverty reduction through wealth creation." (ITC, UNCTAD and UPU, 2014)

Other policy aspects that enable or encourage the use of ICT by businesses are adequate regulatory and legal frameworks, and better business awareness of e-business opportunities. In the spirit of the WSIS process, multistakeholder partnerships between governments, development partners, international organizations, the private sector and civil society, can ensure that as many businesses as possible seize the opportunities offered by ICTs and reap their benefits.

Finally, the C7 e-business action line encompasses many more aspects of the information economy that are not covered by the proposed indicators. The latter aim to monitor basic connectivity related to universal access to ICTs. Targets to be defined for the post-2015 agenda could be forward-looking in considering the desired progress in the information economy between 2015 and 2025. Once targets are defined for the post-2015 agenda, stakeholders could propose other relevant indicators for monitoring progress towards any targets related to e-business, such as on e-commerce, on the ICT sector, or gender-related. Other recommendations on this action line have been made by the co-facilitators.[8]

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Endnotes

[1] The ILO was co-facilitator until 2008.

[2] These indicators were shown as A.1, A.2 and A.3 in the 2011 WSIS statistical framework.

[3] See http://unctadstat.unctad.org.

[4] Latest year available.

[5] See the European Commission's Digital Agenda Scoreboard at http://ec.europa.eu/digital-agenda/en/scoreboard.

[6] See http://www.gsma.com/mobilefordevelopment/programmes/mobile-money-for-the-unbanked/insights/tracker.

[7] See http://www.gsma.com/mobilefordevelopment/reading-the-m-pesa-half-year-results-for-2013-2014.

[8] See ITC, UNCTAD, UPU (2013).

Conclusions and way forward

Executive summary

The appearance of information and communication technologies (ICTs) in the high-level political agenda includes statements by the United Nations (UN) Administrative Committee on Coordination in 1997, the UN Economic and Social Council in 2000 and the G8 group in 2000, recognizing the importance of ICTs to sustainable development and the development of a global knowledge-based society and economy. These paved the way for the UN *Millennium Declaration* stating that the benefits of ICTs should be available to all, and to the endorsement of the World Summit on the Information Society (WSIS) by the UN General Assembly in 2002. Subsequent to the Geneva and Tunis phases of WSIS, and agreement on the Geneva vision "… to build a people-centred, inclusive and development-oriented Information Society …", annual WSIS meetings have been conducted to discuss the lessons learnt in pursuing ICT for Development (ICT4D). In particular, the 2013 WSIS Forum issued a statement by the United Nations Group on the Information Society (UNGIS) on the potential of ICTs to support the Post-2015 Development Agenda.

The high rate of failure of ICT4D initiatives and the difficulties in transferring successful initiatives between contexts emphasise the need for ICT4D decision-making to rely more on research and evidence. This has created favourable conditions for the growth of ICT4D as a field of applied research. The field experienced a 39 per cent average annual growth in the volume of publications produced between 1999 and 2008. The research has identified two stages in the development of the ICT4D domain: ICT4D 1.0 focused on replicating off-the-shelf solutions in developing countries and addressing the readiness and availability of ICT, considering the poor as primarily passive consumers. ICT4D 2.0 focused on the uptake and impact created by ICTs, designed around existing needs and capabilities of the poor as producers of digital content and services. While ICT4D research initially attracted criticism for its focus on action over knowledge and insufficient analysis, the quality and rigour of ICT4D research, and therefore its reliability, has improved over the years.

While we still know little about the impact of ICTs on development, there is growing evidence of impact of ICTs in different sectors. In the economy, several studies have linked the introduction of broadband to GDP growth. In education, there is some evidence that the use of specific ICTs has positive impact on student performance, but the relationship is complex. In health, there is evidence for European countries that the average costs versus benefits of electronic health records is distributed in favour of citizens and health practitioners. In the environment, ICTs have been shown to have both positive and negative impacts. Examples of positive impacts include dematerialization, improved energy efficiency of devices and reduction in transport. Negative impacts include energy use in the production of ICT equipment and generation of e-waste.

Concerning the final quantitative assessment review of the WSIS targets carried out in this report, the assessment shows that while extensive growth in ICT networks, services, applications and content has driven the global information society in the decade following the WSIS Summits, ICT access and use is far from equally distributed. Large parts of the world's population have limited access to ICTs (in particular the Internet) and cannot fully benefit from their potential. While the last decade has seen enormous growth in mobile-cellular penetration (with now nearly one mobile-cellular phone subscription for every person in the world), over 4 billion people in the world (60 per cent of the world's population) are still not using the Internet.

The assessment in this report has also highlighted the lack of data to fully assess progress. It should be noted that the results are possibly distorted by uneven data contributions in favour of more connected countries. In particular, for most indicators, data in respect of least developed countries were lacking.

Concerning specific targets:

- *Target 1:* Significant but unequal progress has been observed for the four indicators defined for this target. Rural mobile coverage is on track and good progress has been made with access to phones in rural households, but rural areas lag in Internet access and use.
- *Target 2:* Good progress has been made on this target, but great variations exist between and among developed and developing countries across all four indicators. The presence of radio and television for educational purposes is mixed due to countries' varying policies. Learner-to-computer ratios are high and Internet penetration levels are generally low in developing countries, while the opposite is true of developed countries.
- *Target 3:* Significant progress has been observed across the three indicators defined for this target: connectivity of scientific and research centres with broadband Internet, number of National Research and Education Networks (NRENs) and connecting NRENs with broadband Internet. However, the target has not been achieved by all countries.
- *Target* 4: Mixed progress has been made in achieving this target, with the lack of data hampering a complete review of the 11 indicators defined for this target. Available data suggest that while an increasing proportion of public libraries and museums have broadband Internet access, the proportion with a web presence is lower. Post offices are more likely to have broadband Internet access, but a relatively small proportion offer public Internet access. National archives tend to have both broadband Internet access and a web presence. However, limited progress has been made in in terms of digitizing cultural heritage and making it available online. A notable finding of Chapter 4 is that public libraries and post offices are underutilized as public Internet access venues.
- *Target 5:* Good progress has been observed for the first indicator defined for this target – connecting hospitals to the Internet, less progress for the second indicator – connecting health centres, and no data were available to assess the third indicator – the level of use of computers and the Internet to manage patient information.
- *Target 6:* For most of the indicators for this target, progress is not uniform, with many countries still not utilizing the full potential of ICT in government. For most of the indicators, lack of data hamper the analysis. However, data for two of the indicators are available for most countries and show that by 2013, all countries had a central government web presence and the provision of information and transactional services on government portals is growing.
- *Target 7:* The review of this target has seen mixed progress across all indicators: the percentage of the national teaching workforce trained to teach basic computer skills is generally low, the proportion of teachers trained to teach using ICT varies substantially between and among developed and developing countries, and computer-assisted instruction and Internet-assisted instruction are common in high-income countries, but uncommon in many developing countries.

- *Target 8:* While this target has not been universally achieved, good progress has been made. Household access to radio and TV is widespread globally, although the target for TV remains unmet in the least developed countries. The adoption of multichannel television has been growing rapidly and slightly more than half of all households had it by 2012.
- *Target 9:* Good progress has been made towards this target, although there are major problems with lack of reliable data. The data that are available show that the proportion of Internet users whose primary language is English has fallen significantly as access to the Internet has become more widespread. There has been particularly strong growth in the number of Chinese speakers online and there is growing linguistic diversity in web content. For instance, there has been a marked decline in the proportion of Widipedia articles in English (from 46 per cent in 2003 to 15 per cent in 2013) and a corresponding increase in the proportion of articles in languages that are not among the ten most-used international languages.
- *Target 10:* Significant progress has been made towards achieving this target across all five indicators: mobile-cellular subscriptions have grown to almost one subscription for every person; more than half of all households have a telephone; at least half of the world's inhabitants use mobile phones in countries where data are available; and almost 40 per cent of the world's population and a similar percentage of households use the Internet, although still slightly below the 50 per cent target.
- *Proposed Target 11:* In countries for which data are available, about half of all businesses use computers. While fixed broadband access has grown for all countries with available data, the level is still unequal. Data for business mobile phone use are not widely available, although anecdotal evidence suggests that mobile phones have become the most commonly used ICT tool among micro and small businesses in low-income countries.

In addition to the mixed results in terms of achieving the WSIS targets, this report points to the difficulties in monitoring them. Defined in 2003, the targets largely focused on bringing connectivity and access to various groups, and reflect the situation of ICT uptake at the time, when relatively few people and organizations were connected. However, no formal monitoring process was put in place to carry out global assessment of the WSIS action lines or targets until 2010. In addition, data availability is low for the majority of indicators that were identified to help track the targets. While the Partnership on Measuring ICT for Development developed a core list of ICT indicators (*Partnership*, 2010) to track and compare international ICT developments and a statistical framework specifically to track the WSIS targets (*Partnership*, 2011), the WSIS targets cover subjects that are challenging to capture in quantitative terms, and to compare at the international level.

A number of lessons can be learnt for identifying and monitoring the targets. A key benefit of identifying targets is to bring global attention to ICT development challenges, and to stimulate ICT investment. These benefits were not fully realized for WSIS due to the low level of awareness amongst policy-makers until 2010. Relatively little attention was paid to the WSIS targets, which remained unmonitored until 2010 (ITU, 2010) and it is not entirely clear how they were set and why they focused on certain policy areas and not others. In particular most of the targets deal with ICT connectivity and access. Concerning methodological criteria, while the WSIS targets were time-bound, the targets were vague, which in turn hampered the identification of indicators. Also, the availability and quality of data remain a challenge, highlighting the lack of coordination between policy-makers and the statistical community, and lack of statistical capacity at the national level.

The review of the WSIS targets and indicators has shown that revisions are necessary: data for some targets are not available, others are less relevant, and there is a need to move from ICT access to use to monitoring the quality and equality of access. In addition, capturing the impact of ICTs is becoming more important than just capturing the rapid development of ICTs. The impact includes the role of ICTs as a development enabler to help achieve other development goals, including MDGs, and future goals of the post-2015 agenda. A number of recommendations were made for future ICT target-setting:

- high-level endorsement and awareness building among policy-makers
- open consultation processes to identify targets
- targets should be time-bound, concrete and measurable to be able to track progress
- they should be ambitious but realistic and achievable, based on the assessment of historical and current trends of progress
- indicators should be clear and easy to understand for policy-makers and other stakeholders, and relevant to policy intervention
- where possible, they should be based on internationally-agreed statistical standards.

In this context, the *Partnership* should continue to take the lead in coordinating measurement of the information society at the international level. In close collaboration with national statistical offices, relevant ministries, regulatory authorities and other relevant stakeholders, the *Partnership* should continue its work on identifying and disseminating statistical standards, concepts and classifications on ICT measurement, in order to produce data needed to assess information society progress and measure the impact of ICTs on development.

Finally, this report highlights that the current debates and processes that are feeding into the development of the post-2015 development agenda do not seem to sufficiently recognize the potential and the importance of ICTs. While the final review of the WSIS outcomes highlights the importance of linking any future ICT monitoring framework to the post-2015 development agenda, none of the key input documents for the post-2015 development agenda focus on ICTs. A number of documents have made reference to ICTs, but there is limited substantive content and no clear or sufficiently strong message on the role of ICTs for achieving future development goals.

Introduction

As the target year for the achievement of the Millennium Development Goals (MDGs), 2015 represents an important milestone for the United Nations (UN) system and for UN member states. The pursuit of MDGs since 2000 coincides with remarkable progress achieved by the world community in the development and use of information and communication technologies (ICTs) for promoting and enabling socio-economic development (ICT4D) and the MDGs. There is also growing evidence that ICTs have the potential to support all three pillars of sustainable development – economic growth, social inclusion and environmental sustainability and will therefore be important for the future development agenda (UNGIS, 2013). However, despite the progress made, the inequalities in access to ICTs platforms, information, knowledge and technological progress remain vast (UNGIS, 2013). Therefore, in the light of the 2015 milestone, there is a need to take stock of the achievements made and the challenges encountered in the pursuit of the World Summit on the Information Society (WSIS) targets, and to discuss the lessons learnt to prepare for a possible post-2015 monitoring framework.

This chapter pursues three goals:

1. to outline the developments in ICT4D in general, including the international policy context, advances in research and understanding of the ICT4D phenomena, the emerging evidence of impact of ICT4D in different sectors, and how this impact is being measured
2. to summarize the content of this report, including statements of achievement, partial achievement or non-achievement of the WSIS targets, the evidence presented in support of such statements, the challenges and lessons learnt regarding measurement of the WSIS targets, and recommendations for defining future WSIS targets, should monitoring continue after 2015
3. to discuss the way forward with measuring progress of ICT4D in general and WSIS in particular, in order to advance the post-2015 development agenda.

The chapter comprises three sections. The first section focuses on ICT4D in general, the second focuses on WSIS measurement, and the third brings the focus on ICT4D and WSIS together within the post-2015 development context.

ICT4D – policy, research and impact

This section outlines the international policy framework for pursuing ICT4D development at a global level; describes the achievements of ICT4D research towards better understanding of the ICT4D phenomenon; and presents evidence of impact of ICT4D on the economy, employment, education, health and environment, and how this impact is being measured.

ICT4D – international policy context

As early as 1997, the UN Administrative Committee on Coordination recognized that ICTs should be at the centre of the efforts undertaken by UN member states to promote and secure sustainable development for all, and requested "establishing universal access to basic communication and information services for all" (UN Administrative Committee on Coordination, 1997).[1] A few years later, the UN Economic and Social Council (ECOSOC) recognized that ICTs are "central to the creation of the emerging global knowledge-based economy and can play an important role in accelerating growth, in promoting sustainable development and eradicating poverty in developing countries as well as countries with economies in transition, and in facilitating their effective integration into the global economy" (ECOSOC, 2000). In the same year, the G8 summit conducted in Okinawa, Japan, stressed the impact of ICT on how people live, learn and work, and reinforced that "everyone, everywhere should be enabled to participate in and no one should be excluded from the benefits of the global information society" (G8, 2000).

Probably the most important reference to ICT4D was included in the MDG declaration, through which all UN member states committed to "ensure that the benefits of new technologies, especially information and communication technologies … are available to all" (UN General Assembly, 2000). However, the challenge of making ICTs "available to all" was enormous. By 2000, the world's population of a little over 6 billion (UNDESA Population Division, 2014) included fewer than 400 million Internet users,[2] so fewer than one in 15 people were using the Internet. Other data from 2000 showed that one out of three persons had never made a phone call, and most of the information available on the Internet was in English – the language spoken by less than 10 per cent of the world population (UNDP Evaluation Office, 2001).

Faced by the magnitude of the task to make ICTs available to all, and the pressing need to harness the potential of knowledge and technology for promoting the MDGs, the UN General Assembly endorsed the World Summit on the Information Society (WSIS) in 2002, to be conducted in two stages – Geneva in 2003 and Tunis in 2005 (UN General Assembly, 2002):

- The Geneva Summit defined a common vision "… to build a people-centred, inclusive and development-oriented Information Society …" and formulated key principles to achieve this vision: "… improve access to information and communication infrastructure and technologies as well as to information and knowledge; build capacity; increase confidence and security in the use of ICTs; create an enabling environment at all levels; develop and widen ICT applications; foster and respect cultural diversity; recognize the role of the media; address the ethical dimensions of the Information Society; and encourage international and regional cooperation." (ITU, 2005). The Summit also recognized that ICTs should help create a more equitable, developed and sustainable society; that communication is a fundamental social process and a basic need; that education, knowledge, information and communication are at the core of human progress; that the main challenge is to harness the potential of ICTs to promote the MDGs; and that ICTs should be seen as the means (tools) and not as an end. The Summit also defined 11 action lines to translate the vision and principles into concrete programs and projects.
- The Tunis phase of WSIS reaffirmed the vision defined in 2003 in Geneva and the commitments made to pursue this vision. The Summit also raised awareness about the transformative power of ICTs to benefit people's activities, interactions and lives. For example, the Tunis Commitment document highlights the potential of ICTs to expand access to quality education, and to boost literacy and universal primary education; the relevance of well-conceived investments in ICTs for increasing trade and better employment; and the role of ICTs to promote peace and security, and to improve social cohesion, good governance and the rule of law. The Summit called upon major stakeholders including governments, businesses, civil society and international organizations to work together towards the implementation of the commitments. Attention was also brought to the need to follow up on the commitments, and to develop financial mechanisms for bridging inequalities between people in access to, use of and knowledge of ICTs.

Subsequent to the Geneva and Tunis phases, WSIS meetings have been conducted annually since 2006. They have provided opportunities for major stakeholders to renew their commitments to ICT4D in general and to WSIS in particular, to showcase their achievements, and to discuss the lessons learnt. In particular, the 2013 WSIS Forum reviewed the progress made over the past ten years towards the implementation of the WSIS outcomes, and a statement was issued by the United Nations Group on the Information Society (UNGIS) on the potential of ICTs to support the Post-2015 Development Agenda (UNGIS, 2013); see Box 12.1.

Box 12.1: Joint Statement – UNGIS on Post-2015 Development Agenda

Submitted by UNGIS to the UN Secretary General and the UN Task Team as a contribution to the dialogue on the Post-2015 Development Agenda, the statement acknowledges that thirteen years since the UN Millennium Summit and ten years after the Geneva Summit, we developed a much better understanding of how ICTs can be utilized to advance development.

In particular, the statement highlighted existing knowledge that:

- ICTs can help "accelerate delivery on all three pillars of sustainable development – economic growth, social inclusion and environmental sustainability".
- ICTs can contribute to rights-based development, especially "freedom of expression and press freedom, which in turn are critical to combating corruption, ensuring gender-sensitivity, deepening accountability, and promoting socially-inclusive development".
- ICTs have become critical drivers for "the creation of jobs and the delivery of basic public services, for improving access to knowledge and education, for empowering women, enhancing transparency, and for giving marginalized populations a voice in decision-making processes".
- "ICTs play a transformative role in governance and institutional development at the global, regional, national and local levels, which are essential for sustainable development."
- "Regional cooperation, through the sharing of best practices, policies and experience" can facilitate the emergence of mutually-beneficial solutions that are relevant to given regions.
- ICTs can enhance the "technical effectiveness of development work, as well as the way in which common objectives are defined, set, monitored and achieved".
- "Affordable access to ICTs will continue to transform people's lives, as this enables people to empower themselves, their communities and their societies."

However, ICTs by themselves cannot ensure that the development goals are achieved but need to be combined with "strategic policies, human capacity, appropriate knowledge management, relevant content development, infrastructure deployment and an enabling environment". In addition, despite the progress made, "inequalities in access to ICT networks/infrastructure, education and technological progress and to innovation systems remain vast, within and between countries", and "important digital and knowledge divides" remain. The statements therefore proposed that:

- "The potential of ICTs as key development enablers, and as critical components of innovative development solutions, is fully recognized in the Post-2015 Development Agenda."
- "The Post-2015 Development Agenda reflects the lessons learned during the past decade in the implementation of the WSIS outcomes."
- "Interaction between the Post-2015 Development Agenda and the WSIS+10 Review processes be established to create synergies."

Source: UNGIS, 2013.

ICT4D – advancing research and understanding

The recognition that ICTs have the potential to advance the cause of sustainable social and economic development, as reflected in the high-level policy agenda by the United Nations and UN member states, has been supported by anecdotal evidence of how specific ICT initiatives have made a difference and have contributed to development. However, the faith in ICT4D is also being undermined by ample evidence of large-scale ICT initiatives that have failed to deliver the expected development impact – or even failed to deliver at all. The resulting confusion regarding the exact causes of success or failure of ICT4D initiatives, and the difficulties encountered in replicating successful ICT4D initiatives, has emphasised the importance of relying on analysis and research to inform ICT4D decision-making. These reasons, complemented by high political stakes and the vast amounts of public funds involved, have created favourable conditions for the growth of ICT4D as a vibrant field of applied research (see Box 12.2).

According to (Heeks, 2010), ICT4D research experienced a 39 per cent average annual growth and about a 2 000 per cent increase in the volume of publications produced between 1999 and 2008. One important outcome of this research was to identify two stages in the development of the ICT4D domain as follows:

- ICT4D 1.0 initiatives focused on replicating off-the-shelf solutions in poor communities in developing countries to pursue development, often through telecentre-type projects. They regarded the poor as primarily passive consumers, addressed the readiness and availability of ICT infrastructure, policies and regulations, and were driven largely by donor organizations and non-government organizations (NGOs) (Heeks, 2010).
- ICT4D 2.0 initiatives focused on the uptake of ICTs and the impact created by them. They designed ICTs around existing resources, capabilities and demands of the poor, who were regarded as potential innovators and producers of digital content and services, able to create jobs and generate income for themselves. For ICT4D 1.0, ICT is a tool for development; for ICT4D 2.0, ICT is a platform for development (Heeks, 2009).

ICT4D research also attracted criticism for its focus on action over knowledge, preference to study what can be narrowly described, and insufficient analysis (Heeks, 2009). However, the quality and rigour of ICT4D research, and therefore its reliability, has also improved over the years.

Box 12.2: Analysis of ICT4D research

The content analysis of 948 ICT4D research papers published in selected journals and conferences between 2000 and 2010 was documented by Gomez (2013) and found that:

- Most ICT4D research takes a single country (40 per cent), single organization (29 per cent) or multiple countries (24 per cent) context as its unit of analysis, although the neighbourhood- and community-level analyses are emerging, with 16 per cent and 15 per cent respectively. India is by far the largest recipient of single-country ICT4D research.
- ICT in general (48 per cent), information systems (26 per cent) and software (14 per cent) are typical objects for ICT4D research but mobile phones (10 per cent) are fast gaining attention.
- About half of the analysed papers are addressing identifiable research questions, the most common being: descriptive questions, including case studies and comparisons (31 per cent); measurement and improvement questions, including assessment, evaluation and ways to improve project implementation (21 per cent); and social change questions that address empowerment, democratization, sustainability and related issues (21 per cent).
- ICT4D research applies mainly qualitative (37 per cent), mixed (29 per cent) or quantitative (16 per cent) research methods, although the mixed methods are gaining in popularity.
- The common application domains for ICT4D research are: business, including e-commerce, industry and entrepreneurship (36 per cent); empowerment, including participation, social capital and community development (31 per cent); education, including literacy and science (22 per cent); and e-government, including politics and public services (18 per cent). A paper can belong to several domains.
- The most common contributions of ICT4D research are: best practices, including lessons learnt and success factors (31 per cent); field experience, including descriptions and evaluations of projects (30 per cent); as well as policy recommendations (26 per cent) and theory development (24 per cent), with growing contributions to design and policy recommendations. A paper can make multiple types of contributions.
- The most common recommendations issued by ICT4D research concern: infrastructure and resources (26 per cent); participation and collaboration (15 per cent); planning and implementation (13 per cent); and capacity building and training (12 per cent).

Source: Gomez (2013).

ICT4D – impact and its measurement

Despite political support (because of the presence of ICT4D on the high-level agenda of the UN) and the steady provision of best practices, field experiences and policy recommendations by the growing body of ICT4D literature, there is ample evidence that many ICT4D projects fail or underperform in terms of the benefits and impacts expected from them (Heeks, 2006). Such evidence underscores both the complexity of designing and implementing successful ICT4D initiatives and the difficulty of replicating such initiatives in different contexts. It also emphasizes the importance of measuring the performance and impact of ICT4D initiatives to underpin accurate, context-specific analysis, and enable evidence-based decision-making. In addition, despite increasing policy attention and research, we still know very little about the impact of ICTs on development. In particular, we are missing internationally comparable cross-country data.

As part of the evidence concerning achievement, partial achievement or non-achievement of the WSIS targets, earlier chapters of this report provided some examples of ICT4D initiatives, and how they contribute to such targets. In order to put WSIS targets in a larger ICT4D context, examine the impact of ICT4D beyond WSIS, and possibly contribute to the reformulation of WSIS targets to guide ICT4D in support of post-2015 development, the following list provides examples of efforts undertaken to measure the impact of ICTs in different sectors:

- **Economy:** According to research conducted in 25 Organisation for Economic Cooperation and Development (OECD) countries during 1996-2007 to examine the effect of broadband infrastructure on economic growth (Czernich *et al.*, 2009), after introducing broadband, gross domestic product (GDP) per capita would be 2.7 to 3.9 per cent higher on average than before its introduction, and further increases in broadband penetration by 10 percentage points would raise the annual per capita growth between 0.9 and 1.5 percentage points. However, it is unclear to what extent the evidence from OECD countries can be used to predict the outcomes for developing countries, and how far the first adopter experience can be used to predict the late adopter outcomes. According to the World Bank (2009), for developing countries such increases were 1.38, 1.12 and 0.81 percentage points of per capita growth for every 10 per cent increase in broadband, Internet and mobile phone penetration, respectively. However, according to Kenny (2011) and based on available evidence, economic benefits of broadband are overestimated.
- **Education:** Several studies exist to assess the benefits brought by ICTs to education, including positive effects of the use of specific ICTs on student performance, particularly in mathematics, science and English (UIS, 2009). However, ICT can only improve classroom performance if its use matches the pedagogical approach adopted by teachers (UIS, 2009) and if certain pedagogical conditions have been met (OECD, 2010). According to OECD (2005), performance in mathematics by students without home access to computers was significantly below the performance by students with such access; the same but weaker differentiation exists with respect to computers at school. The same study established that the highest performances in reading and mathematics were by students with average computer use, indicating that too much computer use could have a negative effect on student performance in school. However, it is not possible to demonstrate any consistent relationship between the availability and use of ICT at schools and educational attainment (OECD, 2010).
- **Health:** According to a World Health Organization (WHO) study (WHO, 2013), of 64 countries examined, 42 per cent established national e-health strategies but only 36 per cent implemented them (even partly). Typical e-health initiatives included: tele-consultation (47 per cent of the countries examined), health promotion (36 per cent), health call centres (33 per cent), health education (30 per cent) and treatment compliance and appointment reminders (28 per cent each). Nearly half of the countries (45 per cent) provided access to information at point of care to health care professionals, including electronic health records (36 per cent) and decision-support systems (25 per cent). The majority of countries offered ICT training to medical students (75 per cent) and health practitioners (58 per cent). A study of socio-economic impact of electronic health records (European Commission, 2010) identified that the average costs versus benefits of such systems are distributed as follows: citizens (2 per cent of costs and 17 per cent of the benefits), health practitioners (11 per cent costs and 17 per cent benefits) and health care providers (80 per cent costs and 61 per cent benefits).
- **Environment:** ICTs can have positive impacts on the environment through, for example, dematerialization and online delivery, reduction of energy use in transport, and greater energy efficiency of devices. In fact, ICT-enabled solutions offer the potential to reduce greenhouse gas emissions (GHG) by 16.5 per cent (Global eSustainability Initiative, 2012). ICT can also have negative environmental impacts through, for example, energy use in the production of ICT services and equipment (exacerbated by short life-cycles of many ICT products) and consequent issues of e-waste (UNCTAD, 2011) and the growing energy consumption by data centres (Glanz, 2012). Impacts can be related to production, maintenance and disposal of ICT equipment (first

order), to the application of ICTs throughout the economy and society (second order) or to fundamental changes to the economic and social structures and behaviours due to the use of ICT (third order) (Maclean, 2008). For example, electricity use of the office ICT equipment in the United States was estimated in 2000 at 2 per cent of the national electricity use (Williams, 2011). However, for a typical laptop computer, only 36 per cent of energy is used for its operations, while the remaining 64 per cent is used in its manufacture (Williams, 2011). Also, 80 per cent of ICT-generated GHG are not due to direct effects, but indirect ones (Maclean, 2008). A conceptual framework for measuring the relationship between ICTs and the environments is presented in Roberts (2009).

Box 12.3 provides some examples of how ICTs can directly contribute to MDGs.

Box 12.3: Examples of ICT contributions to MDGs

ICTs have the potential to, and some cases have shown the actual impact on, directly contributing towards the fulfilment of MDGs. Examples from Broadband Commission for Digital Development (2013) are presented below:

- *Goal 1: Eradicate Extreme Hunger and Poverty* – A growing body of evidence exists to show that broadband can boost GDP and incomes, and that ICTs enable access to new markets, spur innovation, enable the invention and delivery of services, and generate economies of scale, all helping overcome poverty and hunger.
- *Goal 2: Achieve Universal Primary Education* – There are studies showing that high-quality electronic content curricula can improve educational outcomes (Jagger, 2005), and that Short Message Service (SMS) text messaging can be used to practice and reinforce literacy and numeracy skills (Tostan, 2014).
- *Goal 3: Promote Gender Equality and Empower Women* – In India, computers are being used as an inducement to keep children, particularly girls, in schools (Nambiar, 2005). Various studies have also reported that men and women use ICTs differently, for example, to access information (women) or to communicate with friends (men) (Thioune, 2003).
- *Goal 4: Reduce Child Mortality* – A community health reporting and alerts platform called ChildCount+ helps community health extension workers register children under five in order to monitor their health status, including screening for malnutrition every 90 days, as well as monitoring immunizations, malaria, diarrhoea and pneumonia (Lemaire, 2011).
- *Goal 5: Improve Maternal Health* – ChildCount+ also supports maternal health by registering pregnant mothers and providing support for antenatal care, aspiring to reduce mother-to-child transmission of Human Immunodeficiency Virus (HIV). WE CARE Solar provides healthcare workers with mobile phones and reliable lighting using solar electricity to facilitate safer deliveries (WE CARE Solar, 2014).
- *Goal 6: Combat HIV/AIDS, Malaria and Other Diseases* – A content-sharing platform from Africa called Bozza applies mobile services to raise awareness about Acquired Immune Deficiency Syndrome (AIDS) and condom use (Bozza, 2014). In South Africa, an open source SMS system based on electronic health records tracks HIV patients and reminds them about appointments (Lemaire, 2011).
- *Goal 7: Ensure Environmental Sustainability* – Broadband can reduce energy and water consumption through smart transportation and logistics, dematerialization and other technologies. Smart grids can reduce energy consumption through improved heating, cooling and monitoring technologies (Global eSustainability Initiative, 2008).
- *Goal 8: Develop a Global Partnership for Development* – In order to make available the benefits of new technologies, especially ICTs, the private sector, in conjunction with public sector policy leadership has driven expansion in the markets for broadband, moving mobile-cellular subscriptions towards saturation levels in 2013 (UN, 2013).

Source: Broadband Commission for Digital Development (2013).

Measuring WSIS targets

This section summarizes the conclusions of the previous chapters concerning the achievement, partial achievement or non-achievement of the WSIS targets and recalls the evidence presented in support of such statements. It reflects on the indicators themselves, including the challenges encountered and the lessons learnt.

Achievements

The final quantitative assessment review of the WSIS targets in this report shows the much faster than anticipated move towards ubiquity in telephony, the fastest growth in any technology in human history. However, while extensive growth in ICT networks, services and applications and content has driven the global information society in the decade following the 2003/2005 World Summits on the Information Society, ICT access and use is far from equally distributed. Large parts of the world's population have limited access to ICTs and cannot fully benefit from their potential. While the last decade has shown much-faster-than-anticipated growth in mobile-cellular services and the move towards ubiquity in telephony, still over 4 billion people in the world (60 per cent of the world's population) are not using the Internet. Subject to the general shortage of data for several targets, an assessment review of each one of the 10 (+1) WSIS targets highlights these mixed results and the need for policy-makers to address a number of remaining challenges. The assessment also highlights the lack of data to fully assess progress and it should be noted that the review is possibly distorted by more connected countries more likely to produce, and to respond to requests for, information than less connected countries.

- *Target 1:* The WSIS Target 1 aims at connecting all villages with ICTs and establishing community access points. Despite the seeming ubiquity of ICTs, their benefits are not uniformly experienced by the 7.1 billion people in the world. The review of this target suggests that significant progress has been made in terms of increasing coverage by a mobile cellular signal for rural populations (Indicator 1.1) and access to phones (Indicator 1.2). By 2015, all rural communities around the world are likely to be covered by a 2G signal, and 3G coverage is likely to increase rapidly. Although Target 1 has not been achieved in respect of telephone connectivity, it must be recognized that the progress in spreading basic telephone access has been unprecedented. For most of the countries for which data are available, over 70 per cent of rural households have phone access of some type. The proportion is likely to be lower for the least developed countries (LDCs), most of which do not collect data on household ICT access. In terms of Internet access (Indicator 1.3) and use (Indicator 1.4), Target 1 is unlikely to be achieved by 2015. Access to the Internet in any form (narrowband or broadband, fixed or wireless) was extremely low for rural households in developing countries for which data are available. Internet user penetration is also low in many developing countries, with people in rural areas trailing those in urban areas.
- *Target 2:* The WSIS Target 2 aims at connecting all primary and secondary schools with ICTs: radio, television, computers and Internet. Only relatively few countries collect and publish data on the proportion of schools with radios (Indicator 2.1) and televisions (Indicator 2.2) used for educational purposes. The penetration levels vary between developed and developing countries, but also among developed and developing countries, suggesting that national policies and objectives vary. Existing data on the learner-to-computer ratio (Indicator 2.3) also show sizeable variations between countries, with relatively low ratios in most developed countries (<10:1) and

less favourable ratios in developing countries, particularly low-income countries. The vast majority of schools in developed countries are connected to the Internet (Indicator 2.4), typically to high-speed broadband networks, and many stopped tracking ICT infrastructure in schools since connectivity is approaching 100 per cent. In contrast, penetration levels vary considerably in developing countries and typically include a combination of both fixed broadband and other types of connectivity. By implementing strong policy initiatives and programmes with high-level governmental support and a sector-wide approach, a number of developing countries have successfully attained a relatively low learner-to-computer ratio and high levels of Internet penetration in schools.

- *Target 3:* The WSIS Target 3 aims at connecting all scientific and research centres with ICTs. While the ICT revolution has not occurred at a uniform pace in all regions, it has to a large extent led to the creation of dynamic networks, cross-border collaborative processes, and internationalization of research and higher education. The review of this target suggests that it has not been achieved but that significant progress has been made in all three indicators. Where data were available, the connectivity of scientific and research centres with broadband Internet (Indicator 3.1) was high, typically 100 per cent, but there were a few countries that have yet to achieve this target. Significant progress has been made in increasing the total number of National Research and Education Networks (NRENs), regional NRENs and countries with a NREN, and their bandwidth has also increased significantly from megabit to gigabit capacity. Progress was particularly noteworthy in Africa, where the number of regional NRENs increased from none before 2006 to three by the end of 2013 (Indicator 3.2). In most countries with existing NREN and available data, the majority of the universities and research centres, but few government departments engaged in research and development, are connected through broadband Internet access to NREN (Indicator 3.3), suggesting that this is one area for greater collaboration between policy-makers, scientists and academics.
- *Target 4:* The WSIS Target 4 aims at connecting all public libraries, museums, post offices and national archives with ICTs. The review of this target was particularly hampered by a shortage of data. In almost half of the (only 30) countries that provided data about public libraries, all (or nearly all) public libraries had broadband Internet access (Indicator 4.1), more than a quarter (7 out of 26 countries) had a web presence (Indicator 4.3), and the use of libraries to provide public Internet access is generally low, in particular in developing countries (Indicator 4.2). In half of the (25) countries that provided data about museums, all (or nearly all) museums had broadband Internet access (Indicator 4.4) but in only one-third of the (21) countries with data all museums had a web presence (Indicator 4.5). In one-fifth of the (74) countries that provided data about post offices, at least 90 per cent of post offices had broadband Internet access (Indicator 4.6) but the provision of public Internet access by post offices remains generally low (Indicator 4.7). In almost all of those 22 countries that provided data about national archives, all archives had broadband access (Indicator 4.8) and a web presence (Indicator 4.9). Among the few (19) countries that provided data about digitization of national archives, in a majority of countries less than 5 per cent of the items were digitized (Indicator 4.10) and only three countries provide all of their digitized items online (Indicator 4.11).
- *Target 5:* The WSIS Target 5 aims at connecting all health centres and hospitals with ICTs. The review of this target was hampered by a severe shortage of data, but results show that almost 80 per cent of responding countries had connected between 75 and 100 per cent of their hospitals (Indicator 5.1). The available connectivity figures are not as high for health centres (Indicator

5.2), with 65 per cent of countries reporting having connected 75 to 100 per cent of health centres. Data about the level of use of computers and the Internet to manage individual patient information (Indicator 5.3) are not available. Alternative data sources for Target 5 from WHO were explored, including the adoption of eHealth strategies by countries and the uptake of an online knowledge services providing scientific journals to health institutions (HINARI). The latter is proposed as a reliable measurement of health facility connectivity as it is only available to health institutions with Internet access in developing countries. Data show solid and linear growth over the period 2003 to 2013; growth of the number of connected institutions is an impressive 600 per cent, from an original baseline in 2003 of 792 connected institutions to 5 584 at the end of 2013. In terms of eHealth strategies, in 2009, 55 countries indicated that they had eHealth strategies; this number had grown to 85 by 2013.

- *Target 6:* The WSIS Target 6 aims at connecting all central government departments and establishing websites. The review of the target, which is based on very limited data for indicators 6.1 to 6.5, shows that whereas the majority of developed countries indicated a high level of routine use of computers (Indicator 6.1) and the Internet (Indicator 6.2) by government employees, the proportions were lower for most developing countries, with some notable exceptions, especially in the Americas. The majority of the developed and developing countries reported close to 100 per cent local area network coverage (Indicator 6.3). Most countries in Europe and Asia had a high intranet presence (Indicator 6.4) among central government organizations but there was limited intranet presence in some developing countries. Most countries had close to 100 per cent Internet access by central government organizations (Indicator 6.5). By 2014, all countries had a central government web presence but only a little over half of them link to the websites run by lower levels of government (Indicator 6.6). Online information and services on government website portals increased threefold in the last decade, with 70 per cent of countries providing a one-stop shop portal in 2012, compared to 26 per cent in 2003. By 2014, almost all of the countries of Europe, and the majority in the Americas and Asia, provided archived information on education, health, finance, social welfare, labour and environment. The proportion was less in other regions, such as countries in Africa, which ranged from 31 per cent in social welfare to 65 per cent in finance. In terms of transactional services in 2014, about half the countries of the world provided for creation of a personal online account and in nearly 40 per cent of countries, income taxes could be paid online (Indicator 6.7).
- *Target 7:* The WSIS Target 7 aims at adapting all primary and secondary school curricula to meet the challenges of the information society, taking into account national circumstances. In the majority of both developed and developing countries representing various regions and income levels, less than 10 per cent of the national teaching workforces is trained to teach basic computer skills (Indicator 7.1). The proportion of teachers trained to teach using ICT varies substantially, with developed countries typically training a higher share of the entire workforce. Nevertheless, the proportion of trained teachers also varies amongst developing countries, for example, from less than 20 per cent in Argentina to about 88 per cent in Jordan (Indicator 7.2). Computer-Assisted Instruction (CAI) is common in high-income countries in Asia and Europe, but rarer in many low-income developing countries (Indicator 7.3). Internet-Assisted Instruction (IAI) typically lags behind CAI but is universal in a number of high-income European and East Asian countries, and less common in many developing countries where, in some cases, the administrative use of the Internet is prioritized over its educational use (Indicator 7.4).

- *Target 8:* The WSIS Target 8 aims at ensuring that all of the world's population has access to television and radio services. A review of this target suggests that household access to radio (Indicator 8.1) and TV (Indicator 8.2) is widespread. While in developed countries, most households are able to access radio and TV, in most developing countries for which data are available, at least 50 per cent of households had access to radio by the end of 2012. About 80 per cent of households globally had a television by the end of 2012, compared to about 72 per cent of households in developing countries. However, the target for television access remains largely unmet in Africa, with only 42 per cent of households in Africa having a television set by the end of 2012. In least developed countries, only 35 per cent of households had a TV in 2012. The adoption of multichannel television (Indicator 8.3) has been growing rapidly and by 2012, slightly more than half of all households (or 71 per cent of households with television) had access to multichannel services, compared to two in five in 2008. The review of this target also showed that most developed countries have completed, or are on track to complete, the transition to digital television, while developing countries have begun or are committed to the transition.
- *Target 9:* The WSIS Target 9 aims at encouraging the development of content and putting in place technical conditions in order to facilitate the presence and use of all world languages on the Internet. No reliable data are available for calculating the proportion of Internet users by language (Indicator 9.1); ITU data on use of the Internet are not dissected by language. The proportion of English speakers among those online has decreased over the past years. It was estimated as 80 per cent in 1996, 35 per cent in 2004 and 27 per cent in 2011. A similar decline can be seen for other European languages, but also for Japanese and Korean. At the same time, other languages – in particular Chinese – have grown in terms of the online presence (Indicator 9.2). There is no satisfactory data source to measure the proportion of webpages by language (Indicator 9.3). Available data suggest that there is growing linguistic diversity in web content, although English remains the most widely used language on websites. However, the nature of online content has evolved rapidly since WSIS as a result of the development of social media and user-generated content, while automated translation is now having impact on linguistic diversity. The Internet is dominated by content providers from Europe and the Americas, with domain registrations from these two continents substantially greater than those from Asia, which has a much higher population. Registrations from Africa remain below 1 per cent although the continent has nearly 15 per cent of the world population (Indicator 9.4). The number of Wikipedia articles rose from 398 000 in 2003 to a little over 30 million in 2013. The proportion of articles written in English declined during this period from 46 to 15 per cent and the articles in languages other than the ten most-used languages rose from 26 per cent in 2003 to 58 per cent in 2013 (Indicator 9.5).
- *Target 10:* The WSIS Target 10 aims at ensuring that more than half the world's inhabitants have access to ICTs within their reach and make use of them. It is clear that significant progress has been made towards achieving Target 10 and the main agent for growth is the mobile cellular telephone, the penetration of which has increased phenomenally. Mobile-cellular subscriptions have grown from one subscription for every five persons in 2003, two subscriptions for every three persons in 2009, to almost one subscription for every person in 2013 (Indicator 10.1). For most countries for which data are available, the target has been reached, with 50 per cent or more households with a telephone, primarily a mobile phone only or both fixed and mobile phones (Indicator 10.2). All countries with available data reported that at least 50 per cent of their inhabitants were using mobile phones, and half of the countries reported at least 90 per

cent of their inhabitants using mobile phones (Indicator 10.3). In 2013, there were almost 40 per cent of the world's population using the Internet, and assuming previous growth rates of 3 per cent per annum, the number should rise to close to the 50 per cent target by the end of 2014 (Indicator 10.4). Globally, household access to the Internet was 41 per cent in 2013, more than double the 16 per cent in 2003, but falling short of the 50 per cent target. (Indicator 10.5).

- *Proposed Target 11:* The WSIS proposed Target 11 aims at connecting all businesses with ICTs. For selected countries for which data are available, the share of businesses using computers was 49 per cent on average (Indicator 11.1). The growth of fixed broadband access by businesses is unequal, ranging from, for example, Uruguay at 43 per cent in 2005, growing to 91 per cent in 2012, compared to Thailand at 2 per cent in 2005, growing to 11 per cent in 2012 (Indicator 11.2). Anecdotally, mobile phones have become the most commonly used ICT tool among micro and small businesses in low-income countries, and in the informal sector. In 2012, about 39 per cent of European business enterprises provided non-computer portable devices to their staff, while mobile connection to the Internet was allowed by 90 per cent of large businesses, 71 per cent of medium-sized businesses and 43 per cent of small businesses (Indicator 11.3).

Challenges, lessons learnt and recommendations

In addition to the mixed results in terms of achieving the WSIS targets, this report points to the difficulties in monitoring them. Data availability is low for the majority of indicators that were identified to help track the targets. In this context, and to identify some of the lessons learnt that could help improve future target-setting and monitoring, it is important to understand the process through which the targets were identified.

When the WSIS was held in Geneva in 2003 and Tunis in 2005, it brought together governments, civil society and the business sector to discuss a broad range of subjects related to ICT4D. Through its outcome documents, governments agreed on a set of commitments and actions to foster the establishment of an inclusive information society. The Geneva *Plan of Action* (ITU, 2005) identified 11 action lines, and ten targets. The targets largely focused on bringing connectivity and access to various groups, such as rural populations, and institutions, for example, schools, hospitals and libraries. These targets reflect the situation of ICTs uptake at the time, when relatively few people and organizations were connected. In 2003, only about one in eight people were online and mobile-cellular penetration, which is expected to reach close to 100 per cent by 2014, stood at around 22 per cent, and only 14 per cent in developing countries. Only targets 7 and 9, on school curricula, and content and language, respectively, were not focused on connectivity but addressed issues of how and for what purpose ICTs are actually used.

Assessing progress made since 2003 has been a challenging task. Despite several mechanisms and processes that attempted to review the pursuit of the WSIS outcomes and commitments, none of them produced a systematic or regular review of the action lines, or of the progress made in terms of achieving the objectives and targets of the WSIS. Indeed, no formal monitoring process was put in place by the WSIS, and until 2010, no global assessment of the WSIS action lines or targets was made. While the *Partnership* developed a core list of ICT indicators to track and compare international ICT developments, the WSIS targets, which go beyond this core list, cover subjects that are challenging to capture in quantitative terms, and to compare at the international level.

As highlighted in the introduction of this report, the process that has led to this Final WSIS Targets Review report was initiated by ITU in 2009 and 2010, when ITU launched the 2010 ITU World

Telecommunication/ICT Development Report (WTDR), *Monitoring the WSIS Targets, A mid-term review* (ITU, 2010). It was then brought under the umbrella of the *Partnership*, and coordinated through its Task Group on the WSIS Targets. To allow for a more systematic review and assessment of the WSIS targets, in 2011, the *Partnership* published *Measuring the WSIS Targets. A statistical framework*, which included a list of 52 indicators, as well as statistical standards and guidelines on how to collect and harmonize data. In addition, and in preparation for this final quantitative assessment report, the *Partnership* sent out a metadata questionnaire in 2012 and undertook substantial awareness-raising to increase the visibility of the WSIS targets. In 2013, the *Partnership* sent out the WSIS targets questionnaire to collect data for the indicators identified to track the targets. The final assessment report is a joint effort by different members of the *Partnership* as well as other organizations involved in measuring the different areas of the WSIS targets. The process leading to this publication included close cooperation and consultation with member states, particularly through the UN regional commissions. The last years of the WSIS monitoring process have highlighted a number of lessons learnt and allowed the *Partnership* to draw some important conclusions that should be taken into account in the identification of any possible future ICT targets.

A number of lessons can be learnt in terms of the process of identifying and monitoring the targets. In this context, it is also useful to point to the monitoring process that accompanied the Millennium Development Goals (MDGs) and the Post-2015 Development Agenda, which is currently under preparation (see Box 12.4).

Box 12.4: Learning from the MDGs and the Sustainable Development Agenda

Contrary to the WSIS targets, the Millennium Development Goal (MDG) framework includes a clear message on the importance of tracking progress and reporting on achievements.

Based on the United Nations *Millennium Declaration*,[3] which was signed in 2000, world leaders committed their nations to a new global partnership to reduce extreme poverty and set out a series of time-bound targets – with a deadline of 2015 – that have become known as the Millennium Development Goals. At the same time, the UN General Assembly highlighted the importance to “assess, on a regular basis, progress towards implementing the Millennium Declaration” and called upon the UN Secretary General to “prepare a comprehensive report every five years, supplemented by an annual report on progress achieved towards implementing the Millennium Declaration …".[4] In response to this call, and under the lead of the UN Statistics Division (UNSD), the Interagency and Expert Group on MDG indicators (IAEG-MDG) was set up. This group includes a number of UN agencies from within the United Nations system and outside, various government agencies and national statisticians, and other organizations concerned with the development of MDG data at the national and international levels, including donors and expert advisers. The group has met regularly since 2002 to coordinate and facilitate the monitoring of progress toward the MDGs by preparing the data and analysis. It also reviews and defines methodologies and technical issues in relation to the indicators, produces guidelines, and helps define priorities and strategies to support countries in data collection, analysis and reporting on MDGs.[5]

In preparation for the post-2015 development agenda and the list of sustainable development goals, a number of efforts are being undertaken to learn from past experiences and to improve the future monitoring process. The IAEG-MDG created a Task Team on Lessons Learned from MDG Monitoring to share its experiences and to provide technical support to guide the formulation of a new development agenda. At the same time, the various processes feeding into the post-2015 development agenda include close cooperation between member states, but also input from the private sector, civil society and the statistical community. In particular, the statistical community has provided input through a number of statistical briefing notes that accompany the thematic issue briefs of the Open Working Group, one of the key groups tasked with preparing the post-2015 sustainable development agenda. These efforts highlight the need to involve the statistical community and could provide an example for other goal- and target-setting exercises, including in the area of ICT development.

Source: ITU.

A key potential benefit of identifying goals and targets is to bring global attention to ICT development challenges, to highlight the link between ICTs and other (broader) development goals, to stimulate ICT development efforts and investments, and to increase resources to implement targeted interventions. In the case of the WSIS targets, these benefits were not fully realized because the level of awareness amongst policy-makers remained relatively low, at least until 2010, when ITU and key partners published the mid-term review (ITU, 2010). Although WSIS highlighted the importance of internationally comparable ICT statistics to benchmark and monitor the progress made on the information society, relatively little attention was paid to the WSIS targets, which remained unmonitored.

Linked to this process, it is not entirely transparent on how the targets were set and why they focused on certain policy areas, such as connecting schools, rural areas, museums etc. but not others, such as businesses. Additionally, the WSIS targets mostly emphasize physical access to ICTs. However, access is only one of the pathways to inclusiveness in the information society.

Relevant lessons were also learnt with regard to the methodological criteria that have to be taken into consideration when goals, targets and indicators are set, which also highlights the important role of the statistical community in the monitoring process. While the WSIS targets were time-bound, which set an appropriate stage for the final quantitative assessment review, the targets were vague and left ample room for interpretation. Their vagueness also hampered the identification of indicators to track targets. Additionally, current data availability and data quality remain a major challenge for WSIS monitoring, and highlight the lack of coordination between policy-makers and the statistical community, which was not involved in the identification of targets and indicators. The review process highlighted that data that are not collected by an international agency, are generally not highly available at the country level. It has also highlighted the lack of statistical capacity at the national level to deliver data to track the WSIS targets.

Finally, recommendations can be made, linked specifically to the nature and potential of ICTs. As demonstrated in this publication, the ICT landscape has changed dramatically over the last ten years and the review of the WSIS targets and indicators selected to track the targets has shown that revisions are necessary. While data for some targets are not available, some targets and indicators are no longer relevant. It makes it very difficult to set targets and indicators that have a life as long as ten years. Rapid changes in technology, services, regulation and applications have had a profound impact on the way people live, work, communicate and interact. At the time of the first phase of the WSIS, only few people would have imagined or predicted the true extent of change due to ICTs. Apart from the rapid changes in ICTs, it is also important to take into account the potential impact of ICTs. The WSIS targets deadline was set in line with the target date of the MDGs. This highlighted the important role of ICTs as a development enabler and their potential to help achieve other development goals, including the MDGs. A similar link would have to be made for a future framework, which should highlight the powerful role of ICTs in the post-2015 development agenda.

In this regard, the following recommendations could be made for future ICT target-setting, and for the identification of indicators:

- The formulation of targets and indicators should be preceded, at the policy level, by the identification of high-level goals.
- For any possible future ICT goals, their identification should be accompanied by a high-level endorsement, including raising awareness among policy-makers.

- Forward-looking ICT targets should be closely linked to the broader post-2015 development agenda and identified based on their potential to help achieve these new goals. For the post-2015 development agenda, the UN Inter-Agency Expert Group on the MDG Indicators (IAEG-MDG) Task Team suggested that the time-span should be 10–15 years,[6] but that intermediate targets could be identified. Since ICTs change rapidly, and long-term target setting may be a challenge, it could be advisable to align ICT targets with short- to mid-term targets, and to revise ICT targets over time, possibly every five years, and to adapt them based on technological developments and policy priorities.
- While some continuity with the existing WSIS targets and indicators could be desirable to allow for long-terms analysis, and while indicators that have worked well and are still relevant should be retained, changes are needed when ICT concepts are no longer relevant, and when new goals and targets are introduced.
- For the formulation of targets and to appropriately reflect national priorities and challenges, an assessment of the most pressing challenges and priority areas must be made. Targets should be identified through a consultation process involving countries, civil society, the private sector and other relevant players. The way that targets are identified and set should be transparent and involve all stakeholders.
- Post-2015 targets should go beyond ICT access and infrastructure, and address inequality and quality issues, such as inequalities between specific population groups (men and women) and quality of access.
- Targets, and the indicators used to monitor them, should focus on the areas where policy interventions can have an impact and where policy-makers have concrete tools to encourage and make changes.
- Any framework on ICT goals and targets should highlight the importance of an international monitoring process and identify stakeholders to take a lead in that process.
- While policy needs and relevance should guide the identification of the broader ICT goals, the statistical community should be more involved and invited to provide technical support to guide the formulation of targets and indicators so as to produce robust and reliable statistics to inform policy development.
- Targets should be time-bound, concrete and measurable to be able to track progress, identify shortcomings and evaluate existing and help identify new policies.
- Targets should be ambitious but realistic and achievable, based on the assessment of historical and current trends of progress.
- Indicators should be:
    - clear and easy to understand for policy-makers and other stakeholders, and relevant to policy intervention
    - based on existing internationally agreed statistical definitions, classifications and standards; metadata on the indicators should be collected and published and methodology, including data sources, method of computation, treatment of missing values, regional estimates, etc. should be well documented and available
    - statistically robust; if indicators are not available, regular data collection mechanisms should be developed within reasonable costs
    - disaggregated by geographical region (urban/rural), sex, income or special population groups (for example, people with disabilities or special needs), where applicable and relevant

- The prime responsibility of an international organization, which should organize their collection, compilation and analysis.

ICT4D, WSIS and post-2015 development

The aim of this section is to close the final quantitative assessment report on the WSIS targets, with a forward-looking discussion on the role of ICT for post-2015 development and how this role could be measured through a revised set of WSIS+10 targets. The discussion advances the earlier presentation of progress with ICT4D and how this progress has been reflected through the global pursuit of the WSIS targets.

Post-2015 development agenda

In September 2010, the United Nations General Assembly (UNGA) requested the United Nations Secretary General (UNSG) to make recommendations on how to advance the UN development agenda beyond 2015 (UNGA, 2010). In September 2011, the UNSG called for the process leading towards the post-2015 agenda to be open, transparent and inclusive of various stakeholders (UNGA, 2011). In the same month, the UNSG requested the United Nations Department of Economic and Social Affairs (UNDESA) and the United Nations Development Programme (UNDP) to establish the UN System Task Team on the Post-2015 UN Development Agenda (UNSTT) to develop a vision and road map for the agenda (UN, 2011). In June 2012, the UNSG appointed the Special Advisor on Post-2015 Development Planning and in July 2012 appointed the High Level Panel (HLP) on Post-2015 Development Agenda to issue recommendations on the post-2015 agenda (UN, 2012).

The initiatives undertaken by the UNSG were completed by three levels of global consultations facilitated by the United Nations Development Group (UNDG):

1. 88 national consultations organized with different groups of stakeholders by the UN Country Teams between June 2012 and March 2013 to discuss the post-2015 development agenda, to provide inputs to the global vision, to issue recommendations for governments, and to represent voices from the poor and align the agenda with expectations from the civil society (UNDG, 2012)
2. 11 thematic consultations with different stakeholder groups led by specialized UN agencies (UNDG, 2013) between September 2012 and March 2013 to discuss: inequalities, health, education, growth and employment, environmental sustainability, food security and nutrition, governance, conflict, violence and disaster, population dynamics, and water and energy
3. Global online conversation taking place on the www.worldwewant2015.org website and through the www.myworld2015.org survey to ask individuals to select 6 among 16 issues that are most important to their lives (UNDG, 2013).

The main outcomes of this process were:

- The report *Realizing the Future We Want for All* produced by UNSTT in June 2012, which lays out a vision of inclusive, people-centred, sustainable global post-2015 development, based on the principles of human rights, equality and sustainability, structured along the four dimensions of inclusive social development, inclusive economic development, environmental sustainability and peace and security, and supported by various development enables (UNSTT, 2012a).
- The report *A Renewed Global Partnership for Development* produced by UNSTT in March 2013 to consider the nature of the partnership required to support the post-2015 agenda including the

dimensions and format of the partnership, financing for sustainable development, debt and trade, technology and migration, governance and accountability (UNSTT, 2013).

- In May 2013, HLP released the report *A New Global Partnership: Eradicate Poverty and Transform Economies through Sustainable Development* that calls for completing MDGs and advancing sustainable development by implementing five global shifts: leave no one behind; put sustainable development at the core; transform economies for jobs and growth; build peace and effective, open and accountable institutions; and forge a new global partnership (HLP, 2013).
- In September 2013, UNDG released the report *A Million Voices: The World We Want* (UNDG, 2013) that collects the results of national consultations, thematic consultations and the global online dialogue and summarizes the key messages obtained: finishing the job of MDG is critical; the world has the resources and technology to eradicate poverty; the new agenda should pursue quality, not only access; growing inequalities and insecurities create feeling of injustice among people; governments should do a better job representing and giving voice to people; etc.

While the first phase of the post-2015 consultations focused on the goals and issues to be included in the agenda, the second phase commenced in April 2014 by UNDG launching the "Dialogues on Implementation of the Post-2015 Development Agenda" (UNDP, 2014). The dialogues focus on: 1) localizing the agenda; 2) strengthening capacities and institutions; 3) monitoring and accountability; 4) partnering with civil society and the private sector; and 6) culture and development.

In parallel to the process outlined above, the United Nations Conference on Sustainable Development which took place in Rio de Janeiro, Brazil in June 2012, initiated a process aimed at developing Sustainable Development Goals (SDGs) as a successor of the MDGs. According to the outcome document *The Future We Want* (UNGA, 2012) agreed upon by this conference, SDGs must be "limited in number, aspirational and easy to communicate", they must address all three dimensions of sustainable development and their inter-dependencies, not divert efforts towards MDGs, and be well-integrated into the post-2015 agenda. The outcome document also mandated the creation of an inter-governmental Open Working Group (OWG) to work on the SDGs (UNGA, 2012), which was established in January 2013 (UNGA, 2013) with the mandate to prepare a proposal for SDGs for consideration by the UNGA at its 68th session in September 2014.

Box 12.5: Open Working Group on the Sustainable Development Goals

OWG is a thirty-member body based on the new to the UNGA constituency-based system of representation where most of the seats are shared by several countries. The body comprises representatives of five country groups: African, Asia-Pacific, Latin American and Caribbean, Western European and Others, and Eastern European Group; and is open to participation from Non-Governmental Organizations in consultative status with the UN Economic and Social Council (ECOSOC). During 11 sessions held by OWG since January 2013, the group deliberated proposals from member states, country groups, local authorities, indigenous people, business and industry, and other stakeholders, concerning additions, deletions and amendments to existing Sustainable Development goals and targets, focusing on several areas:

- Poverty eradication, building shared prosperity and promoting equality
- Sustainable agriculture, food security and nutrition
- Health and population dynamics
- Education and life-long learning
- Gender equality and women's empowerment
- Water and sanitation
- Energy
- Economic growth, employment and infrastructure
- Industrialization and promoting equality among nations
- Sustainable cities and human settlements
- Sustainable Consumption and Production
- Climate change
- Conservation and sustainable use of marine resources, oceans and seas
- Ecosystems and biodiversity
- Means of implementation/Global partnership for sustainable development
- Peaceful and inclusive societies, rule of law and capable institutions; and others.

The UNSTT was assigned as the Technical Support Team (TST) to the OWG, with the report (UNSTT, 2012a), various thematic think pieces prepared by the UNSTT, and a series of TST Issues Briefs provided as inputs.

Other important contributors to the post-2015 process are: Sustainable Development Solutions Network which mobilizes scientists and development practitioners to contribute to problem-solving for sustainable development published in May 2014 a report to the UNSG *An Action Agenda for Sustainable Development* (Sustainable Development Solutions Network, 2014); and United Nations Global Compact which brings together companies and the UN system under the framework of principles in the areas of human rights, labour, the environment and anti-corruption, published in June 2013 a report to the UNSG *Corporate Sustainability and the United Nations Post-2015 Development Agenda* (United Nations Global Compact, 2013).

ICT and post-2015 development

The current debates and processes that are feeding into the development of the post-2015 development agenda do not seem to sufficiently recognize the potential and the importance of ICTs. None of the key input documents, nor the thematic think pieces that were produced by the UN System Task Team on some of the key issues of the post-2015 development agenda, focus on ICTs. While a number of documents have made reference to ICTs, there is limited substantive content and no clear or sufficiently strong message on the role of ICTs for achieving future development goals.

The thematic think piece *Science, Technology and Innovation and Intellectual Property Rights The vision for Development* produced by the members of UNSTT in May 2012 (UNSTT, 2012b) called for: improving access to ICTs to contribute to economic growth; using ICTs and mobile phones to support the delivery of health services and the management of health records; and using ICTs, combined with real-time data, to produce early warning systems and reduce disaster risks. The report also promotes regulatory reform to encourage ICT investment and growth through public-private partnerships.

The report *Realizing the Future We Want for All* (UNSTT, 2012a) refers to ICTs as:

- an opportunity, enabling "the creation, transmission and dissemination of information"
- a challenge, due to inequalities in access to ICT and demand for energy-efficiency
- an innovation driver, towards more "sustainable patterns of consumption and production"
- an enabler to human development, through principle-based knowledge societies
- an enabler to social development, supporting social development and empowerment of families
- an enabler to economic development, generating inclusive and green growth through ICTs
- an enabler to environmental protection, reducing the impact of climate change through ICTs
- an enabler to empowerment, holding institutions accountable through ICTs and social media
- a development enabler in general, through access to technology and knowledge.

However, the document does not present a coherent statement about ICTs, as might be implied by this collection of quotes from different parts of the document. At best, the document views ICT as an interesting tool for development but certainly not central to development.

According to the Expert Group Meeting on "Governance, Public Administration and Information and Communication Technology for the Post-2015 Development" organized by UNDESA and UNU during the ECOSOC High-Level Segment Meetings in Geneva in July 2013 (UNDESA, 2013), technology-enabled governance is fundamental to achieving the expected policy outcomes as part of post-2015 development. ICTs should play the role of an enabler, in order to add value to public service, institutional efficiency and participatory governance. The meeting further noted three key issues concerning ICT for governance, public administration and development:

1. Treating ICT as an enabler of post-2015 development is both a challenge and an opportunity, but it should lead to institutionalizing ICT in the post-2015 agenda.
2. Public governance will be impacted by technology in the years to come, particularly in the areas of social media, mobile technology, cloud computing, big data and cybersecurity.
3. The challenge to integrating technology-enabled governance in post-2015 development by different member states is unequal access to ICTs.

The high-level event of the UNGA "Contributions of North-South, South-South, Triangular Cooperation, and ICT for Development to the implementation of the Post-201S Development Agenda" in May 2014 aimed at mobilizing political commitment for implementing the post-2015 agenda (Ashe, 2014), using "How can [ICTs] help countries be integrated as technological enablers for the achievement of future sustainable development goals?" as one of the guiding questions.

In the stream of work contributing to the SDGs, the 2013 UNDP report *ICTs and Participation: Learning from the Sustainable Development Networking Programme* (UNDP, 2013) analyses the experience and lessons learnt from the Sustainable Development Networking Programme established by UNDP in 1992 to utilize the potential of ICTs to "supporting access to sustainable development information and broadening stakeholder participation in local decision-making processes".

The potential of ICT4D contributing to the post-2015 development agenda is also being noticed in the research community. In particular, Heeks (2014) compares the content of the post-2015 development agenda against existing development informatics research and identifies a set of 16 priorities for international development with insufficient coverage within development informatics research, in priority order as follows: environment and sustainability, poverty, development management, food and agriculture, development finance, inclusive development, rights and justice, data revolution and development 2.0, growth and jobs, security and violence, gender/women, cross-border flows, resilience, governance and urban development.

The 2013 ITU World Telecommunication/ICT Indicators Symposium, a key global forum to discuss telecommunication/ICT measurement issues, included a high-level panel on ICTs, MDGs and the post-2015 development agenda. The panel recognized that ICTs are critical for achieving development goals, including future SDGs. The panel further highlighted that many people are excluded from the information society. Therefore, high priority should be given to increasing access and use of ICTs as a key enabler for future sustainable development. The high-level panel emphasized the important role of ICTs as a development enabler in such areas as employment, education, health, governance and peace-building, women's empowerment, and their ability to accelerate progress towards the achievement of broader development goals. The panel's discussions highlighted the need to identify synergies between a post-2015 ICT monitoring framework and the post-2015 development agenda.[7]

The UNESCAP secretariat, in line with global mandates and further supported by its regional mandate (UNESCAP Commission resolution 69/10), carried-out a review of the WSIS targets at the regional level. The review examines the evidence available at the regional level on the WSIS target indicators and offers recommendations on the post-2015 ICT framework for development. The review finds that while important progress have been made with regards to some of the targets, the evidence is less clear in other areas and at times reflects a growing digital divide, that is evident from qualitative analysis. Further quantification of the nature of this divide is crucial, for the evolution of an inclusive knowledge society, while fostering regional cooperation is an important means of implementation.[8]

Measuring WSIS+10 for post-2015 development

This chapter has identified a number of efforts undertaken by various actors from the United Nations system, government, academia and the civil society with the aim of utilizing ICT as part of the post-2015 development agenda. The discussion now turns to the efforts associated with the final review of the WSIS outcomes and the development of a new proposal for WSIS beyond 2015, organized around the high-level event called WSIS+10.

Coordinated by ITU and co-organized by ITU, United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Conference on Trade and Development (UNCTAD) and UNDP, WSIS+10 will take place in Geneva in June 2014 in order to "review the progress made in the implementation of the WSIS outcomes", take stock of achievements in the last ten years based on the reports from countries, action line facilitators and other WSIS stakeholders and "review the WSIS Outcomes (2003 and 2005) related to the WSIS Action Lines with the view of developing proposals on a new vision beyond 2015, potentially including new targets" (ITU, 2014a).

The WSIS+10 High-Level Event will be an extended version of the WSIS Forum. It is designed to review the progress made in the implementation of the WSIS outcomes under the mandates of participating agencies, and to take stock of achievements in the last ten years based on reports of

WSIS Stakeholders, including those submitted by countries, Action Line Facilitators and other stakeholders.

The WSIS+10 High-Level Event will review the WSIS Outcomes (2003 and 2005) related to the WSIS Action Lines with the view of developing proposals on a new vision beyond 2015, potentially including new targets. This process will take into account the decisions of the 68th Session of the UN General Assembly.

The preparatory process of the WSIS+10 High-Level Event was an open and inclusive consultation among WSIS Stakeholders (governments, private sector, civil society, international organizations and relevant regional organizations) focused on developing multistakeholder consensus on two WSIS+10 High- level Event Outcome Documents; the thematic aspects, and innovations on the format of the Event. The two Outcome Documents, developed during the open consultation process and submitted for endorsement by the WSIS+10 High-Level Event are[9]:

- WSIS+10 Statement on the Implementation of WSIS Outcomes
- WSIS+10 Vision for WSIS Beyond 2015

Five important documents constitute inputs to process:

1. *WSIS+10 Visioning Challenge* (ITU, 2013d) – a compendium of WSIS+10 reports and meetings
2. *Identifying Emerging Trends and a Vision Beyond 2015* (ITU, 2013b) – combined outcomes and recommendations produced by more than 150 sessions organized as part of the 2012 and 2013 editions of the WSIS Forum
3. *WSIS Forum 2013 Outcome Document* (ITU, 2013c) – compilation of session descriptions submitted to the WSIS Secretariat by the organizers of different sessions that took place during the WSIS Forum 2013
4. *Towards Knowledge Societies for Peace and Sustainable Development: Final Statement* (UNESCO, 2013) – the recommendations issued by the meeting hosted by UNESCO in February 2013
5. *Measuring the Information Society 2013* (ITU, 2013a) – 2013 edition of the ICT Development Index which “captures the level of ICT developments in 157 economies worldwide and compares progress made during the last year”.

Here are examples of findings documented by these reports:

- The Ministerial Round Table on “WSIS+10: Future of the Information Society and Challenges to Address beyond 2015” organized at WSIS 2013 and documented in (ITU, 2013c) encouraged WSIS to continue beyond 2015 and emphasised the importance of the review process to properly define the vision and objectives. The Ministers stressed the importance of linking the WSIS and post-MDG processes and ensuring interaction between the Post-2015 and WSIS+10 reviews. They also outlined possible future vision of WSIS to include time-bound, measurable targets and objectives, and key performance indicators that consider global and regional circumstances. However, the challenges ahead include: affordability; broadband for sustainable development; local content; ICT infrastructure; capacity building including e-learning; fostering of innovation and ICT entrepreneurship; preservation of culture and ecology; good governance and wellbeing; accessibility; cloud computing; cybersecurity; spam; ICT policy and regulatory frameworks; use of ICTs for economic integration; financial resources and new business models; and others.
- The plenary “WSIS+10 Visioning Session” at WSIS 2013 (ITU, 2013c) included contributions by countries, civil society and the private sector, for example: prioritizing digital literacy and

infrastructure development; learning from the MDGs process that ICT is crucial to sustainable development; digital technologies are enablers, they enhance users' capabilities; WSIS+10 should concentrate on accessibility, infrastructure, pricing, digital divide, content, multilingualism and multiculturalism; WSIS should link informatics and development; future agenda requires finding local innovative ICT solutions; and the ethical dimension should underpin the information society post-2015. The discussion also explored possible expansion of WSIS action lines with: capacity building, cultural factors, green ICTs and public governance. It also called for strengthening the WSIS Process Design through: regional coordination and preparatory process, government role to enable access, inclusiveness, and providing a larger role for young people.

- The "WSIS+10 Visioning Challenge: Geneva Phase" at WSIS 2013 (ITU, 2013c) engaged WSIS participants in examining the achievements, opportunities, expansion and emerging themes for the WSIS Action Lines. The achievements include: access, connectivity, mobile penetration, innovation in ICTs and civil society involvement in ICT4D. The opportunities include: people-oriented policies, new technologies and innovation, partnerships and cooperation, and cybersecurity. The action lines expanded with new topics such as: social inclusion; gender issues; security issues and ethics; access to infrastructure; and climate change, e-waste, open data, cyber ethics and cybersecurity, and social media. The emerging issues include: public governance including green ICTs and ICTs as a tool for governance; infrastructure including broadband, cloud and cybersecurity; capacity building on new technologies; and culture protection through ICTs.
- The "WSIS +10 Visioning Challenge: Tunis Phase" at WSIS 2013 engaged WSIS participants in discussing the evolution of WSIS Implementation Process including key features, strengthening the WSIS Forum, and opportunities and challenges beyond 2015. The features include: clear targets; monitored, time-bound progress; repository of success stories; regional coordination; and enabling environment. Strengthening the WSIS forum includes: raising engagement amongst politicians; transparent and inclusive sharing of the outcomes; international technical bodies and other social actors taking part; using social media to create awareness and encourage remote participation; and fostering innovation and training the trainers. The challenges beyond 2015 include: security threats, aligning WSIS and MDG, and protecting intellectual property rights. Opportunities exist in terms of: advocacy for knowledge sharing; multicultural and multilingual content; connecting agriculture and health; ICTs to empower small and medium enterprises (SMEs); developing cybersecurity skills; and improving regional coordination.
- The document "Identifying Emerging Trends and a Vision Beyond 2015" (ITU, 2013b) contains trends observed during the implementation of the 11 WSIS action lines discussed during the WSIS Forum 2012 and 2013. Example trends for different action lines are: 1) support e-strategy review; 2) develop devices to expand ICT usage to underdeveloped areas; 3) secure Open Knowledge Commons; 4) ensure safe use of mobile technologies for education; 5) promote "security by design" concept; 6) leverage ICTs for transparency and public service reform; 8) safeguard endangered languages; 9) contribute to rights-based sustainable development through media; 10) contribute to online commerce, by businesses adopting rights-based codes of practice; and 11) use internationally-agreed ICT indicators by the national statistical systems. For Action Line 7: e-government – promote legally-bound use of mobile signatures; e-business – engage users in sustaining e-business solutions; e-learning – make learning accessible through mobile devices; e-health – empower health professionals with information for high-quality care; e-environment – spur cooperation between environmental and ICT communities on

sustainability; e-agriculture – promote ICT innovations; and e-science – promote e-publishing and open access.

- The document "Towards Knowledge Societies for Peace and Sustainable Development: Final Statement" (UNESCO, 2013) states that: education is key to empowering people for sustainable development and peace; given the potential of ICTs, it is important to protect freedom of expression; finding pathways to sustainable development must rely on scientific knowledge; knowledge societies must respect cultural diversity and freedom of expression; etc. The document also calls on all stakeholders to: promote universal access and free flow of information; protect privacy in the cyberspace; solve the problem of inaccessibility; promote information and media literacy; ensure the availability of data for measuring the WSIS targets; and apply the lessons learned during the WSIS review to development goals post-2015.

The current report complements the input documents produced by the Open Consultation Process for the High-Level WSIS+10 Event both in terms of quantitative assessment of the WSIS targets, summarized in this chapter, and the recommendations for measuring WSIS+10 post-2015, issued by each target-specific chapter, and summarized as follows:

- *Target 1*: Have fewer indicators to provide more concise insights into the information lives of rural households, shifting attention from coverage to quality of access, and capturing rurally-relevant applications and content.
- *Target 2*: Narrow the target to monitor ICT access in primary and secondary schools, introduce learner-to-computer connected to Internet ratio as a new indicator, recognize the role of community media centres, and negotiate low-cost Internet access.
- *Target 3*: Measure the information and knowledge shared through the networks including software models and applications, and international research and development efforts, and measuring open access to scientific information and data.
- *Target 4*: Shift attention from access to ICTs to libraries, museums, post offices and archives as online content providers and public Internet access venues.
- *Target 5*: Revise this target with the aim of making the data more applicable to e-health, measure connectivity of health-related institutions and access to medical knowledge through the WHO HINARI database, and capture the development and implementation of national e-health strategies.
- *Target 6*: Address the scarcity of globally-comparable data by revisiting the indicators on ICT in government to capture a wider assessment, and review the framework of supporting and monitoring e-government at the global level.
- *Target 7*: Disaggregate enrolment data in programmes offering computer-assisted instruction and/or Internet-assisted instruction by gender, collect additional metadata about teacher training qualifications, measure how ICTs are integrated into the educational setting (for example, location in schools) and measure the increasing presence of mobile learning models using newly emerging technologies.
- *Target 8*: Continue tracking household access to radio and TV and the adoption of multichannel television and add an indicator to track transition to digital TV. New indicators could measure supply of radio and TV services in terms of availability and quality of content, and content variety and competition through multiple stations and operators.
- *Target 9*: Enable output on Internet usage by language spoken by national statistical offices (in national censuses and household surveys), include data on the evolution of domain name

registrations by country weighted by general and Internet user population, include Wikimedia data on content creators and pageviews, measure online social networks and mobile apps, and incorporate qualitative data in the monitoring of content and language.

- *Target 10*: Continue tracking ICT access but replace the usage with ownership of mobile phones, and move towards measuring the quality of access, barriers to and equality of Internet use, and mobile phone and Internet usage activities.
- *Target 11*: Monitor connectivity and the use of ICT by businesses, to ensure continuity and the highest technical standard of official statistics, integrate data collection into national statistical plans, and assess the presence of regulatory and legal frameworks.

Finally, this report presents a number of key recommendations with regards to measuring ICT developments and the information society in a post-2015 development agenda. In particular, it emphasizes the important role of ICTs in the achievement of broader development goals and recommends that any future ICT monitoring framework should be closely linked to the broader post-2015 development agenda in order to help achieve this future development agenda.

This final review of the WSIS targets has shown that a forward-looking ICT monitoring framework should be developed in close cooperation between UN agencies, WSIS Action line facilitators, and other relevant stakeholders. New goals and targets should be identified based on the most pressing priority areas for policy-making and be ambitious but realistic, time-bound, concrete and measurable to be able to track progress, identify shortcomings and evaluate existing and help identify new policies. Future ICT targets should be accompanied by a monitoring framework that could regularly assess achievements and challenges, and provide an update on progress made.

This report has further highlighted the importance of an open, inclusive, multistakeholder process to develop such a monitoring framework, including goals, targets and indicators. These should be developed with technical support from the statistical community and include a timetable and also regular assessments and reviews of progress. In terms of the production and dissemination of results, data should be shared transparently, online to the extent possible. Dedicated funds should be made available for data collection and capacity building of data producers, in particular in developing and least developed countries. Only clearly defined and monitored ICT goals will be able to monitor the information society post-2015, and its impact on the future development agenda.

In this context, the *Partnership* should continue to take the lead in coordinating measurement of the information society at the international level. In close collaboration with national statistical offices, relevant ministries, regulatory authorities and other relevant stakeholders, the *Partnership* should continue its work on identifying and disseminating statistical standards, concepts and classifications on ICT measurement, in order to produce data needed to assess information society progress and measure the impact of ICTs on development.

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Endnotes

[1] The name of the Administrative Committee on Coordination (ACC) is now "United Nations System Chief Executives Board for Coordination" (CEB). See: http://www.un.org/esa/documents/acc.htm.

[2] ITU World Telecommunication/ICT Indicators database, 17th Edition, December 2013.

[3] See http://www.un.org/millennium/declaration/ares552e.pdf.

[4] See http://mdgs.un.org/unsd/mdg/Resources/Static/Products/GAResolutions/55_162/a_res55_162e.pdf.

[5] For more information on the work of the IAEG on MDG Indicators and the monitoring of the MDGs, see: http://mdgs.un.org/unsd/mdg/Default.aspx.

[6] Inter-Agency Expert Group on the MDG Indicators (IAEG-MDG)'s Task Team. Report of the Task Team on Lessons Learned from MDG Monitoring of the IAEG-MDG, at: http://unstats.un.org/unsd/broaderprogress/pdf/Lesson%20Learned%20from%20MDG%20Monitoring_2013-03-22%20(IAEG).pdf.

[7] See the Final Report of the 11th ITU World Telecommunication/ICT Indicators Symposium (WTIS): http://www.itu.int/en/ITU-D/Statistics/Documents/events/wtis2013/WTIS13_final_report.pdf.

[8] See UNESCAP Secretariat, Working Paper on Assessing the outcome of the World Summit on the Information Society in Asia and the Pacific, 23 April 2014, at: http://www.unescap.org/resources/assessing-outcome-world-summit-information-society-asia-and-pacific.

[9] Both documents can be accessed at: http://www.itu.int/wsis/review/mpp/pages/consolidated-texts.html.

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