ICT AND TELECOMMUNICATIONS IN LEAST DEVELOPED COUNTRIES

Review of Progress Made During the Decade 2000-2010

ICT Service / Applications

Strategies & Policies

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Emergency Telecommunications

ITU

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Foreword

It is with utmost pleasure that I present the *ICT and Telecommunications in Least Developed Countries* report, which reviews the progress these countries have made during the last decade in deploying and upgrading their telecommunication and ICT networks to more actively participate in the digital economy. The report constitutes one of the Union's inputs to the Fourth United Nations Conference on the Least Developed Countries (LDC-IV), which will take place in Istanbul, Turkey, in May 2011 and, as such, it aims at supporting the assessment of the results of the implementation of the 10-year Programme of Action for the LDCs – known as the Brussels Programme of Action (BPoA) adopted at the Third United Nations Conference on the LDCs, held in Brussels, Belgium, in 2001.

The report builds on the mid-term review report for the decade 2001-2006 which was published and presented in New York during the United Nations General Assembly Mid-Term Review on the implementation of the Brussels Programme of Action. This publication overviews activities the ITU Special Programme for LDCs undertook between 2001 and 2010 to support the Least Developed Countries in meeting the telecommunication and ICT targets contained in the BPoA. It also reviews synergies that exist between the seven interconnected commitments outlined in the BPoA's Framework for Partnership and the activities and projects implemented by the ITU under the priority areas of its LDC Programme: Universal access, emergency telecommunications and the provision of concentrated assistance to LDCs and countries with special needs[1] to help them meet the Millennium Development Goals (MDGs) by the target year of 2015.

In 1971, most of the initially identified 25 countries had very limited access to telecommunications. Today, the average number of people with access to telephones in the 49 least developed countries has gone beyond our expectation. We may all recall that the Third United Nations Conference for the LDCs set a target of increasing the average telephone density to 5 main lines per 100 inhabitants and Internet connections to 10 users per 100 inhabitants by the year 2010. The target of increasing the number of telephone lines to 5 per 100 inhabitants has been already surpassed - in some cases, the increase has been ten-fold. In 2001, the number of telephone lines per 100 inhabitants were 1.17% while Internet penetration per 100 inhabitants was 0.2%. By 2010, the number of telephone lines per 100 inhabitants went up to 27.2% and Internet penetration went up to 2.8%. When the statistics for end of 2010 are released, the results are going to be even more positive. Though lagging behind, Internet penetration continues to grow at an unprecedented rate. The introduction of low-cost wireless technologies, broadband, regulatory reforms, demand for mobile services and political will, in part account for these positive developments.

The challenge of creating digital opportunities in least developed countries –including small island developing states and countries with special needs– remains. Achieving this goal will require reinforced efforts on the part of ITU to coordinate with all Member States, the private sector and development partners, so that, working in consonance to pool resources and muster partnerships, we can support LDCs in making the best use of the technological promise of ICT to promote economic growth.

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[1] Countries emerging out of war or natural disasters.

At less than five years from the MDGs' target date and aware that LDCs face the most challenges in developing their telecommunications and ICT sectors, the ITU has reaffirmed its commitment to address the special needs of LDCs in these sectors and help close existing gaps in universal and information access in these countries. In this vein, ITU and UNESCO established the Broadband Commission, to focus on how broadband technologies can hasten the pace towards the attainment of the MDGs by 2015. It is my hope that the insights and information provided in this publication will add value to all those participating at the IV UN Conference on the LDCs, as well as for those stakeholders actively involved in fostering sustainable development in least developed countries.

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List of abbreviations

2G	Second generation (mobile technology)
3G	Third generation (mobile technology)
ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADSL	Asymmetric Digital Subscriber Line
AfDB	African Development Bank
AHI	Africa Health Infoway
ATCB	Adaptive Technology Centre for the Blind
AU	African Union
BDT	Telecommunications Development Bureau
BPoA	Brussels Programme of Action
BTRC	Bangladesh Telecommunication Regulatory Commission
CAB	Central African Backbone project
CAGRs	Compound Annual Growth Rates
CANTO	Caribbean Association of National Telecommunication Organizations
CARICOM	Caribbean Community
ccTLD	Country code Top Level Domain
CDMA	Code Division Multiple Access
CDP	Committee for Development Policy
CERT	Computer Emergency Response Team
CIIP	Cybersecurity and Critical Information Infrastructure Protection
CIS	Commonwealth of Independent States (region)
CITEL	Inter-American Telecommunication Commission
CoE	Centres of Excellence (ITU)
COP	Child Online Protection Initiative
CSME	Caribbean Single Market and Economy
DBCDE	Department of Broadband Communications and the Digital Economy (Australia)
DSL	Digital subscriber line
EAC	East African Community
EASSy	Eastern Africa Submarine System
EC	European Commission
ECOSOC	UN Economic and Social Council
ECOWAS	Economic Community of West African States
ECTEL	Eastern Caribbean Telecommunications Authority
EDGE	Enhanced Data rates for Global Evolution (mobile technology)
ENISA	European Network Information Security Agency
EVI	Economic vulnerability index
FDI	Foreign direct investment
FTRA	Forum on Telecommunication and ICT Regulation and Partnership
GAN	Global Area Network
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tariffs and Trade

GB	Gigabit
Gbps	Gigabits per second
GCA	Global Cybersecurity Agenda
GCBI	Global Capacity-Building Initiative
GDP	Gross domestic product
GNI	Gross national income
GPRS	General Packet Radio Service
GSM	Groupe Spécial Mobile
GSP	Generalized System of Preferences
GSR	Global Symposium for Regulators
HAI	Human assets index
HIPSSA	Harmonization of ICT Policies in Sub-Saharan Africa
HSPA	High Speed Packet Access (mobile technology)
ICT	Information and communication technologies
IDA	International Development Association
IDN	Internationalized Domain Names
IFC	World Bank International Finance Corporation
IMPACT	International Multilateral Partnership Against Cyber-Threats
IPoA	Istanbul Programme of Action
IRA	International Reference Alphabet
ITU-D	ITU Development Sector (also BDT)
ITU-R	ITU Radiocommunication Sector
ITU-T	ITU Standardization Sector
KADO	Korea Agency for Digital Opportunity and Promotion
LDCs	Least Developed Countries
LDC-IV	Fourth United Nations Conference on the Least Developed Countries
LLDCs	Landlocked developing countries
MCT	Multipurpose Community Telecentre
MDGs	Millennium Development Goals
MTN	Mobile Telephone Networks South Africa
NEPAD	New Partnership for Africa's Development
NGN	Next generation networks
NGOs	Non-governmental organisations
NIX	National Internet exchange
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
ODA	Official development assistance
OECD	Organisation for Economic Co-operation and Development
OSS	Observatory for Sahel and Sahara
PC	Personal computer
PCP-TDR	Partnership Coordination Panel on Telecommunications for Disaster Relief
PIDA	Programme for Infrastructure Development in Africa
PKI	Public key infrastructure
PoA	Programme of Action
PPP	Purchasing power parity
PwD	Persons with disabilities

RCIP	Regional Communications Infrastructure Programme
RECs	Regional Economic Communities
RICS	Rural Internet Connectivity System
SADC	Southern Africa Development Community
SIDS	Small Island Developing States
SIM	Subscriber identity module (mobile technology)
SIMs/100	SIMs per 100 inhabitants
SISEI	Système d'information et de suivi de l'environnement sur Internet (Environment Information Circulation and Monitoring System on the Internet Programme for Africa)
SMS	Short Message Service
SMS4DC	Spectrum Management System for Developing Countries
TB	Terabit – also Terabyte or Tbytes
TRIPS	Agreement on Trade-Related Intellectual Property Rights
UEMOA	Union Economique et Monétaire Ouest Africaine
UAP	Universal access policy
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High-Commissariat for Refugees
UNITAR	United Nations Institute for Training and Research
UN-OHRLLS	United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and the Small Island Developing States
USD	United States dollar (currency)
VoIP	Voice over Internet Protocol – voice over IP
WATRA	West Africa Telecommunications Regulators Assembly
WHO	World Health Organization
WiFi	Wireless Fidelity
WiMAX	Worldwide Interoperability for Microwave Access
WSIS	World Summit on the Information Society
WTDC	World Telecommunication Development Conference
WTO	World Trade Organization
WTPF	World Telecommunication Policy Forum

1   Introduction

The ITU report *ICT and Telecommunications in Least Developed Countries: Review of progress made during the decade 2000-2010* is produced as an input to the Fourth United Nations Conference on the Least Developed Countries (LDC-IV), to be held in Istanbul, Turkey, in May 2011. The objective of this report is to present projects and actions the International Telecommunication Union (ITU) undertook from 2006 to 2010 to assist least developed countries (LDCs) in joining the knowledge economy through the deployment and use of information and communication technologies (ICT). The report seeks to complement and update the 2001-2005 review of activities ITU presented at the Special Session of the UN General Assembly in 2006, in which the UN conducted a comprehensive mid-term assessment of the progress made until then in implementing the Programme of Action for the Least Developed Countries for the Decade 2001-2010 (PoA).

The Programme of Action was adopted at the Third UN Conference on the Least Developed Countries, held in Brussels in May 2001, to establish a comprehensive, result-oriented, poverty reduction strategy, tailored to the special needs of the LDCs. The Programme of Action – also known as the Brussels Programme of Action (BPoA) – has an overarching goal to make "substantial progress towards halving the proportion of people living in extreme poverty and suffering from hunger by 2015 and promote sustainable development" of LDCs. To this end, the BPoA developed a framework for partnership between LDCs and their development partners carrying the overarching goal of helping in the eradication of poverty, which contains 30 international development goals, including those of the Millennium Declaration, articulated around seven interlinked commitments:

- Fostering a people-centred policy framework.

- Good governance at national and international levels.

- Building human and institutional capacities.

- Building productive capacities to make globalization work for LDCs.

- Enhancing the role of trade in development.

- Reducing vulnerability and protecting the environment, and

- Mobilising financial resources.

The BPoA also established specific targets for accelerating growth and promoting sustainable development in LDCs. In the area of telecommunications and ICT, the BPoA incorporated the objectives of the then ITU Special Programme for Least Developed Countries,[1] calling on LDCs under Target 27 to develop their telecommunication sectors, so as to meet two specific goals by 2010: *Increasing telephone density to five main lines per 100 inhabitants and Internet connections to 10 users per 100 inhabitants.* To assess the progress made by LDCs on these two goals and support the LDC-IV's comprehensive appraisal of the implementation of the BPoA, chapters 2 and 3 of this report provide an overview of the current status of telecommunications worldwide and in LDCs in particular.

Among its objectives, the LDC-IV Conference aims to identify effective international and domestic policies that have enabled growth and improved economic performance among LDCs under the BPoA, as well as to ascertain current and emerging challenges. During the last decade, many LDCs have successfully reformed their telecommunication sectors, establishing the necessary legislative and institutional framework to promote competition, encourage domestic and foreign investment in the industry and advance towards achieving universal access. Chapter 4 of this report identifies some of the strategies LDCs have followed to strengthen their telecommunication sector, as well as key remaining challenges. Particular emphasis is given to changes made by LDCs in their ICT policy and regulatory environment.

The special attention ITU dedicates to least developed countries dates from the time the United Nations General Assembly adopted this category in 1971. As the oldest UN specialized agency, ITU has played a catalyst role between LDCs, their development partners and the private sector; it has pooled resources and facilitated the coordination of activities among diverse stakeholders, promoting new partnerships and supporting the implementation of sustainable projects and regional initiatives. Through the ITU Special Programme for Least Developed Countries, the ITU Telecommunication Development Bureau (BDT) has undertaken diverse activities and provided concentrated assistance to LDCs aiming to help them develop infrastructure, improve rural telecommunications, introduce new technologies and services, and build human capacity, among other goals. These activities are described in detail in Chapters 5 and 6 of this report.

Following with the objectives of the LDC-IV, Chapter 7 points out some of the bottlenecks and constrains identified by ITU and its LDC members while implementing the telecommunications and ICT related targets of the BPoA, which could be addressed in the Istanbul Programme of Action. Finally, Chapter 8 provides recommendations and conclusions, based on ITU experiences and on the conclusions reached at a recent Pre-Conference event on Digital Inclusion for LDCs, organized by ITU in Geneva, Switzerland, in preparation for LDC-IV. The goal is to inform the discussions on ICT policy development that will take place at LDC-IV.

Before focusing on telecommunication developments, the section below provides a brief overview of the category of Least Developed Countries, summarizing the status of the countries that have been included under this status since its inception in 1971, as well as the criteria for inclusion to and graduation from the LDC category that the Committee for Development Policy (CDP) of the UN Economic and Social Council (ECOSOC) used in its most recent review.

1.1   Least Developed Countries

Recognized by the international community as the most vulnerable members of the United Nations, the UN General Assembly officially endorsed the category of "Least Developed Country" (LDC) in 1971 to provide special support to low-income countries whose economies were considered to face severe structural impediments to growth.[2] Since the adoption of the category, 50 low-income economies have been categorized as LDCs. Although the criteria for including a country into the LDC category has been refined over time, the selection is based on a country's gross national income (GNI) per capita, the weakness and vulnerability to external shocks of its economy, the remoteness and environmental vulnerability of its territory, and on particular characteristics of its human assets, such as literacy, nutrition and health levels.[3]

The Committee for Development Policy of the ECOSOC reviews the LDC membership and the criteria for inclusion periodically. Every three years, the CDP reviews the socio-economic conditions of all low-income economies to determine whether a country should be added to or recommended for graduation from the LDC category. The CDP also sets up threshold levels for the criteria that will be used for the review. During its last review in 2009, the CDP used the following thresholds to identify LDCs and to determine eligibility for graduation:

- A *low-income criterion*, based on a three-year average estimate of the gross national income (GNI) per capita (under USD 905 for inclusion, above USD 1,086 for graduation);

- A *human capital status criterion*, involving a composite Human Assets Index (HAI) based on indicators of: (a) nutrition: percentage of population undernourished; (b) health: mortality rate for children aged five years or under; (c) education: the gross secondary school enrolment ratio; and (d) adult literacy rate; and

- An *economic vulnerability criterion*, involving a composite Economic Vulnerability Index (EVI) based on indicators of: (a) population size; (b) remoteness; (c) merchandise export concentration; (d) share of agriculture, forestry and fisheries in gross domestic product (GDP); (e) homelessness owing to natural disasters; (f) instability of agricultural production; and (g) instability of exports of goods and services.[4]

Of all the LDCs, only three − Botswana (1994), Cape Verde (2007) and Maldives (2011) − have graduated from the status so far, while other two (Samoa and Equatorial Guinea) have been scheduled for graduation. As of 2011, 48 countries are categorized as least developed: 33 are located in Africa, 13 in Asia and the Pacific, one in the Americas (Haiti) and one in the Arab States region (Yemen) (see Figure 1.1). Of the current LDCs, 16 are also landlocked developing countries (LLDC) and ten are classified as Small Island Developing States (SIDS).[5] In terms of population, the LDCs were estimated to have 855 million inhabitants in 2010 − about 12 per cent of the world's population − and their population is projected to grow by about 100 million more by 2015.[6] Regretfully, of this population, about half is projected to live in conditions of extreme poverty by 2015, should the economic conditions of the LDCs not improve considerably.

To foster growth and sustainable development in these countries, the classification of LDC provides its members special support in the areas of trade and official development assistance (ODA) − including development financing and technical cooperation. Nevertheless, despite the support of the international financial community and international organizations, the process of graduation from the LDC status has proved challenging, as illustrated by the extremely low number of countries that have successfully graduated in the last 30 years.

By design, the thresholds for graduation are set up higher than those for inclusion, making them more difficult to be meet as a means to ensure that only countries that are able to maintain improved economic performance for a continued period of time are considered for graduation. To be eligible for graduation, an LDC must cease to meet at least two of the three inclusion criteria or have a GNI per capita that exceeds, and is expected to remain at, a level at least twice the GNI graduation threshold.[7]

Figure 1.1: Least Developed Countries – Current, scheduled for graduation and graduated*

Region	Total LDCs	Countries
Africa	33	Angola, Benin, Burkina Faso, Burundi, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Rwanda, Sao Tome & Principe, Senegal, Sierra Leone, Somalia, Sudan, Togo, Uganda, United Republic of Tanzania, Zambia (+ Botswana, Cape Verde - already graduated).
America	1	Haiti
Asia and Pacific	14	Afghanistan, Bangladesh, Bhutan, Cambodia, Kiribati, Lao People's Democratic Rep., Myanmar, Nepal, Samoa, Solomon Islands, Timor-Leste, Tuvalu, Vanuatu, Yemen. (+ Maldives – graduated January 2011)

Note: As of January 2011.
Source: ITU, based on UN-OHRLLS data (www.unohrlls.org/en/ldc/related/62/).

Another factor affecting the graduation rate from the LDC status has been the vulnerability of its members to external economic shocks, and, in particular for the ones that are also SIDS, to environmental impacts. For instance, in 2005, Maldives was granted a postponement from graduation until December 31, 2010 due to a tsunami in the Indian Ocean that destroyed an important portion of its infrastructure. Similarly, the UN General Assembly deferred Samoa's graduation for an additional three years, to 1st January 2014, as a result of the September 2009 Pacific Ocean tsunami that hit the island, destroying a considerable percentage of its infrastructure and causing economic difficulties to the country.[8] Not surprisingly, countries recommended for graduation tend to be reluctant to be removed from the list, expressing concerns about continued vulnerability to economic, social and natural shocks, as well as to the effect that the cessation of preferential treatment from development partners might have on their economies.[9]

To facilitate the graduation process, the CDP has set up smooth transition rules[10] that give graduating states a three-year grace period from the time they are first recommended for graduation to coordinate with their development and trade partners regarding strategies to phase out preferential treatment and any special support provided under the LDC status.[11] Graduation becomes effective only after the CDP confirms the graduating state's eligibility based on the results of a second consecutive triennial review. Should a reversal in the socio-economic progress of the

country or a natural shock affect the graduating country before graduation takes place, the graduation date may be deferred.

Concerns about the graduation process are already being discussed as part of the preparatory meetings to LDC-IV and will become part of the agenda of such conference for the stakeholders to determine the best way to proceed in the next decade, as part of the Istanbul Programme of Action (IPoA).

While the challenges LDCs face in the path to sustainable growth are multiple, they have achieved significant progress in developing their telecommunication and ICT sectors in the last decade. The following chapters present an overview of this progress and identify some of the main drivers for expansion.

2 Overview of the global state of telecommunications

2.1 Overview

This chapter examines the evolution of digital inclusion worldwide, contrasting growth trends in least developed countries, as a group, against those in developing and developed countries. In general, ICT uptake in LDCs has grown at double and even triple digit rates in the last five years for services such as mobile cellular telephony and fixed Internet subscriptions, slightly reducing the gap between LDCs and developing countries. Yet, the digital gap between them and the rest of the world is still significant. This is particularly evident in the adoption of new generation technologies, such as fixed and mobile broadband Internet services and third generation of mobile cellular technologies (3G), where developed countries have reached high levels of penetration.

There are also disparities in the growth of ICT penetration among regions, with Africa, the region with most LDCs, ranking last in most services, highlighting the need to dedicate additional resources and assistance to LDCs in this region. The sections below assess the evolution on diverse telecommunication services, including fixed and mobile telephony, Internet access and broadband penetration, addressing also the effect affordability of services has on the rate of ICT adoption in LDCs.

2.2 Fixed and mobile telephony

The Brussels Programme of Action underscored the importance of access to both fixed and mobile cellular telephony by adopting the target of having at least five main lines per hundred inhabitants in LDCs by 2010. Nineteen LDCs have included individual fixed-line service in their definition of universal access, and fixed-line public payphone service was cited by 27 LDCs as part of their universal access policies (UAP). Yet, as illustrated in Chart 2.1, the penetration of fixed telephone main lines in LDCs, as a group, is still very low, with an average 1.1 per cent of the population having access to fixed main line telephones, compared to 12.1 and 40.9 per cent in developing and developed countries, respectively.

In the last five years, growth in fixed teledensity has been almost flat among LDCs, with a compound average growth rate (CAGR) of 0.06 per cent for the 2005-2010 period; meanwhile, developing and developed countries have showed negative growth rates for this indicator during the same period. Several factors have contributed to this trend. Beyond population growth, access to mobile cellular technology has been an important contributor to the reduced emphasis on fixed telephone networks, as the deployment of mobile cellular networks tends to be less costly and requires lower level of investment than fixed networks.[1] In developed countries, the decline has been explained mostly as a fixed-to-mobile substitution among users, caused by the advantages of mobility and reduced costs of mobile cellular technology.[2]

From the policy perspective, several LDC governments have liberalized the mobile cellular market, attracting new operators, but have kept fixed telephone service as a monopoly for a longer period of time; in other cases, competitive entry into the fixed market has been delayed by lack of regulatory clarity on issues of infrastructure sharing or interconnection rules. Moreover, the geophysical

characteristics of some LDCs also make fixed telephony a less attractive option, due to the dispersion of the population, particularly among the LDC islands in the Pacific Ocean.

Chart 2.1: Fixed lines per 100 inhabitants, 2000-2010
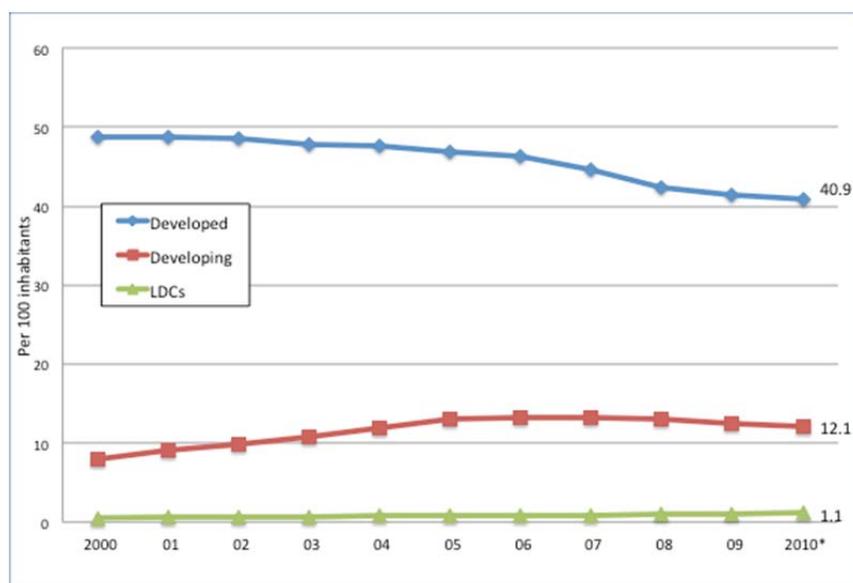
*Estimates
Source: ITU World Telecommunication/ICT Indicators database.

It is not surprising then that penetration rates for mobile cellular subscriptions during the 2000-2010 period has vastly surpassed those for fixed telephone lines in LDCs, developing and developed countries (Chart 2.2). [3] The number of mobile cellular subscriptions worldwide has increased from about 740,000, to over 5 billion by the end of 2010, when mobile cellular penetration stood at over 75 per cent. As of 2010, it is estimated that about one third (29.1 per cent) of the population in LDCs has mobile telephone subscriptions, while 67.6 per cent of the population in developing countries do so. Penetration of mobile cellular subscription in developed countries, in contrast, has surpassed the saturation rate since 2007 and is estimated to have reached 116.1 per cent of its population by 2010. From 2005 to 2009, growth rates for mobile cellular subscriptions in LDCs have surpassed those in the rest of the world and their CAGR of 0.43 per cent for the 2005-2010 period is two and a half times higher than that of developed countries and almost twice as fast as that of developing countries.

In terms of overall telephone service penetration, the combination of fixed telephone lines and mobile cellular subscriptions has helped LDC surpassed the BPoA's target of 5 mainlines per 100 inhabitants. As a group, LDCs have increased their total teledensity from an average of 1.1 main lines per 100 inhabitants in 2001 to 27.2 per cent in 2009. The results have also been positive in terms of population coverage. LDCs have been successful at improving access to mobile services beyond the urban areas. By the end of 2010, 62 per cent of the LDC population was covered by a mobile cellular signal (Chart 2.3). Compared to the world average of 90 per cent, however, this remains relatively low, suggesting that governments in LDCs need to ensure that mobile operators extend their network coverage to reach more people.

Chart 2.2: Mobile cellular subscriptions per 100 inhabitants, 2000-2010
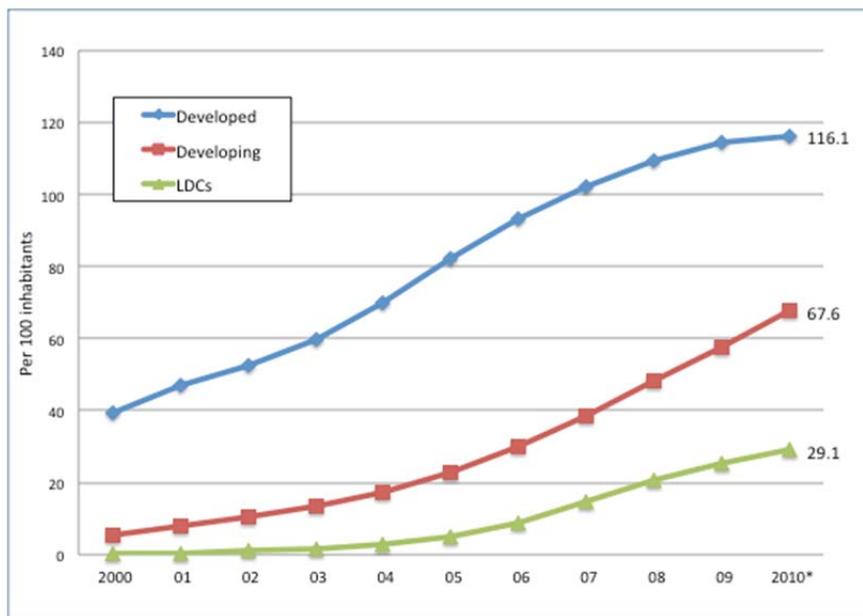
*Estimates
Source: ITU World Telecommunication/ICT Indicators database.

Chart 2.3: Percentage of the population covered by a mobile cellular signal, LDCs
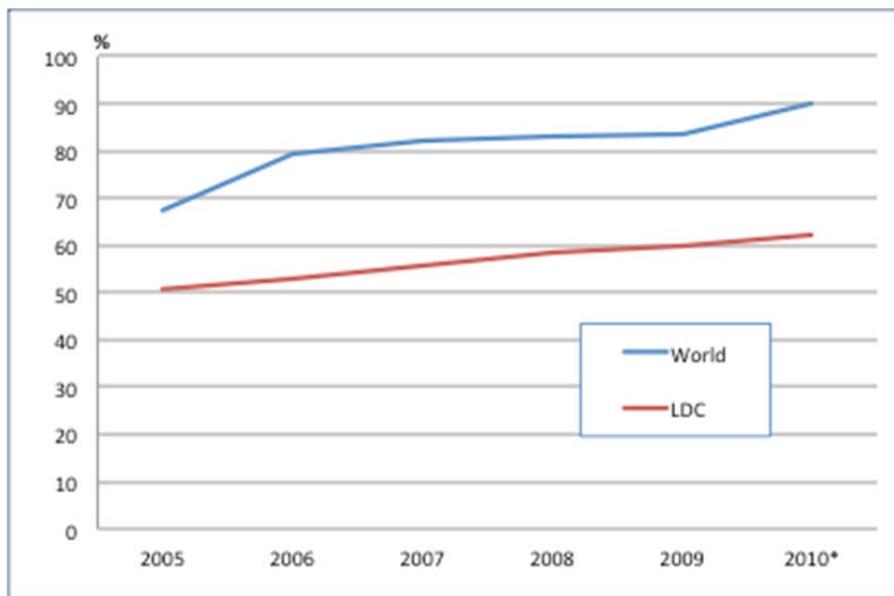
*Estimate
Source: ITU World Telecommunication/ICT Indicators database.

2.3   Internet

The digital divide between LDCs and developing and developed countries regarding Internet use remains wide. While by the end of 2010, only about 3 out of 100 people in LDCs were online, 21 out of 100 people in all developing countries were online. In the developed world, Internet penetration had reached almost 72 per cent (Chart 2.4). Although LDCs have made great progress in promoting

Internet access and use since 2005, with a compound annual growth rate of 0.30 per cent for the 2005-2010 period, as a group, they have failed to meet the target set in the Brussels Programme of Action of ten Internet users per 100 inhabitants.

Chart 2.4: Internet users per 100 inhabitants, 2000-2010*
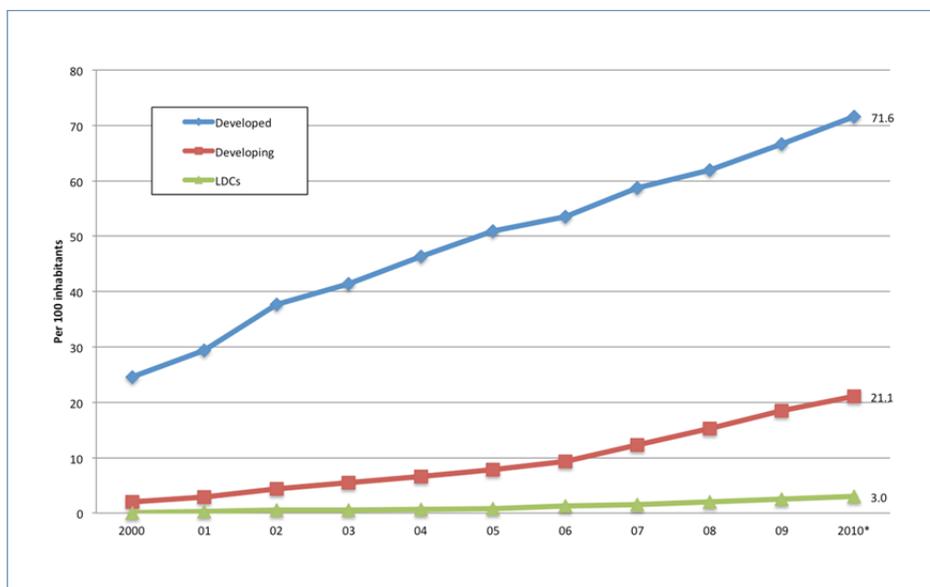
*Estimates
Source: ITU World Telecommunication/ICT Indicators database.

To help bridge this gap, LDCs and their development partners, including the ITU, are taking diverse strategies to improve access and use of Internet and broadband technologies. Since less than ten out of 100 people in Africa are online (Chart 2.5), several of these strategies, such as the ITU Connect Africa Summit, have focused on mobilizing resources and coordinating partner activities to reduce digital gaps in this region.[4] ITU, with the support of other development partners, is planning similar summits for the Americas, the Arab States and the Asia-Pacific region, where the remaining LDCs are located, with the purpose of connecting the unconnected by 2015.[5]

Chart 2.5: Internet users per 100 inhabitants, by region, 2010*
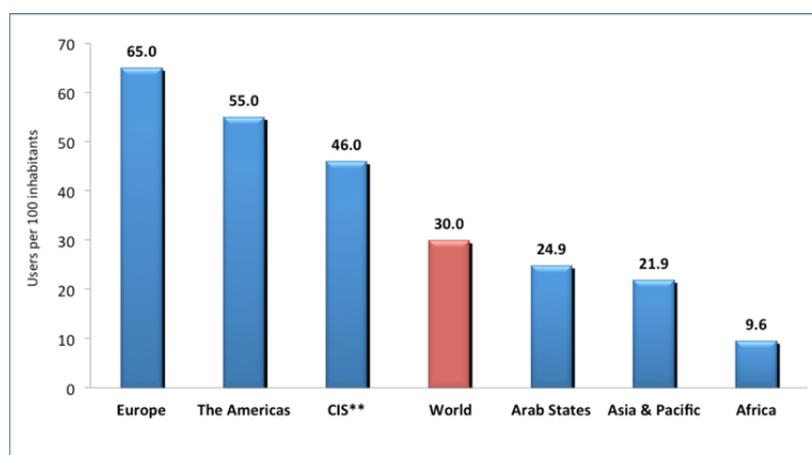
*Estimate
Source: ITU World Telecommunication/ICT Indicators database.

2.4   Fixed and mobile broadband

Broadband technology is considered a uniquely valuable tool to meet the Millennium Development Goals (MDGs) by the target date of 2015.[6] Yet, least developed countries, and even several developing countries, are lagging well behind developed counties in deploying these technologies. With respect to fixed broadband penetration, LDCs average access is expected to remain as low as 0.2 per cent by the end of 2010. Meanwhile, in developed countries 25 out of 100 people are subscribed to this service compared to 4.4 out of 100 people in all developing countries (Chart 2.6).

*Chart 2.6: Fixed broadband subscriptions per 100 inhabitants, 2000-2010**
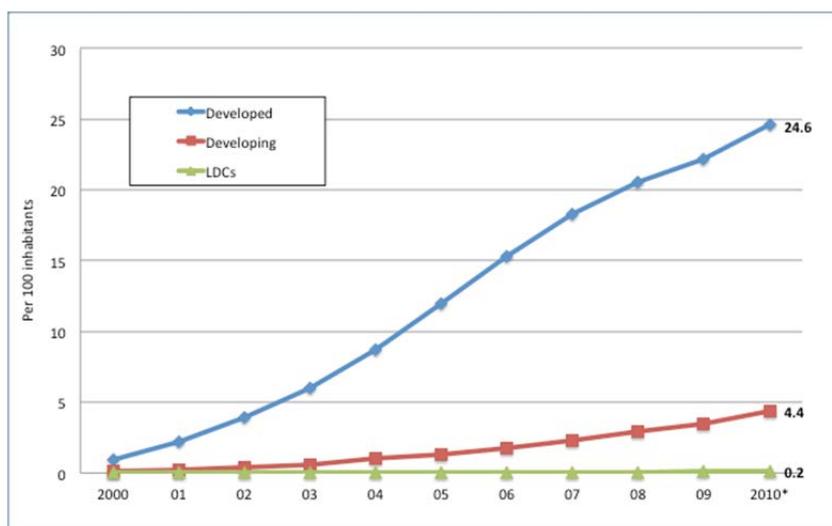
Source: ITU World Telecommunication/ICT Indicators database.
Note: * 2010 data are estimates.

A regional comparison (Chart 2.7) confirms the disparities in fixed broadband penetration, with Africa having very low percentage of subscribers (0.2%), followed by the Arab States (2.3%) and the Asia-Pacific region (5.7%).

*Chart 2.7: Fixed broadband subscriptions per 100 inhabitants, by region, 2010**
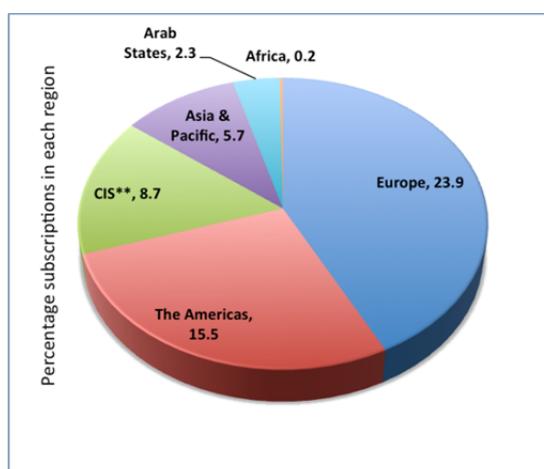
* Estimate, ** Commonwealth of Independent States
Regions are based on the ITU BDT Regions, see: www.itu.int/ITU-D/ict/definitions/regions/index.html.

Despite being a more recent technology, the number of mobile broadband subscriptions[7] is growing fast across the world and has even surpassed the number of fixed broadband subscriptions in each of the three categories of countries. Yet, the gap between LDCs and the developed world is also increasing, with mobile broadband subscriptions having reached an estimated 51.1 per cent in developed countries by the end of 2010, compared to only 0.5 per 100 inhabitants in LDCs (Chart 2.8).

Chart 2.8: Mobile broadband subscriptions per 100 inhabitants, 2000-2010
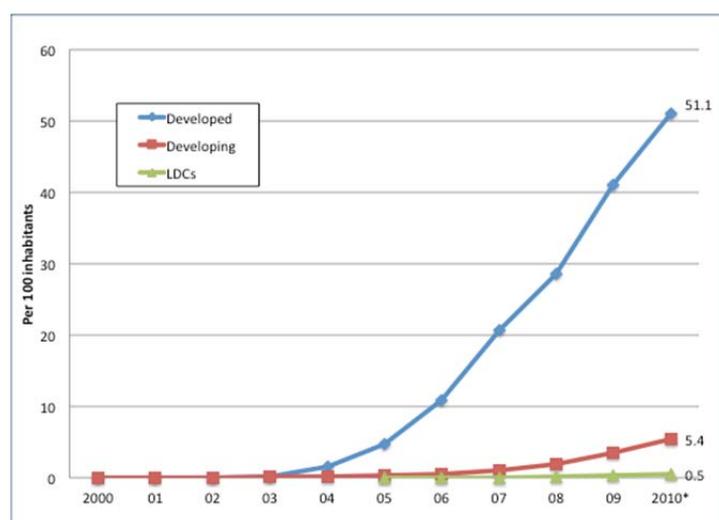
Source: ITU World Telecommunication/ICT Indicators database.
Note: * 2010 data are estimates.

2.5   ICT access at the household level

Another way to compare the level of ICT access achieved in a country or region is through the use of demand-side indicators, such as the adoption of technologies at the household level. Comparing the availability of television sets, personal computers (PCs) and Internet access at the household level between developed, all developing and least developed countries, it is clear that LDCs lag well behind developed and developing countries with respect to access to newer ICT, such as a computer and the Internet, at home. While almost one fourth of developing countries have access to PCs at home, only 3.1 per cent of LDC households have PCs. The gap is even wider for Internet access at the household level, where almost two thirds of households in developed countries are online, compared to only 2 in 100 households in LDCs. Even when considering access to televisions, a technology that has been around for more than fifty years, there is a significant gap, albeit smaller, between LDCs and the rest of the world. Nevertheless, the fact that almost 25 per cent of households in LDCs have television sets serves as a proxy indicator of access to electricity and a level of household income that has the potential of subscribing to the Internet and even to broadband services, once such services become more widely available and affordability is improved (Chart 2.9).

Chart 2.9: ICTs at home, by level of development, 2010*
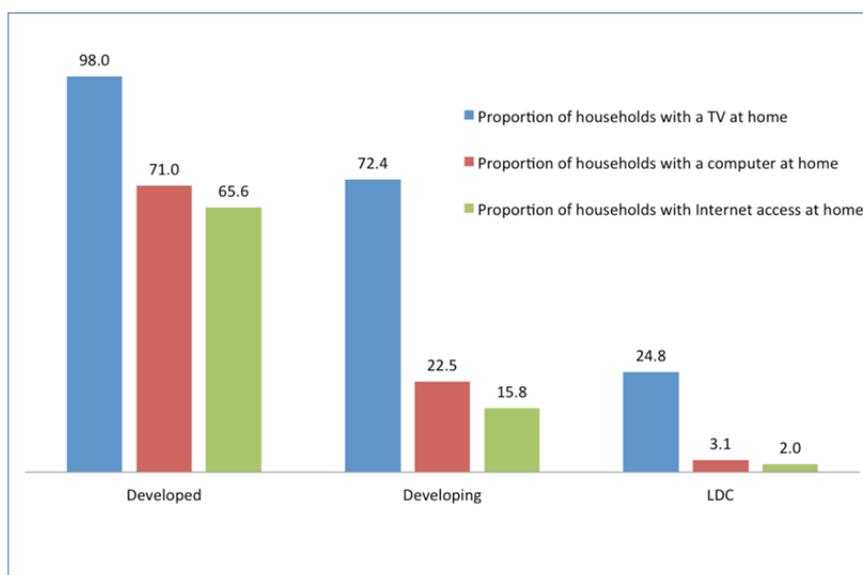
Note: * 2010 data are estimates.
Source: ITU World Telecommunication /ICT Indicators database.

Once again, a regional comparison shows the great disparities that exist on Internet access at the household level between Africa (2.5% of households), the Arab States (14.3%) and the Asia-Pacific region (16.8% of households) and Europe, the region with the highest proportion of access at the household level (58.1% of households) (Chart 2.10).

Chart 2.10: Proportion of households with Internet access, by region, 2008
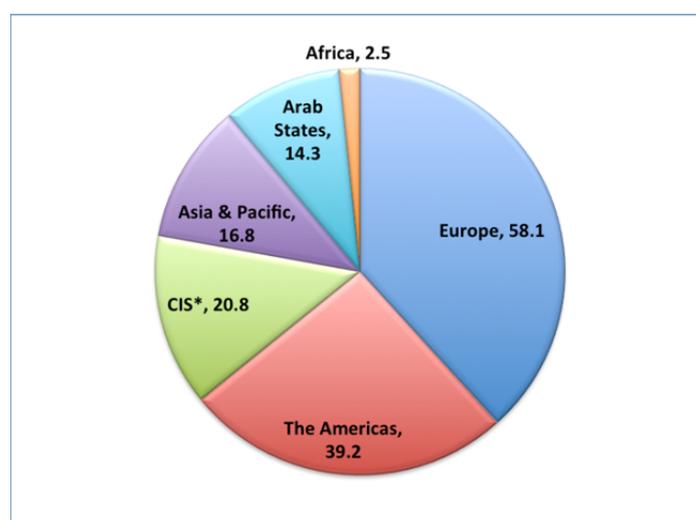
Source: ITU World Telecommunication/ICT Indicators database.

During the last decade, LDC governments have advanced significantly in deploying telecommunication networks and introducing new wireless and broadband technologies to promote economic development. The growth has been considerable in the penetration rates for mobile cellular telephony and even mobile broadband technology. The progress made, particularly in the access to telephone service through mobile cellular subscriptions has allowed the LDCs, as a group, to surpass by five fold the ICT target for main lines. The results were less positive for Internet usage,

leaving LDCs, as a group, well behind the 2010 goal set in the Brussels Programme of Action for LDCs. Gaps between developed, developing and least developed countries remain, and in some cases, are getting wider, which emphasises the need to address existing barriers constraining further development in the telecommunication and ICT sectors of LDCs.

3   Trends in telecommunications in the LDCs

3.1   Overview

Chapter 2 provided an overview of the telecommunication and ICT sectors in LDCs compared to the rest of the world. This chapter examines trends among least developed countries to better understand disparities among economies included under the LDC status and help evaluate the evolution of the different markets within these countries. Particular attention is given to the analysis of individual LDCs performance with respect to the two ICT targets included in the Brussels Programme of Action under Target 27.

As discussed in the previous chapters, although the LDC category includes almost one fourth of the world's countries and about 12 per cent of the world's population, their participation in terms of availability and use of ICTs worldwide remained minimal, according to ITU estimates for 2010. Their largest share is in the mobile cellular market, where LDCs were expected to account for 4.7 per cent of the world's subscriptions by the end of 2010; meanwhile, their share of fixed telephone lines for the same year was estimated to be only 0.8 per cent of the world's total. Their Internet users represent 1.2 per cent of the world's total, compared to 0.2 per cent and 0.5 per cent of all fixed and mobile broadband subscriptions respectively (Chart 3.1).

Chart 3.1: Population and ICT shares, LDCs, 2010
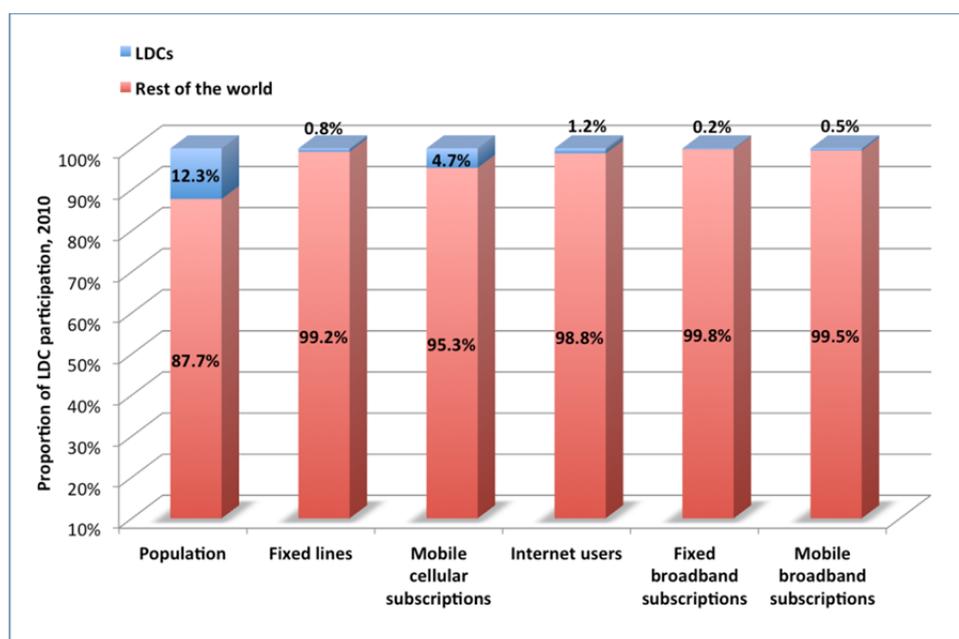
Source: ITU World Telecommunication/ICT indicators database.

To better illustrate the connections between ICT penetration and development in LDCs, some of the charts included in this chapter show data for all the countries classified as LDCs since 1971. As such, the charts present results for Botswana, which had graduated from the LDC status before 2000, as well as for Cape Verde and Maldives, which graduated within and just after the 2000-2010 period analysed in this report, respectively.

3.2   Fixed and mobile telephony

As discussed in Chapter 2, the penetration of fixed telephone line services evolved at a slow pace among LDCs. A comparison of fixed teledensities in LDCs in 2000 and 2009, illustrated in Chart 3.2, shows that, while all LDCs expanded their fixed mainline network during the last decade, only a handful of countries were able to provide telephone lines to more than ten per cent of their population. Positive compound annual growth rates for the 2000-2010 period ranged from 0.01 per cent in countries like Central African Republic and Senegal, to 0.17 per cent annually in Chad. Meanwhile, nine countries had negative annual growth rates during the period, either as a result of internal strife that affected the national ICT infrastructure, either through destruction of the existing lines, by reducing the government's ability to maintain and upgrade the existing network, as well as to deploy new fixed lines, or as a result of a shift of investments towards mobile cellular technology.[1]

Chart 3.2: Growth in fixed telephone lines per 100 inhabitants in LDCs, 2000, 2009
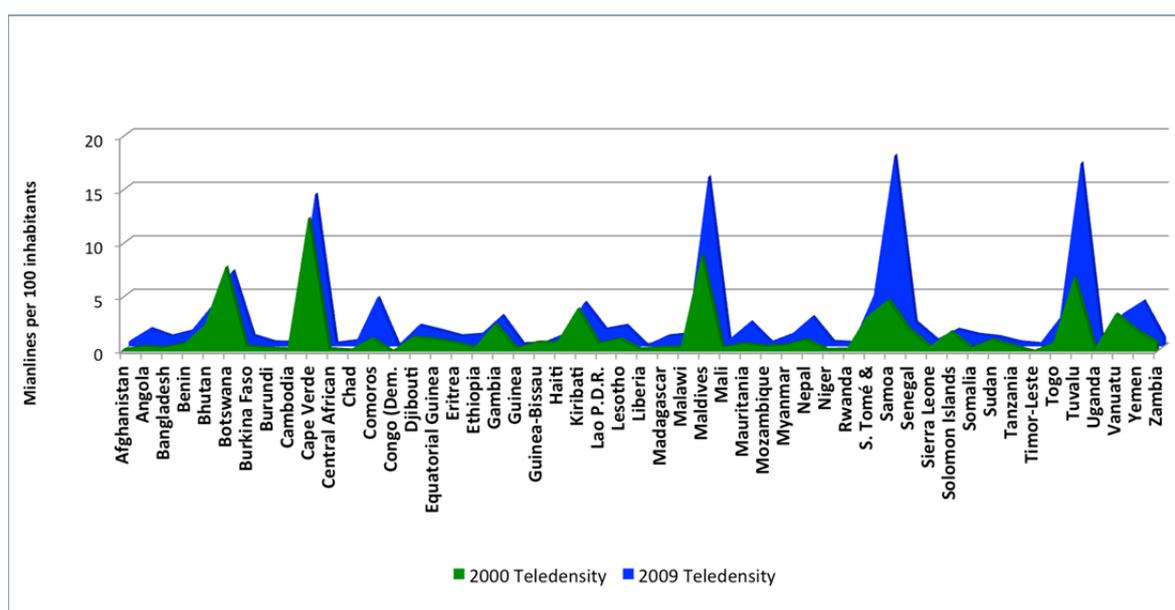
Source: ITU World Telecommunication/ICT indicators database.

By the end of 2009, only five countries, shown in green in Chart 3.3, had five or more fixed mainlines per 100 inhabitants; three of them are the graduated LDCs (Botswana, Cape Verde and Maldives), while the other two (Samoa and Tuvalu) have been recommended for graduation from the LDC status. Among LDCs, as of 2009, Samoa ranked highest with a fixed teledensity of 17.1 fixed telephone lines per 100 inhabitants; Liberia, on the other end, had only 0.1 fixed main lines per 100 inhabitants by the end of 2009.

It should be noted that all the countries at the high end of the spectrum in Chart 3.3 in 2009 had promoted the deployment of fixed mainlines throughout their territories by including this service in their basic definition of universal access. Their governments have set up service obligations for rural and underserved areas, as well as penetration targets, either explicitly in universal access policies or as part of the licensing renewal process of the incumbent fixed operator, as was the case in Maldives.

Chart 3.3: Fixed telephone lines per 100 inhabitants in LDCs, 2009*
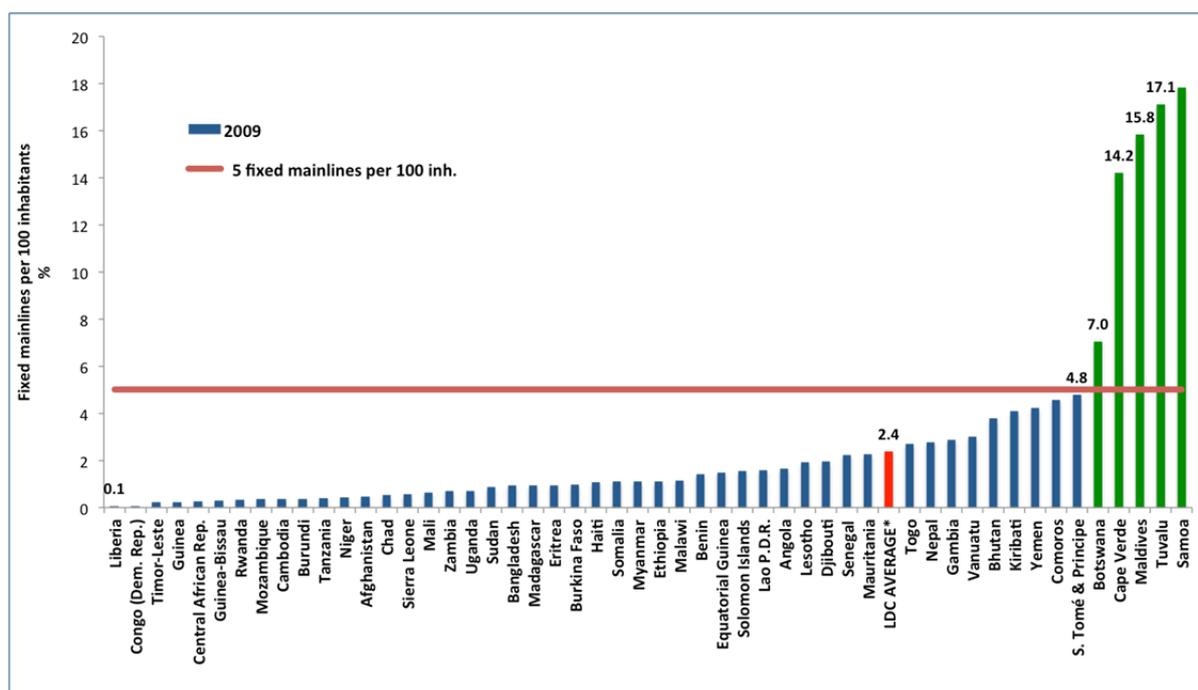
* Note: LDC average for 2009 does not include the values for Botswana and Cape Verde, which had graduated from the LDC status by then.
Source: ITU World Telecommunication/ICT indicators database.

In many LDCs, fixed telephone lines are installed mostly in urban areas, as is the case in Bangladesh, Burkina Faso, Dem. Rep. of the Congo, Djibouti, Eritrea, and Lao P.D.R., where only an average of 10 per cent of the fixed-line infrastructure serves rural areas. The introduction of mobile cellular telephony has allowed LDCs to start bridging this internal access gap, by using mobile cellular networks as the main infrastructure to serve previously unconnected or underserved areas, including rural areas. In Africa, 52 per cent of the rural population was covered by a mobile cellular signal in 2008; meanwhile, mobile cellular coverage reached 76 per cent of the rural population in the Asia-Pacific region.[2] The importance of mobile cellular telephony in LDCs, compared to fixed mainlines, is illustrated in Chart 3.4, which shows the ratio of mobile cellular lines to one fixed mainline in LDCs, as of 2009. On average, by 2009, LDCs had a ratio of 46.5 mobile cellular subscriptions to one fixed main telephone line. In countries, like Guinea, Liberia and Dem. Rep. of the Congo, where the fixed telephone network is almost not existent, the ratio of mobile subscriptions to fixed telephone lines surpasses, by far, the 100:1 ratio.

Chart 3.4: Ratio of mobile cellular subscriptions to one fixed mainline in LDCs, 2009
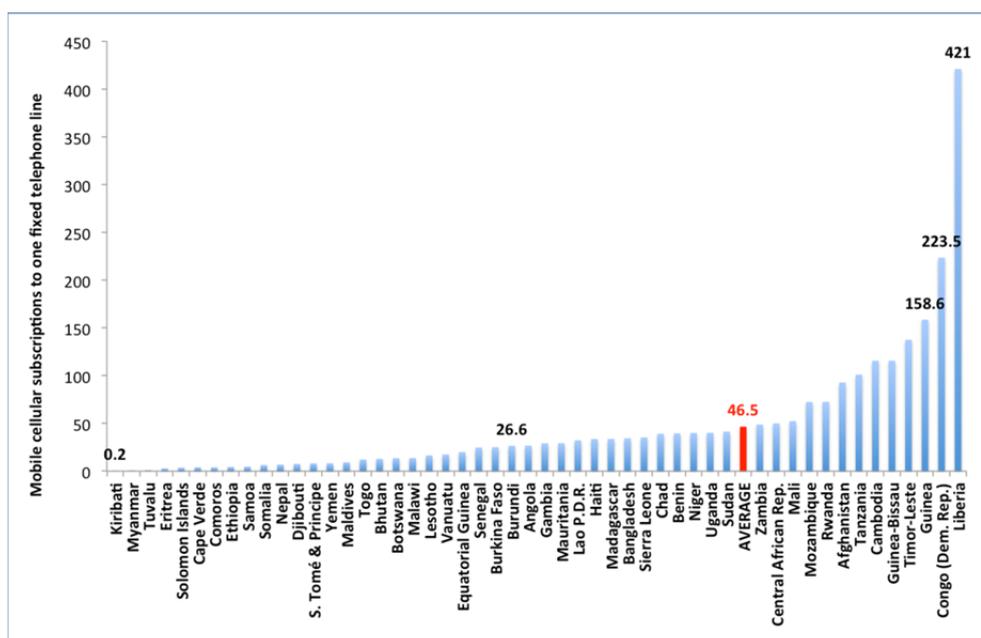
Source: ITU World Telecommunication/ICT indicators database.

Since 2005, the penetration of mobile cellular subscriptions in LDCs has increased at a much faster pace than that for fixed telephone lines, with a compound annual growth rate for the 2005-2010 period of 0.43 per cent and annual increases in mobile cellular subscriptions of up to 81 per cent (Chart 3.5).

Chart 3.5: Evolution of fixed mainlines and mobile cellular subscriptions penetration in LDCs, 2005-2010*
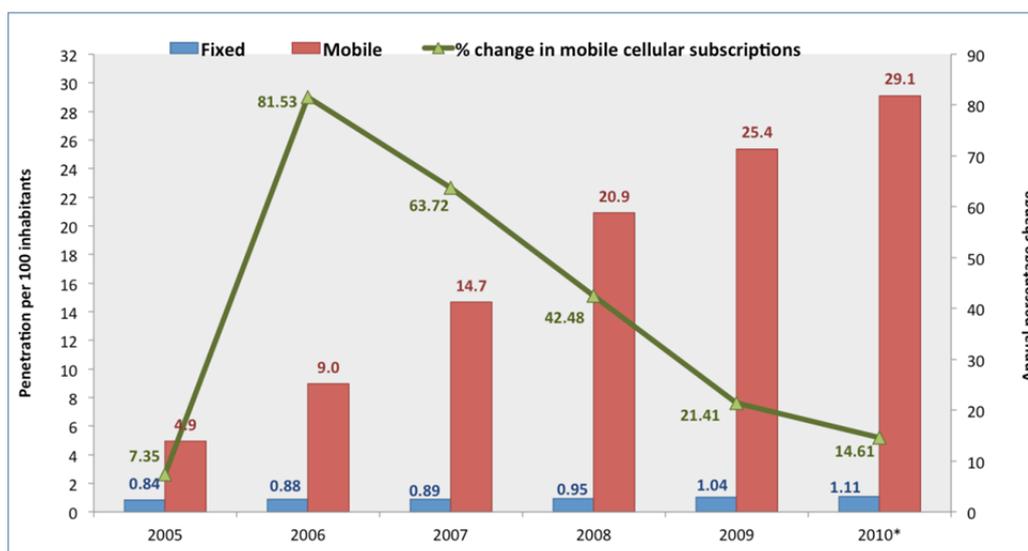
*Estimate
Source: ITU World Telecommunication/ICT Indicators database.

Mobile cellular networks are becoming ubiquitous in many LDCs, where average penetration is expected to reach close to 30 per cent by the end of 2010. With the exception of a few countries affected by political and social unrest, most LDCs advanced considerably in the deployment of mobile cellular networks during the last decade, with compound annual growth rates ranging from 0.12 per cent in Kiribati to 70.5 per cent in Bhutan (Chart 3.6).

Chart 3.6: Growth in mobile cellular subscriptions per 100 inhabitants in LDCs, 2000, 2009
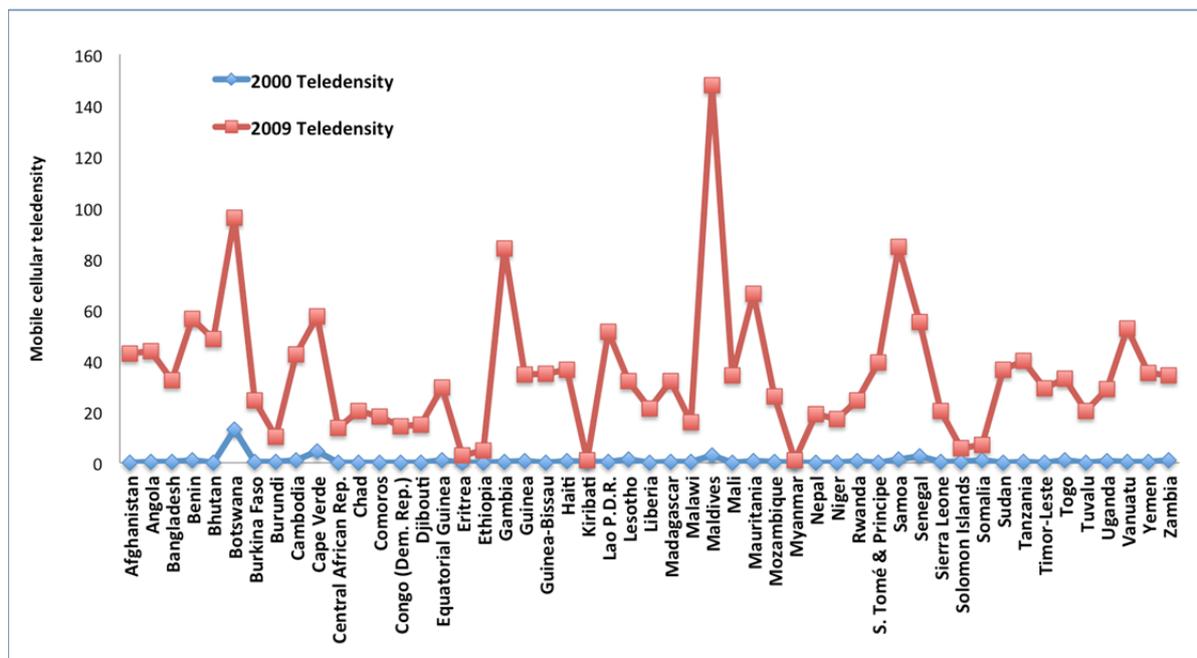
Source: ITU World Telecommunication/ICT indicators database.

By the end of 2009, all but six LDCs (shown in purple in Chart 3.7) had more than 10 out of 100 people subscribed to mobile cellular telephony. The average number of mobile cellular subscribers for current LDCs was 33 subscriptions per 100 inhabitants. Among LDCs, only Maldives' mobile penetration rates have surpassed the saturation threshold, with 148 mobile cellular subscriptions per 100 inhabitants. This outstanding growth has been largely influenced by improvements in the per capita income of the Maldives population, as well as by changes in the mobile cellular market that stimulated adoption, such as the opening of this market to competition in 2004, the launch of pre-paid subscriptions in 2001, and the introduction of free SMS connections in 2002.

Botswana, another graduated LDC, ranks next with a penetration rate of 96 mobile subscriptions per 100 and other seven current LDCs – including Lao, Senegal, Mauritania and Gambia – have rates higher than 50 per cent. In contrast, Myanmar and Kiribati have penetration rates as low as one per cent by the end of 2009. Significantly, Myanmar and Ethiopia, two of the six LDCs with the lowest mobile cellular penetration rates, have not introduced competition in the market yet, a factor that tends to improve penetration rates by reducing prices and increasing service availability.

Chart 3.7: Mobile cellular penetration in LDCs, 2009*
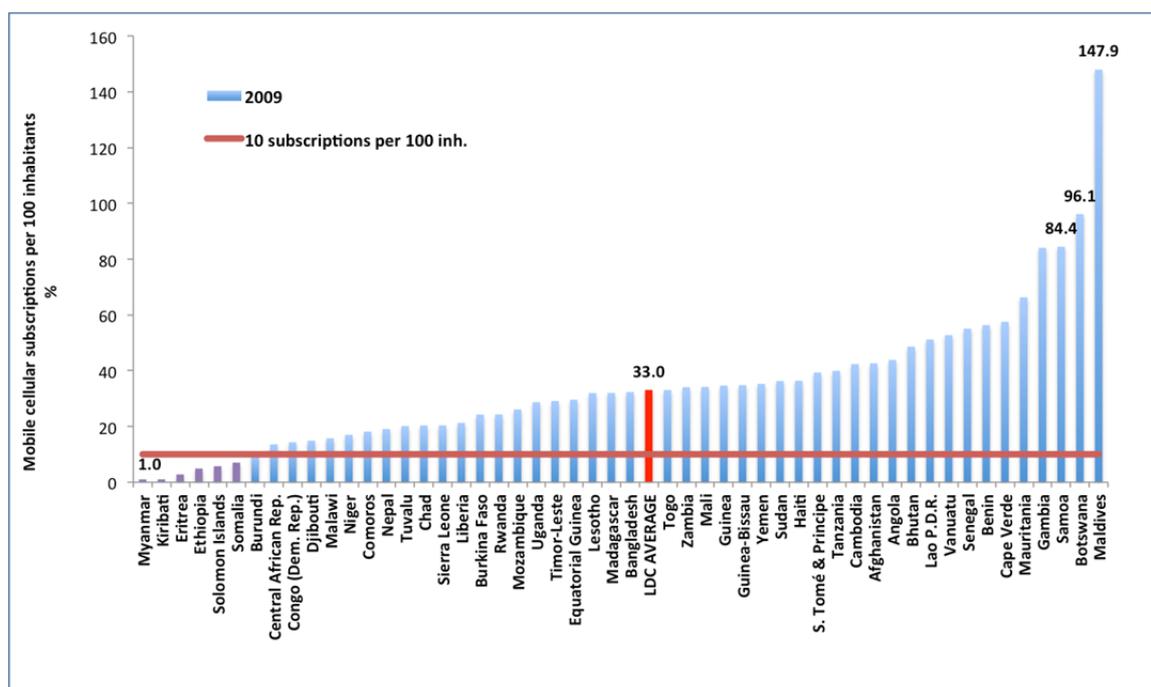
* Note: LDC average for 2009 does not include the values for Botswana and Cape Verde, which had graduated from the LDC status by then.

Source: ITU World Telecommunication/ICT Indicators database.

Another important factor explaining the boom of mobile cellular technology in LDCs is the adoption of prepaid subscription schemes. This type of billing, introduced in the late 1990s, reduces the cost of telephone ownership by giving users control over decisions of how much to spend on the service based on their budget. Although the cost per call tends to be higher under prepaid plans, these plans have made mobile cellular service more accessible to low-income users and displaced or transient populations who, due to the requirements for long-term contracts such as credit checks, would not qualify for post-paid mobile plans with fixed monthly fees.

Not surprisingly, the majority of subscriptions in developing countries are prepaid, and in the LDCs, where income levels are particularly low, 94 per cent of subscriptions were prepaid at the end of 2009. Chart 3.8 shows the proportion of prepaid to post-paid mobile cellular subscriptions in selected LDCs. Even among LDCs with higher per capita income, like Maldives, 85 per cent of the mobile cellular subscriptions were prepaid as of the end of 2009.[3] Another reason that mobile telephony has been so successful and spread rapidly is the growing number of applications, such as mobile banking, which has increased demand and usage. Non-voice mobile phone applications are growing, including in LDCs.

Chart 3.8: Proportion of prepaid and post-paid mobile cellular subscriptions per 100 inhabitants in selected LDCs, 2009 (percentage)
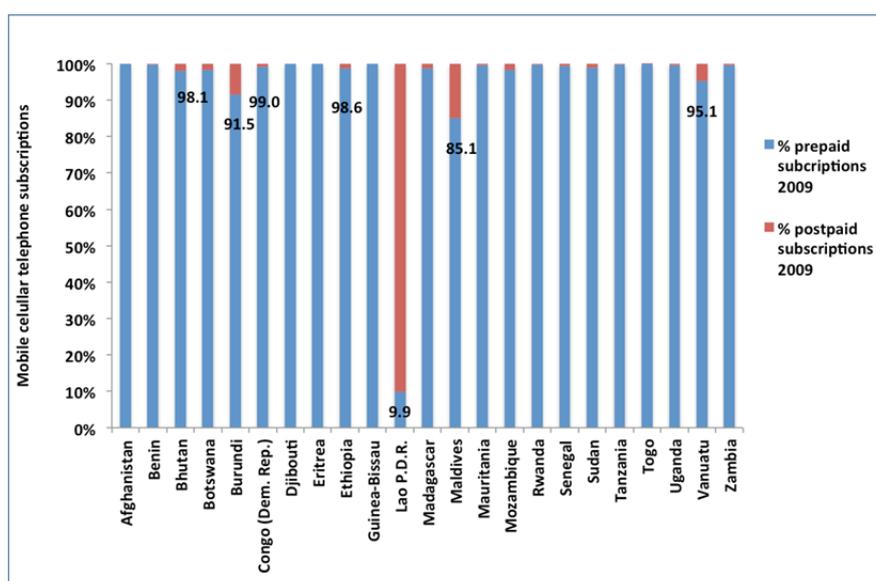
Source: ITU World Telecommunication/ICT indicators database.

The combination of fixed and mobile cellular telephone service penetration, illustrated in Chart 3.9 below, shows extraordinary growth in total teledensity in least developed countries. While in 2001 only six countries (Mauritania, Senegal, Gambia, Tuvalu, Samoa and Maldives) had met and surpassed the threshold of 5 main lines (fixed plus mobile) per 100 inhabitants, by 2009 all but two economies (Myanmar and Eritrea) were above this threshold, having surpassing it by ten, twenty and even 35 times fold, as in the case of the outlier Maldives.

Finally, regarding penetration of fixed telephone lines and mobile cellular service at the household level, available data suggest that mobile telephony is increasingly becoming the dominant means of phone access at home. In Rwanda, in 2008, for example, 13 per cent of households had a mobile phone, but only one per cent had a fixed telephone line. In Tanzania and Cambodia, the difference is even more pronounced and 0.7 and 1 per cent of households have a fixed line, compared to 28 and 37 per cent with a mobile telephone (Chart 3.10).

Public payphones

Like fixed line penetration, the evolution of public payphones has been altered by the boom in mobile telephony. Although in certain countries, like Maldives, universal service was conceived as access to at least one public telephone within a specific area, growth in, and perhaps even the need for public fixed telephone service has decreased in some LDCs as the result of mobile cellular substitution (Chart 3.11). In fact, some of the LDCs that have developed universal access policies have included mobile telephony in their definitions, universal access goals for operators to meet, paying particular attention to the provision of service in rural areas.

Chart 3.9: Total teledensity: Comparison of combined fixed and mobile cellular penetration in LDCs, 2001 and 2009
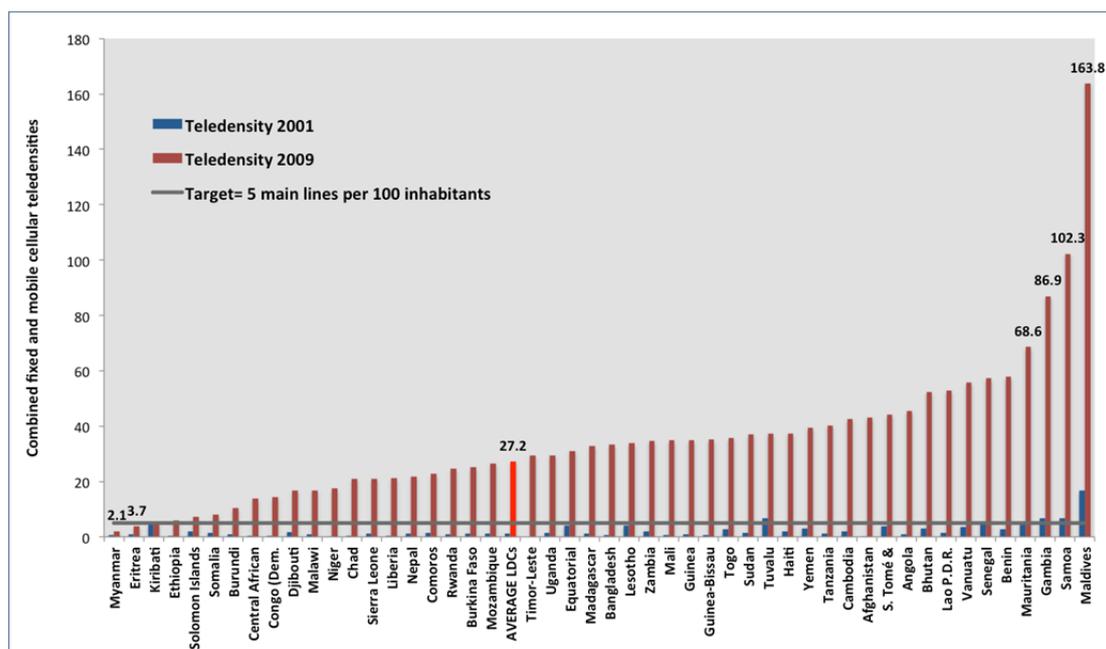
Source: ITU World Telecommunication/ICT Indicators database.

Chart 3.10: Percentage of households with a telephone, 2008-2009, selected LDCs
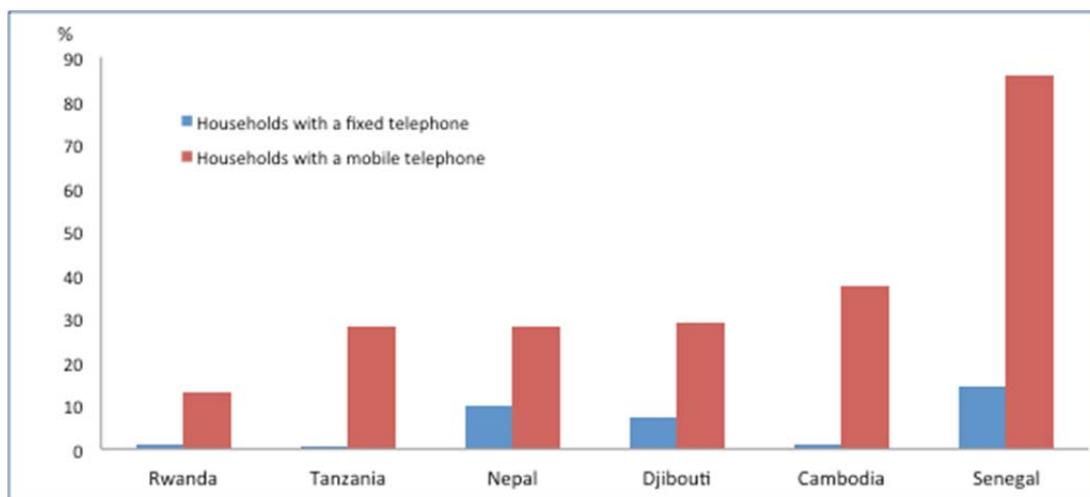
Source: ITU World Telecommunication/ICT Indicators database.

Mobile telephony has also generated new business models, where owners of mobile telephones re-sell the service to others. In Senegal, for example, the number of public phones has been decreasing since 2006, when mobile cellular penetration reached close to 30 per cent. As illustrated in Chart 3.11, countries with higher rates of mobile cellular penetration, such as Botswana and Maldives, the number of public payphones per 100 inhabitants has decreased compared to 2000 levels.

Chart 3.11: Evolution of public payphone service, 2000-2008, selected LDCs
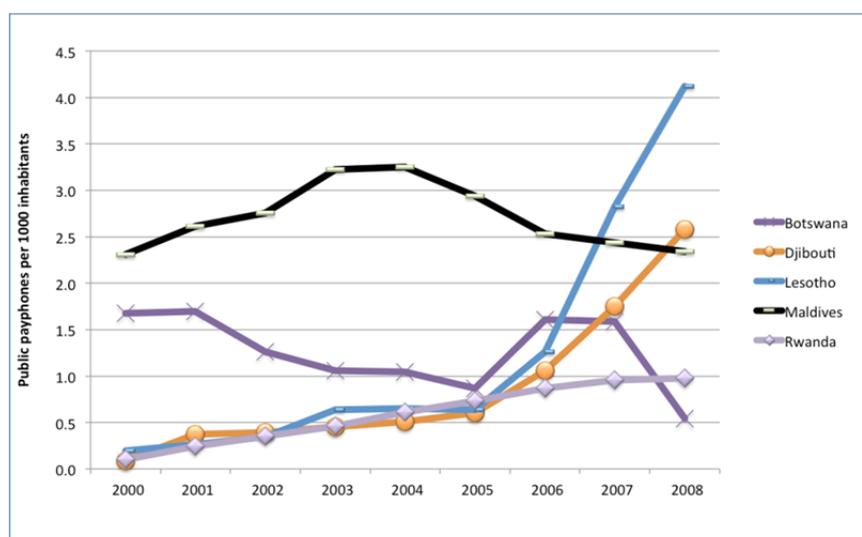
Source: ITU World Telecommunication/ICT Indicators database.

Prices

Prices for mobile cellular services have decreased over the last few years. Based on the ITU ICT Price Basket and its mobile cellular sub-basket,[4] the prices for mobile cellular services in the LDCs decreased for almost all countries between 2008 and 2009. The average change (drop) in prices between 2008 and 2009 was 23 per cent, with the highest percentage change in Rwanda (48 per cent), Sudan (40 per cent) and Bhutan (39 per cent) (Table 3.1).

In terms of the value change of the mobile cellular sub-basket, 9 out of the 10 countries showing the greatest 2008/09 decreases were LDCs (Table 3.2). This highlights that prices for mobile cellular services are decreasing faster in the LDCs than in other countries of the world. At the same time, the price data show that the poorest countries in the world continue to have relatively high mobile prices, in terms of their income levels and in comparison to other countries in the world.

Despite the drop in prices, mobile cellular prices in LDCs remain relatively high and on average, the price of mobile cellular services in LDCs corresponds to 19 per cent of average monthly income, compared to 7.5 and 1.2 per cent in developing and developed countries, respectively.

As mentioned above, the introduction of market liberalization and privatization in the mobile cellular market in several LDCs has provided incentives for investors and new operators to enter the market. Competition has brought down the prices of mobile services, improving affordability and increasing subscription rates. Reducing the prices for mobile services is particularly important, given that the price of services makes up about 80 per cent of the total cost of mobile ownership.[5]

Table 3.1: ICT price basket and sub-baskets, selected LDCs*, 2009 and 2008

LDC rank	Overall rank	Economy	ICT Price Basket		Fixed telephone sub-basket as a % of GNI per capita		Mobile telephone sub-basket as a % of GNI per capita		Fixed broadband sub-basket as a % of GNI per capita		GNI per capita, USD, 2008 (or latest available year)
			2009	2008	**2009**	2008	**2009**	2008	**2009**	2008	
1	52	Maldives	1.87	2.12	1.36	1.54	1.14	1.27	3.11	3.53	3630.00
2	74	Bhutan	3.16	15.19	1.91	2.39	1.26	2.05	6.30	41.13	1900.00
3	116	Sudan	10.80	15.97	4.12	5.49	3.60	5.99	24.70	36.43	1130.00
4	120	Angola	21.45	30.55	5.76	9.47	3.83	5.52	54.76	76.67	3450.00
5	122	Djibouti	25.00	N/A	8.61	N/A	7.02	N/A	59.36	N/A	1130.00
6	123	Nepal	25.73	34.28	8.93	12.08	3.69	10.33	64.58	80.43	400.00
7	124	Lesotho	28.03	29.62	14.20	15.00	14.35	15.15	55.56	58.70	1080.00
8	126	Senegal	29.79	32.98	29.74	25.43	10.29	12.23	49.34	61.28	970.00
9	131	Vanuatu	35.18	42.12	12.22	16.51	6.67	9.84	86.64	293.47	2330.00
10	132	Bangladesh	35.55	35.60	3.61	3.42	3.05	3.38	116.31	137.73	520.00
11	133	Yemen	35.64	35.96	0.83	1.16	6.09	6.71	277.82	311.37	950.00
12	135	Samoa	36.08	30.99	4.46	5.07	3.78	4.30	202.44	83.59	2780.00
13	138	Zambia	37.37	53.35	31.10	41.56	16.07	18.50	64.92	137.19	950.00
14	139	Mauritania	37.93	40.58	17.07	18.43	14.16	14.12	82.58	89.18	840.00
15	140	Ethiopia	37.98	41.57	3.76	8.07	10.19	16.65	2085.05	3512.83	280.00
16	142	Guinea	39.60	40.24	9.22	10.15	9.60	10.57	1546.19	2400.00	390.00
17	143	S. Tomé & Principe	40.20	41.98	11.31	14.55	9.29	11.38	243.88	377.22	1020.00
18	145	Cambodia	41.86	43.01	15.65	17.86	9.94	11.16	177.03	201.24	600.00
19	147	Gambia	42.20	45.91	7.26	15.11	19.33	22.62	945.43	1439.28	390.00
20	148	Comoros	46.65	48.76	17.73	20.53	22.23	25.74	685.44	793.67	750.00
21	149	Mali	46.76	49.25	19.50	23.74	20.78	24.02	114.61	139.58	580.00
22	150	Rwanda	47.68	54.99	23.70	27.34	19.34	37.62	257.64	344.35	410.00
23	151	Benin	47.69	51.71	17.34	22.43	25.74	32.71	204.63	220.38	690.00
24	152	Uganda	50.33	60.41	28.29	44.45	22.71	36.78	555.35	600.00	420.00
25	153	Malawi	52.85	57.82	13.84	16.07	44.70	57.39	2038.33	4320.00	290.00
26	154	Tanzania	53.72	55.36	33.30	32.83	27.85	33.25	173.35	204.01	440.00
27	155	Burkina Faso	54.96	58.57	28.82	28.66	36.06	47.06	228.13	5193.56	480.00
28	156	Madagascar	55.48	71.71	35.80	68.50	30.63	46.64	297.23	450.25	410.00
29	157	Central	55.78	57.73	29.51	33.43	37.84	39.75	3891.20	4407.69	410.00
30	158	Mozambique	56.16	68.03	42.62	66.20	25.85	37.90	260.22	375.28	370.00
31	159	Myanmar	58.18	N/A	4.92	N/A	69.61	N/A	155.40	N/A	220.00
32	160	Togo	58.52	67.89	38.39	43.62	37.16	60.05	558.39	352.82	400.00
33	161	Niger	67.58	72.39	47.01	58.16	55.74	59.00	966.90	249.24	330.00

Source: ITU World Telecommunication/ICT Indicators database.

Note: The 2009 ICT Price Basket included a total of 161 economies. Out of the 49 LDCs, only 33 were included. The only reason for excluding countries from the ICT Price Basket is the lack of tariff data. In the case of the LDCs, most countries had to be excluded because of the unavailability of broadband prices (either because the service does not exist or because prices are not publicly available).

Table 3.2: Ten economies with the greatest decrease in mobile telephone sub-basket value, 2008-2009

Overall 2009 Rank	Country	Mobile sub-basket as % of GNI capita, 2009	Mobile sub-basket as % of GNI capita, 2008	2008-2009 value change
160	Togo	37.2	60	-22.8
150	Rwanda	19.3	37.6	-18.3
158	Mozambique	24.8	37.9	-13.1
153	Malawi	44.7	57.4	-12.7
127	Kenya	11.7	23.7	-12.0
152	Uganda	25.4	36.8	-11.4
151	Benin	22.8	32.7	-9.9
156	Madagascar	37.6	46.6	-9.0
154	Tanzania	25.2	33.3	-8.1
155	Burkina Faso	39	47.1	-8.0

Source: ITU (2010b).
Note: Kenya is the only non-LDC in this table.

Besides opening up the market to several operators, governments can strengthen competition and sustain market growth by introducing mobile portability and by licensing wireless broadband (3G) services. A reduction of taxes, interconnection rates and regulatory fees can all help to further reduce prices and make services more affordable and accessible.

3.3   Internet

Internet access

Access to fixed Internet services in least developed countries is still limited, constrained mostly by the high cost of service relative to the population per capita income. As of 2009, the only LDC with penetration rates higher than 5 subscriptions per 100 inhabitants was Maldives, followed by Cape Verde (2.6 subscriptions per 100 inhabitants), one of the other two graduated LDCs. Among the other LDCs, penetration rates range from 0.01 in Afghanistan to 1.93 subscriptions per 100 inhabitants in Yemen.

Internet use[6]

During the last decade, LDCs have increased the number of Internet users among their populations from almost zero in 2000 to an estimated average of 5 users per 100 inhabitants by the end of 2009. Countries that by 2000 had already penetration rates higher than one per cent, such as Kiribati, Sao Tome and Principe, Maldives, Cape Verde, Vanuatu and, particularly Tuvalu had made extraordinary progress by 2009, with penetration rates ranging from 8 users out of 100 people in Kiribati to 43.3 users per 100 inhabitants in Tuvalu (Chart 3.12).[7] Cape Verde, for example, increased its Internet user penetration level to almost 30 per cent in 2009, up from 6 per cent in 2005 and from 1.8 per cent in 2000 (Chart 3.13). The boost in Internet usage in this country was primarily due to the opening of the market to partial competition, allowing Cabocom, a second Internet provider, to compete against the, until then, monopoly of the incumbent Cabo Verde Multimedia.[8]

Chart 3.12: Fixed Internet subscribers per 100 inhabitants in LDCs, 2009
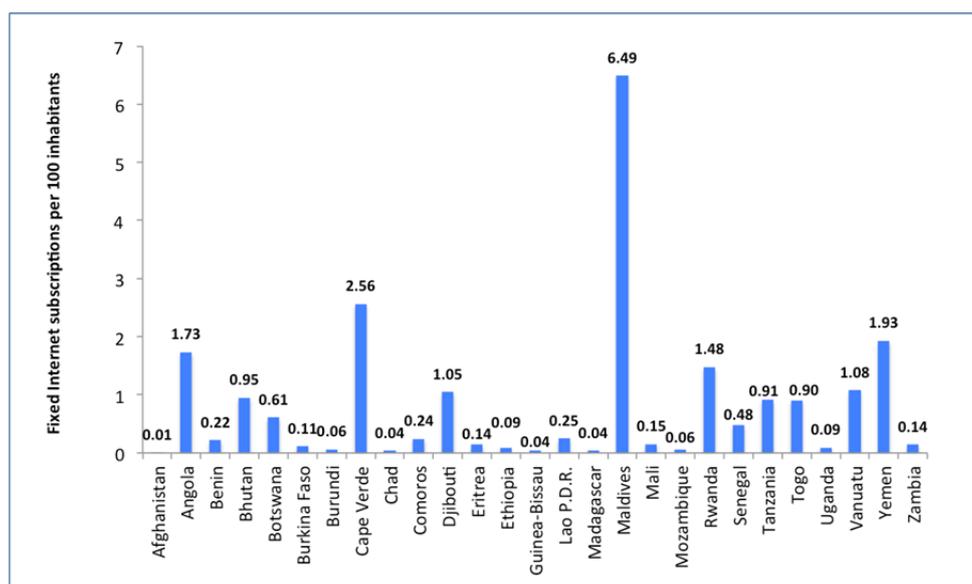
Source: ITU World Telecommunication/ICT Indicators database.

Chart 3.13: Growth in estimated Internet users per 100 inhabitants in LDCs, 2000-2009
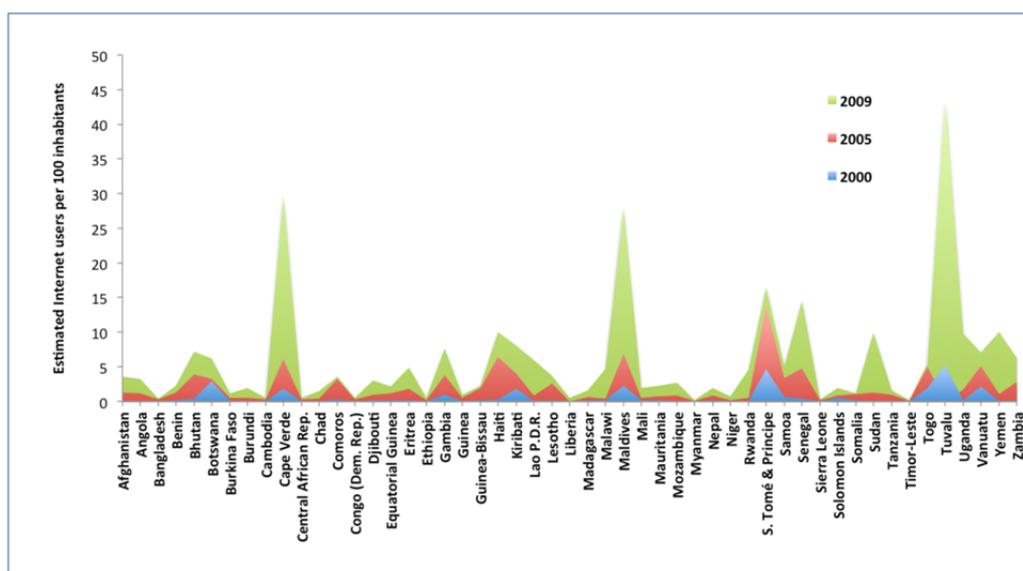
Source: ITU World Telecommunication/ICT Indicators database.

By the end of 2009, the number of Internet users per 100 inhabitants in the LDCs range from below 0.5 per cent in East Timor, Myanmar, Bangladesh and Sierra Leone, to over 15 per cent in Sao Tomé and Principe, Maldives, Cape Verde and Tuvalu. However, 46 LDCs had been unable by then to reach the 10 per cent penetration threshold set up in the Brussels Programme of Action for 2010; only four – Uganda, Sudan, Yemen and Haiti – were near the target by the end of 2009 (Chart 3.14). These results emphasize the need to revise current approaches and policies during LDC-IV to determine the best strategies to attract investment into the sector and reduce the cost of Internet access.

Chart 3.14: Internet users per 100 inhabitants, LDCs, 2009*
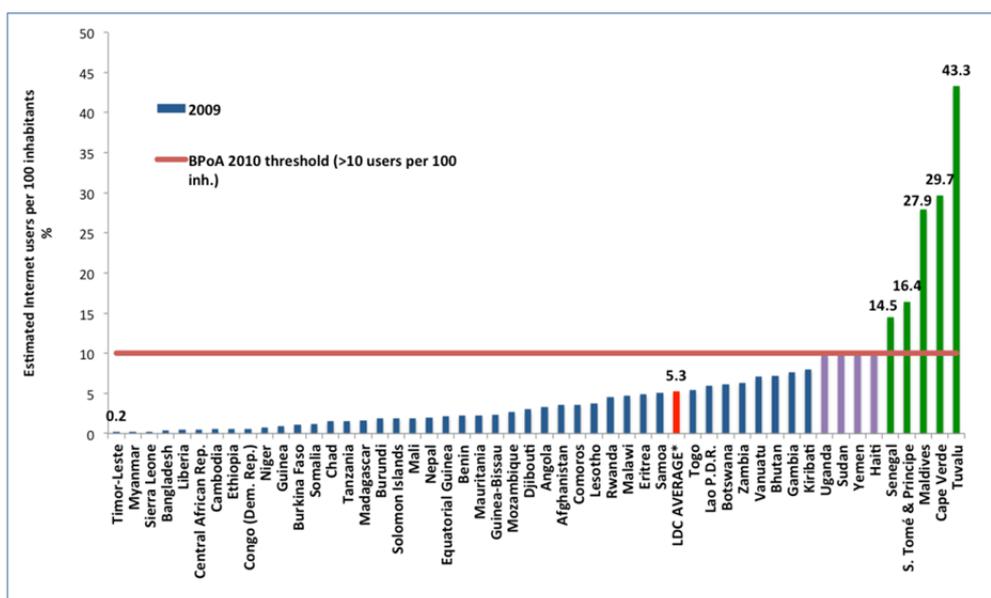
* Note: The LDC average for 2009 does not include the values for Botswana and Cape Verde, which had
graduated from the LDC status by then. Source: ITU World Telecommunication/ICT Indicators database.

3.4   Fixed and mobile broadband

Access to high-speed broadband is considered to be a catalyst for development, as it would open the
door to a vast variety of content and applications, available on the Internet, that LDC governments
and their populations have not taken advantage of due to slow downloading speeds and capacity
limitations of their existing network. The use of electronic applications in the health sector, such as
telemedicine, mobile electronic health (mHealth) and the adoption of electronic health records, for
instance, would help alleviate some of the chronic health issues targeted by the Millennium
Development Goals (MDGs) and bring about much needed healthcare support to rural areas in LDCs.
Yet, these applications require the transmission in real time of large amounts of data and complex
images, with good quality and in a secure environment, which makes the deployment of broadband
infrastructure indispensable for the provision of these services.

As discussed in Chapter 2, the penetration of both fixed and mobile broadband in LDCs has reached
very low rates so far. With the exception of Maldives and Cape Verde, fixed broadband penetration
was at or below one per cent in LDCs by the end of 2009 (Chart 3.15). Meanwhile, mobile broadband
penetration rates for the same year was at or below 3 per cent, with the exception again of Maldives
(Chart 3.16). Several barriers have impeded progress on these markets, mainly limited international
Internet bandwidth, low literacy levels, and high service rates. Fixed broadband Internet prices
remain unaffordable for most of the population in LDCs. According to data tracked by ITU, in 2009,
the cost of an average entry-level fixed broadband subscription exceeded the average monthly GNI
per capita in 22 out of the 33 LDCs included in that year's ITU ICT Price Basket. The Central African
Republic, Ethiopia, Malawi, and Guinea had the highest relative fixed broadband tariffs (See
Table 3.1).

Chart 3.15: Fixed broadband subscriptions per 100 inhabitants in LDCs, 2009
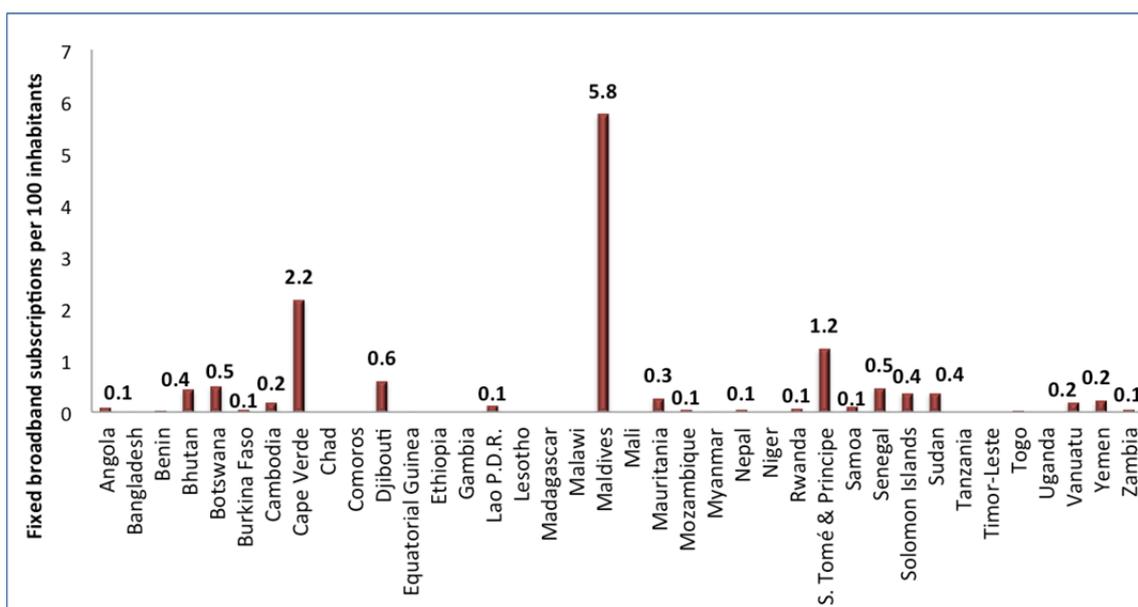
Source: ITU World Telecommunication/ICT Indicators database.

Chart 3.16: Mobile broadband subscriptions per 100 inhabitants in LDCs, 2009
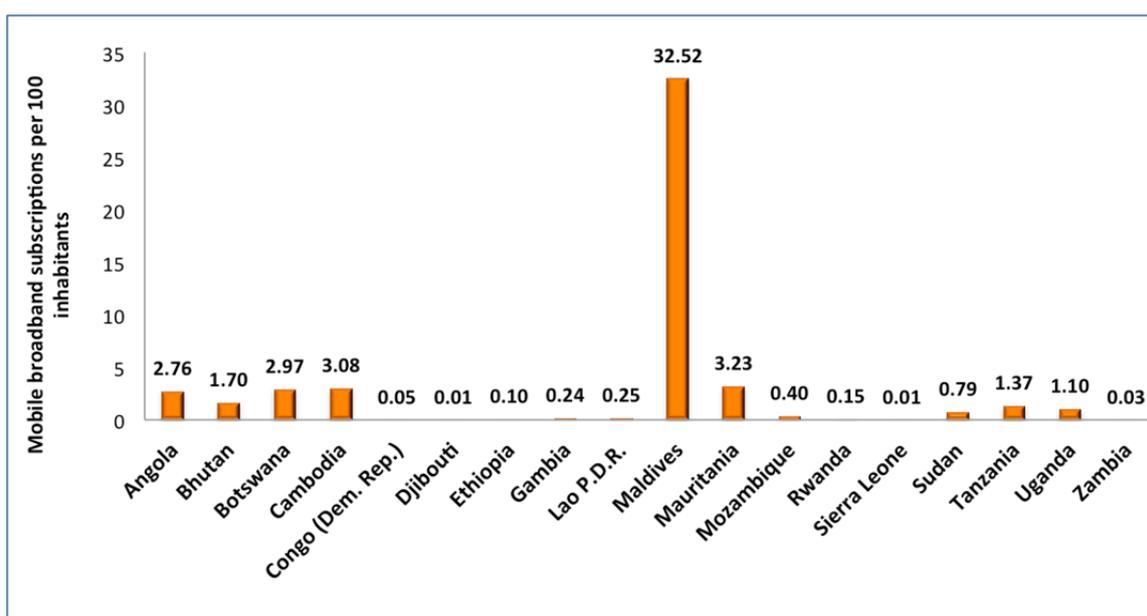
Source: ITU World Telecommunication/ICT Indicators database.

A comparison of the prices and penetration rates for mobile cellular and fixed broadband services in LDCs supports the notion that prices are a crucial factor in increasing the uptake of ICTs (Chart 3.17). The relatively low prices for mobile telephony have resulted in relatively higher penetrations for mobile cellular services, compared to the almost negligible penetration rates achieved in fixed broadband services, which are provided at much higher prices in LDCs.

Chart 3.17: Comparison of LDC's mobile cellular and fixed broadband prices and penetration rates, 2009
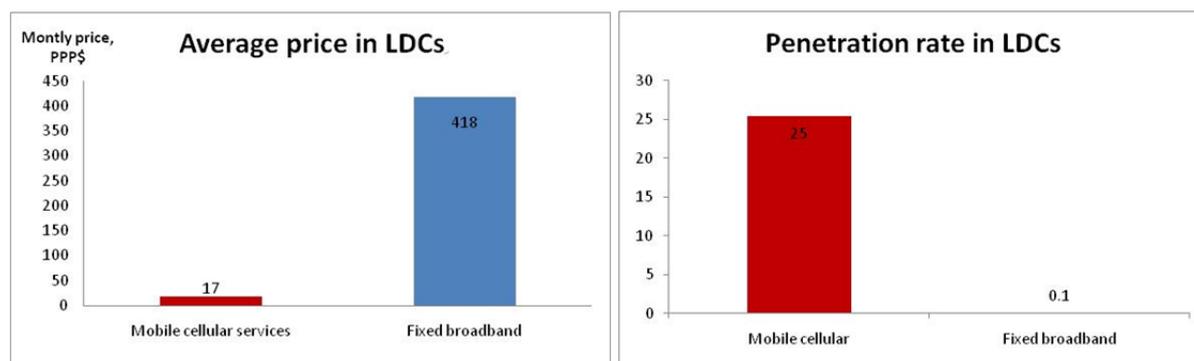
Source: ITU. For more information on the ICT Price Basket and the way it is calculated, see: ITU (2010b).

The ubiquity of mobile cellular technology (2G) in LDCs and the fast uptake rates for mobile broadband in the countries where third generation mobile technologies (3G) are already being offered (see Charts 3.16 and 2.8 above) make mobile broadband a good alternative for the provision of high speed broadband in LDCs. As of June 2010, only 13 out the 49 countries included then in the LDC category (or 25 per cent) offered 3G services commercially. Globally, in mid-2010, 143 countries were offering 3G services (Figure 3.1).

Figure 3.1: The rise of 3G
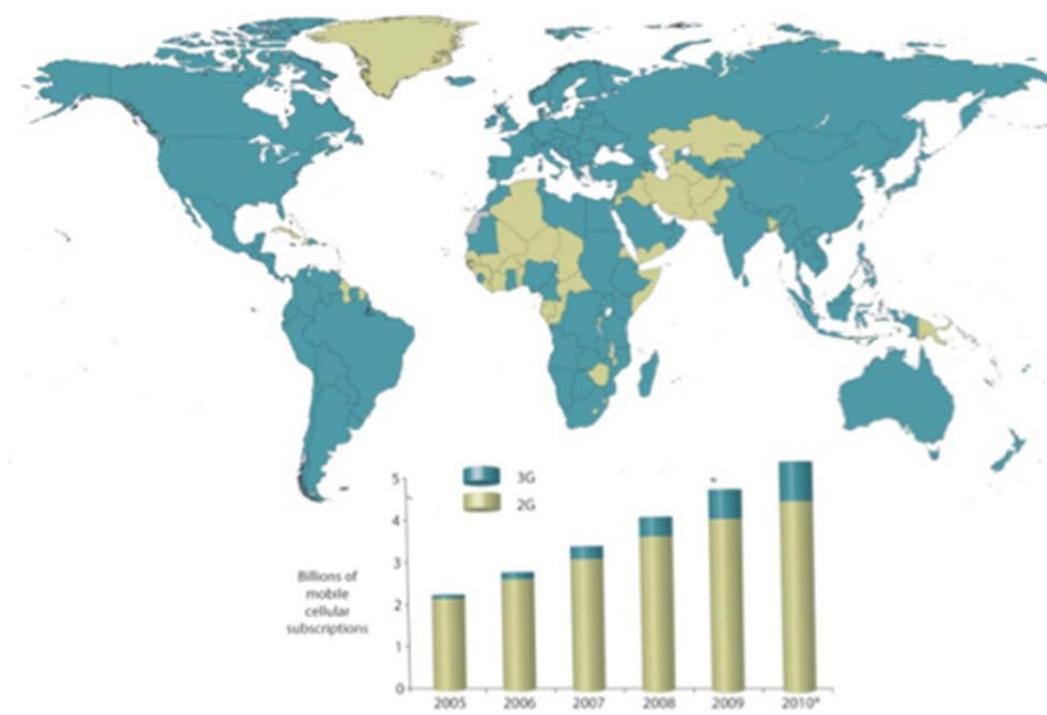
Notes: The map shows countries that are offering 2G/3G services commercially.
*Estimate.
Source: ITU World Telecommunication/ICT Indicators database.

Since then, several LDCs, including Senegal and Burkina Faso, have either launched services or have announced plans to allocate 3G licenses in the near future. The introduction of mobile broadband

services in LDCs is expected to address infrastructure challenges and even increase the uptake of fixed broadband in some countries, as prices for broadband services, both fixed and mobile begin to decrease as a result of inter-modal competition. Although providers around the world are already advertising a new generation of mobile broadband services, beyond 3G, the technology is not yet available in LDCs.

To better understand some of the major barriers faced by LDCs in deploying and updating their telecommunications and ICT infrastructure, Chapter 4 outlines challenges of the economic situation in LDCs. It also addresses the problematic of adapting to and mitigating the effects of climate change in LDCs, and particularly in SIDS. Finally, it introduces telecommunication policies and regulations that have facilitated the establishment of an enabling environment for infrastructure deployment in certain LDCs and highlights remaining bottlenecks.

4 Current challenges

4.1 The financial environment of LDCs

Improving access to markets and financial resources

Historically, the participation of least developed countries in global trade has been limited. According to the UN, their share in the global merchandise trade rose from 0.62 per cent in 2002 to 1.08 per cent in 2008, with exports destined equally to developed and developing countries.[1] To promote economic growth and industrialization, LDCs require the support of schemes that facilitate access of their exports to new markets and provide stable sources of development financing. A primary benefit low-income countries derive from their inclusion in the LDC category is access to special support measures from bilateral donors and multilateral organizations, as well as preferential treatment in multilateral and regional trade agreements they participate in. Mainly, LDCs receive support in the areas of international trade – through preferential market access, special treatment in their obligations before the World Trade Organization (WTO) and support in developing capacity in trade-related matters –, and of official development assistance (ODA), which can be provided through development financing or technical cooperation.

To enhance LDC participation in the global trade system, developed countries have granted non-reciprocal and preferential duty concessions to imports from developing countries and LDCs under the Generalized System of Preferences (GSP) of the General Agreement on Tariffs and Trade and the World Trade Organization. LDCs are granted zero or deeper tariffs cuts in a wider selection of products under the GSP. LDCs have also enhanced their trade relations with other developing countries by joining similar multinational and regional agreements that stimulate South-South trade and economic cooperation. The United Nations Conference on Trade and Development (UNCTAD) notes, however, that despite access to non-reciprocal market access schemes and trade agreements, LDCs still face multiple barriers that impede them from taking full advantage of trade preferences, including supply-side constraints, restrictions regarding rules of origin, sanitary standards, and subsidies in developed countries.[2]

Participation in the World Trade Organization is also essential for LDCs to improve market access. As of January 2011, 31 of the 48 current LDCs had successfully become WTO signatories and twelve other LDCs were negotiating their accession.[3] The organization also counts as members the three countries that have graduated from the LDC status so far. Under WTO, LDC members are granted special provisions, including increased market access, greater flexibility in rules governing trade measures, longer transitional periods and technical assistance. WTO also conferred LDCs special concessions under the Agreement on Trade-Related Intellectual Property Rights (TRIPS), which entered into force in 1995, and the General Agreement on Trade in Services (GATS), adopted in 2003. Finally, the WTO provides additional support to LDCs through the multi-agency, multi-donor initiative called "Integrated Framework for Trade-related Technical Assistance to Least Developed Countries" (IF), which aims at building capacity among LDCs on trade-related issues, to better enable these countries in their response to trade opportunities and their participation in the multilateral trade system.

An additional form of financing for development in LDCs is through bilateral or multilateral official development assistance or ODA. Bilateral agreements with donor countries, the private sector and/or multilateral agencies, such as the United Nations Development Programme (UNDP) and UNCTAD, are voluntary. Some donor countries and multilateral agencies have focused their ODA on initiatives to stimulate infrastructural investment in LDCs, including the telecommunications sector. Other UN organizations, like the UNDP, the World Meteorological Organization and the United Nations Capital Development Fund have established multilateral programmes, earmarked a proportion of their budget or set up special funds to provide technical assistance to LDCs. Key among such bilateral agreements are the Brussels Declaration and the Brussels Programme of Action, which set up policies and measures to assist LDCs and their development partners in substantially reducing conditions of extreme poverty and hunger among the LDC population by 2015 and promoting sustainable development.

Finally, the inflow of foreign direct investment (FDI) has responded positively to LDC improvements in political stability and social democratization. By 2008, FDI inflows to LDCs had risen to USD 33.1 billion, up from 4.1 billion in 2000. Yet, the global proportion of FDI reaching LDCs remains at 2.5 per cent, which is low considering the potential for investment many of these countries have to offer.[4] To improve the capability of LDCs to attract larger investments, development partners have launched diverse programmes during the last decade.[5] Some of the programmes focused on improving telecommunication infrastructure are detailed in Chapters 5 and 7.

4.2   Adapting to and mitigating climate change impacts

Another area of vulnerability for least developed countries is the environment. Weather events are increasing in number and frequency, and while all countries are expected to be affected by climate change, the economic dependency of LDCs on natural resources that are highly sensitive to climate change and on income obtained from traditional activities, such as agriculture, forestry and fishery, puts their potential for development and sustainable growth at greater risk from environmental impacts. LDCs, SIDS and low-lying coastal countries are susceptible to a range of natural hazards, such as cyclones, hurricanes, landslides, storm surges, droughts, flooding, tsunamis, earthquakes and volcanoes. Even among LDCs, some countries are considered to be most at risk from specific natural shocks, including droughts, floods and storms (Table 4.1). In the particular case of Small Island Developing States (SIDS), which includes eleven LDCs,[6] sea level rise is expected to exacerbate inundation, storm surge, erosion and other coastal hazards, thus threatening vital infrastructure, settlements and facilities that support the livelihood of island communities. Moreover, by 2050, climate change is expected to reduce water resources in many small islands, for example in the Caribbean and Pacific, to the point where they become insufficient to meet demand during low-rainfall periods.[7]

Overall, climate change will severely impact human activities and specifically, economic and social development. Most of the impact will be negative, as it will exacerbate current stresses on water resources and the potential for diseases to spread. Increased flood risk also poses challenges to society, physical infrastructure and water quality. Meanwhile, drought-prone areas, such as those in LDCs of northeast Africa and the Sahel, might be extended as a result of higher temperatures related to climate change. This will affect the water supply, negatively impacting livestock, agriculture and energy production, thus decreasing the quality of life and health of the population in such regions.

The IPCC predicts that freshwater availability and crop yields could decrease drastically in many areas of Africa and Asia.[8]

Table 4.1: LDCs most at risk from natural disasters related to climate change

Drought	Flood	Storm	Coastal (<1 metres above sea level)	Coastal (<5 metres above sea level)	Agriculture
Chad Eritrea Ethiopia Malawi Mauritania Mozambique Niger Sudan	Bangladesh Benin Cambodia Lao P.D.R. Mozambique Rwanda	Bangladesh Haiti Madagascar Samoa	All low-lying island states Bangladesh Mauritania Myanmar Senegal	All low-lying island states Bangladesh Senegal	Ethiopia Malawi Mali Niger Senegal Sudan

Source: Based on World Bank (2007, October). *IDA and climate change: Making climate action work for development.*

Based on the lower degree of industrialization in LDCs, reducing the impacts of greenhouse gas emissions (GHG) related to energy consumption and enhancing energy use become less relevant, as LDCs are estimated to produce only 1.4 per cent of the global CO2 equivalent emissions.[9] Consequently, LDC governments have focused their attention on other areas of mitigation, such as avoiding deforestation, and have given priority to adaptation activities to deal with the changes that a warming climate is bringing about. In many cases, these changes directly affect their livelihood and could further impoverish the population. For instance, it has been estimated that one billion people in Asia could face water shortage leading to drought and land degradation and other related hazards by 2050s.[10] Regretfully, as with other challenges facing LDCs, lack of resources, infrastructure and human capacity constrain their ability to adapt to climate change. To address these constraints, the international community, including the ITU, are directing funds, technology transfer and capacity building efforts to help LDCs mainstream adaption measures into their development plans and better deal with the threat of climate change. Yet, enhanced financial and technical support, adapted to the specific needs of LDCs is still required. Some of ITU activities in this area are presented in greater detail in Chapters 5 and 6.

4.3   Challenges specific to the telecommunications sector

Establishing an enabling policy and regulatory environment

During the past two decades, the regulatory environment of telecommunications has undergone multiple transformations. These changes have been global in nature and influenced policies and strategies in the telecommunication sector of LDCs during the last decade, when an increasing number of LDCs implemented institutional reforms, increasing private sector participation, liberalising markets and adopting new telecommunication policies and regulations. The vast majority of LDCs has separated regulation from operation and has endowed regulatory agencies with varying degrees of independence.

To facilitate the transition from monopoly to competition in the sector and create a more transparent organizational structure, most LDC governments have separated the roles of the state as regulator from that of incumbent public operator and from other government functions, by establishing independent agencies to regulate the sector, resolve potential conflicts among service providers and protect consumers. By 2009, 40 LDCs had established independent regulatory agencies, up from 24 in 2001.[11] Regulatory functions remained integrated with other government activities in eight countries. In a number of cases, such as in Guinea-Bissau, the separation between the ministry overseeing telecommunications service provision and the regulatory agency is less clear, as the ministry is home also to regulatory tasks. Nonetheless, the reforms have generated more transparent organizational structures. Where state ownership continues, regulation faces a potential tension between serving the interests of the state as an owner and operator (hence favouring the incumbent firm) and serving competition as well as the interests of users. Independent and professional regulation is an effective safeguard against such potential conflicts of interest and the associated distortions they may cause in the sector.[12]

As in many other developing and developed countries, fixed line telephone operators were publicly owned. By 2009, the main fixed-line telecommunications operator was still fully state-owned in 27 of the 49 LDCs; the remaining LDC governments had initiated the liberalisation of the telecom sector by selling a portion or the full state's stake in the incumbent fixed line operator. Fourteen LDCs had sold some stake in the incumbent, but retained majority ownership. Only Lesotho, Mauritania, Senegal, and Somalia had fully divested ownership in the incumbent telecommunications service provider or had reduced its stake to a non-controlling minority ownership by 2009 (Chart 4.1). In Maldives, for example, the government maintained majority ownership of Dhiraagu – the incumbent fixed telephone operator jointly owned by the government (55 per cent) and Cable and Wireless (C&W) of Great Britain (45 per cent) – until 2010, when it sold seven per cent of its shares to its partner C&W, transferring to it majority ownership.[13]

Chart 4.1: Ownership structure of incumbent fixed line operators in LDCs (2009, number of countries)
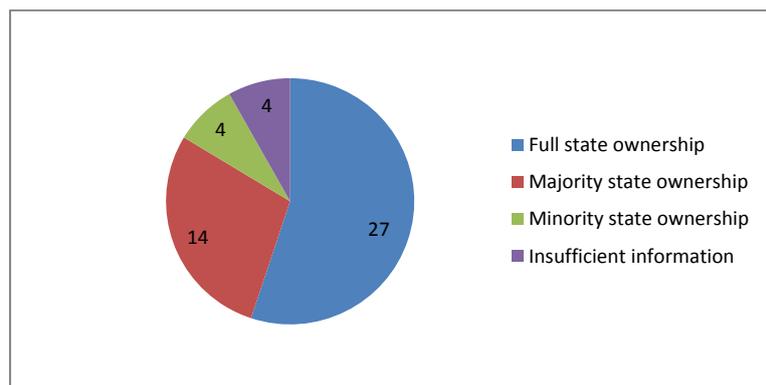
Sources: ITU Regulatory Database and J. M. Bauer's research.

The participation of private investors in the day-to-day operations of the incumbent fixed line telephone provider is expected to bring about new financial resources to extend and upgrade the mainline network, improve the quality of service and reduce any inefficiency that occurred under public ownership. In cases where the new private investors are foreign telecommunications operators, they also are expected to provide their public partners support with technology transfer and know-how, helping LDCs build internal human capacity. On the other hand, the participation of

the government in the provision of fixed telephony may be the only viable solution where the domestic market is too small to attract private investors, such as in the case of smaller LDCs and SIDS.[14] In general, the LDCs are taking advantage of the benefits of public-private partnerships to stimulate network deployment.[15]

In contrast to the fixed main line telephone market, the provision of mobile cellular telephony and Internet services are seen as more attractive commercial propositions for private investors. Where the mobile cellular market has been opened to partial or full competition, most of the newly issued licenses are held by private investors, usually foreign companies that have built a regional presence (such as MTN in Africa) or have significant experience in operating mobile communications services in LDCs. Most LDCs have liberalized telecommunications markets. Although competition is more widespread in mobile than in fixed markets, in 2009 six LDCs (Comoros, Djibouti, Ethiopia, Myanmar, Sao Tome and Principe, and Tuvalu) continued to rely on a single licensee to provide mobile services and another 14 had established only partial competition (Chart 4.2).[16]

Chart 4.2: Competitive organization of market segments in LDCs (2009, number of countries)
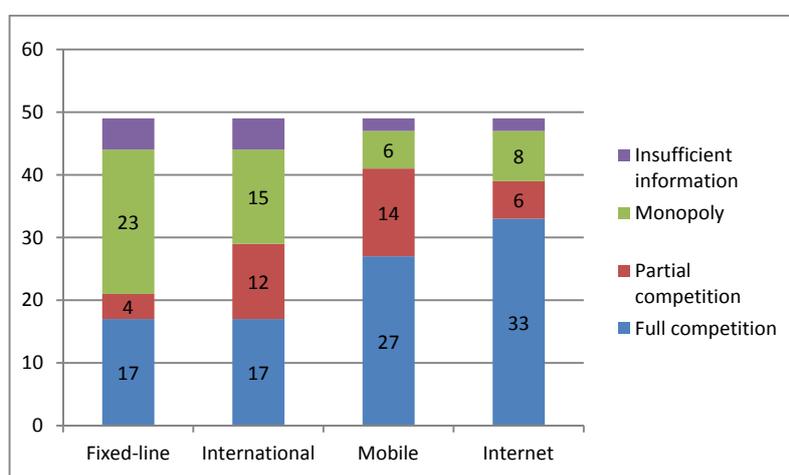
Sources: ITU Regulatory Database and J. Bauer's research.

As of 2009, of the then 49 LDC countries, 17 had fully liberalized fixed-line markets, 17 had fully liberalized international gateways, 27 had fully liberalized mobile markets and 33 the provision of Internet services (Figure 4.1). Four countries had allowed partial competition in fixed-line services, 12 in international gateways, 14 in mobile, and 6 in Internet services. Several LDCs also have policies in place that facilitate services-based entry. As of 2009, 20 LDCs permitted the provision of Voice over IP (VoIP) services;[17] of them, half allowed VoIP calls from PC to PC, from PC to phone, from phone to phone, and on private networks. In the other half, some restrictions applied, mainly for phone-to-phone VoIP calls.

While the markets have been liberalised, enabling true competition in such markets requires states to develop a regulatory environment that clarifies the terms of interconnection between operators, defines the rules for sharing infrastructure and sets up interoperability provisions. For the development of wireless services, regulatory authorities would also need to make decisions regarding spectrum management and the efficient assignment of spectrum to licensees and for diverse uses. Competition is also highly dependent on the size and demand of the market. As the

user base mostly expands in wireless services, fixed-line services in many LDCs are stagnant or even shrinking. In a number of countries around the world, therefore, although fixed-line markets are fully liberalized, they continue to be dominated by the incumbent service provider. Fortunately, recent technological advances, in particular in wireless technology and in IP networking, have reduced the magnitude of economies of scale and scope, thus facilitating inter-modal competition even in small and medium-sized countries.

Figure 4.1: LDCs with fully competitive fixed line, mobile cellular and/or Internet sub-markets (2009)

Fully liberalised sub-market	Total LDCs	Countries
Fixed line	1	Senegal
Mobile cellular	3	Bhutan, Niger, Vanuatu
Internet services	6	Guinea Bissau, Haiti, Kiribati, Liberia, Rwanda, Samoa
Fixed line and Internet	3	Lao P.D.R., Mali, Sudan
Mobile cellular and Internet	11	Angola, Benin, CAR, Chad, Gambia, Guinea, Lesotho, Madagascar, Togo, Yemen, Zambia
Fixed line, mobile cellular and Internet services	13	Bangladesh, Burkina Faso, Burundi, Cambodia, D.R. of Congo, Equatorial Guinea, Malawi, Mauritania, Mozambique, Nepal, Somalia, Uganda, United Republic of Tanzania

Notes: The fixed line sub-market in Mozambique and Senegal is liberalized, but dominated.
Source: ITU Regulatory Database.

While many of the policies implemented in LDCs are based on market-based approaches, there has been a recognition of the need of universal access polices and even public funding to provide investment incentives for infrastructure deployment where demand is insufficient to justify high amounts of commercial investment. Moreover, the repercussions of the financial crisis on the global telecom industry and, particularly on telecom investment in LDCs, have prompted renewed assessments of the role of the state in the sector, not only as a regulator setting guidelines for market participants, but also as an agent to facilitate the roll-out of telecommunications infrastructures.

To ensure the provision of service to rural, high cost areas and disadvantage user groups, a large number of LDCs have established programs to support universal access and service goals. In 2009, 38 LDCs indicated definitions of and measures in support of universal access and many countries had

formal policies in place to achieve this objective. Seventeen countries also included Internet services in their universal service definition (Table 4.2).

Table 4.2: LDCs supporting universal service (2009)

Countries indicating definitions of basic or other universal service			Countries supporting Internet services	
Afghanistan	Guinea-Bissau	Niger	Angola	Sierra Leone
Angola	Haiti	Rwanda	Bhutan	Sudan
Bangladesh	Kiribati	S. Tome & Principe	Burkina Faso	Togo
Bhutan	Lao P.D.R	Samoa	Dem. Rep. of the	Uganda
Burkina Faso	Lesotho	Senegal	Congo	
Burundi	Liberia	Sierra Leone	Guinea	
Chad	Madagascar	Sudan	Lesotho	
Comoros	Malawi	Tanzania	Madagascar	
Dem. Rep. of the	Maldives	Togo	Malawi	
Congo	Mali	Uganda	Mauritania	
Djibouti	Mauritania	Yemen	Nepal	
Ethiopia	Myanmar	Zambia	S. Tome & Principe	
Gambia	Nepal		Samoa	
Guinea			Senegal	
38			**17**	

Source: ITU Regulatory Database.

As illustrated in Chart 4.3, most universal access definitions focus on the establishment of telecentres for community access (29 countries), followed by fixed-line and mobile public payphone service (27 and 17 countries, respectively). Nineteen LDCs included individual fixed-line (19 LDCs) and mobile cellular (17 LDCs) services in universal access definitions. Emergency services were considered in 24 countries and 18 countries also added directory assistance services to the universal access/service mandate. Nine countries also included services to impaired and elderly users.

Chart 4.3: Universal service coverage (2009, number of countries)
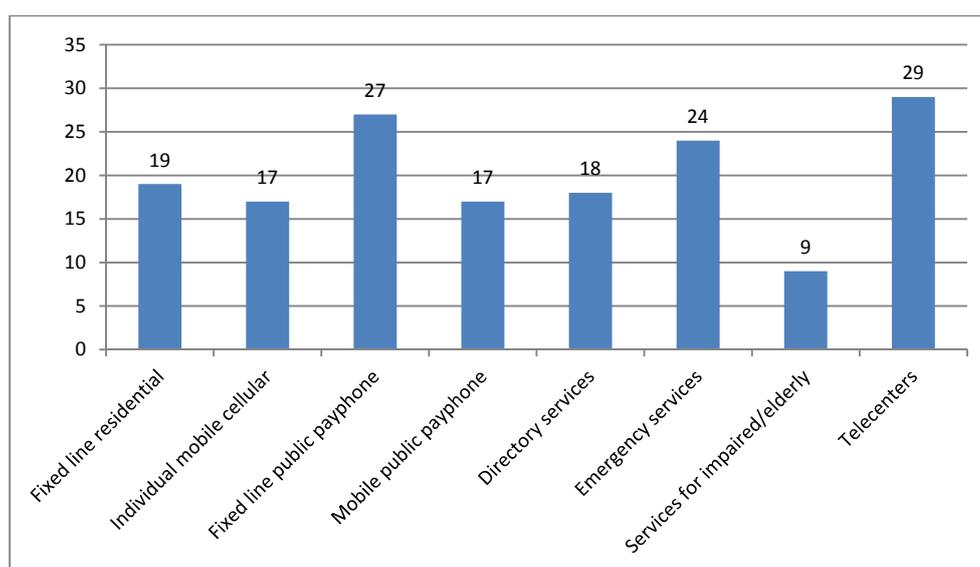
Source: ITU Regulatory Database.

An important factor influencing the successful implementing of universal service programs is the establishment of clear and technology neutral funding and disbursement mechanisms for universal service funds. Equally important is determining the best-fit method for a country to select the providers that will receive universal service funds. Where the technical skills are available, reverse auctions have been used as means to extend the footprint of services. In this selection process, a license or concession to serve a particular region is awarded to the provider willing to offer the lowest price to subscribers. This way the virtuous cycle between lower prices and increased adoption can be initiated.

Technological challenges

Beyond the implementation of universal access policies and funds, achieving universal access will require addressing the diverse technological challenges faced by LDCs in deploying and upgrading their telecommunication networks. These challenges range from regular access to electricity to interconnection to and deployment of backhaul networks, and from improving access to networks to reducing the cost and providing access to the type of terminal devices appropriate for the intended users. Affordability of services, technology and devices is key in LDC economies where most of the population lives on less than USD 2 per day.[18]

Benefits of cost reductions in backhaul networks, access networks and terminal devices will be passed on the end-users only under competitive or highly regulated conditions. Because LDCs also tend to suffer from weak government and regulatory capacity, the introduction of competition has been the best way to drive innovation and bring prices of voice connectivity down in their markets.[19] What is likely to work with regard to data connectivity in LDCs is some variant of this solution. In the case of microstates, such as the SIDS, even one additional competitor may be enough to bring about these benefits.

The transition is complicated by the rapidity of voice becoming a commodity with thin margins.[20] The operators are grappling with the dual challenges of investing in what amounts to an overlay network (3G requires new network equipment though some antenna towers may be shared with existing 2G networks), while at the same time investing in new applications that can generate revenues that voice no longer yields.

Access to electricity

Providing affordable connectivity to rural residents of LDCs requires technological breakthroughs in energy supply.[21] The energy sector in these countries is underdeveloped, limited mostly to large urban areas, leaving rural areas for the most unconnected. Power supply tends to be poorly managed, and rolling (announced or unannounced) blackouts, brownouts, and equipment-destroying power spikes are usual events in LDCs and developing countries. Even in urban areas, telecom operators are compelled to provide backup power and protective devices for network equipment. This involves not only the generators and related equipment, but also the additional costs of transporting diesel and protecting it against theft.[22]

By the same token, the energy for terminal devices is a challenge, but less of a challenge than that of securing low-cost energy sources for network equipment. Lack of electricity did not prevent people in the rural areas of LDCs from using 2G phones, and it will not stop them from using 3G phones and terminal devices. While some of the solar-charged phones on the market are not very efficient,

solar-powered charging stations might provide a highly practical means to charge phones. In the absence of such advanced solutions, car batteries and mobile charging stations will provide solutions. In the longer term, there is promise in "wireless power." Here, the innovation has two prongs. First, the devices are designed to use minuscule amounts of power. Second, they "harvest" power from passing radio waves. While the technology is still in the laboratories, a few prototype products are already in operation.[23]

Backhaul networks

Being the main network used by LDC users for national voice and text connectivity, providing quality mobile telephony and data services through wireless networks is indispensable to promote access. Compared to fixed telephony, the reliance of mobile cellular telephone networks on the backhaul network is greater, due to the need to carry signalling data long distance to access central databases. Whether a call is local or not is determined at the moment the call is connected when the location of the called party is identified. Similarly, many Internet functionalities depend on international connectivity, making this service even more reliant on national and international backhaul. Cloud computing increases the reliance even further. The introduction of data and video-intensive applications accessed by mobile phones require large amounts of bandwidth, and as a result, put pressure on mobile networks operators globally to build additional backhaul capacity. Fibre optic media may be used to maintain optimal user experience of new data services and foster service uptake. Also, it is estimated that this pressure will result in an increase on the number of macro base stations deployed to over 6 million by 2014. Nigeria, for example, will deploy almost five thousand GSM GPRS and EDGE/EDGE+ base stations in 2011.[24]

Due to the greater importance of data connectivity, companies are migrating from point-to-point links to rings to mesh configurations. This is braking the otherwise declining costs in connectivity and increasing the complexity of international backhaul networks. Transnational mesh networks that include both terrestrial and undersea components are difficult to build without the active cooperation of international government organizations and governments. Backhaul, especially on the international routes that many operators in LDCs would have to self-supply, is likely to constitute a barrier. In addition to the required capital, operators from landlocked LDCs face difficulties in gaining rights to lay cable across other countries. Submarine cables between two countries pose fewer difficulties, as shown by operators in Maldives, a microstate and an LDC, building two in the past few years.[25]

Access networks

There is much talk about taking fibre to the home in developed market economies. Yet this option is too costly for LDCs and even for more prosperous developing-country economies. However, the great majority of end-users, especially in LDCs, will tend to access the network wirelessly, using networks such as the current 3G networks, where the service experience is affected by distance and strength of signal as well as the number of users. Neither the operator nor the individual end-user can control the number of mobile users coming into a base station's service area. Therefore, quality is likely to be variable. However, this form of wireless use is the most convenient and is also likely to offer the lowest prices. Service quality, especially for data services, will improve to the extent that microwave-based access networks used in many developing countries and LDCs can be phased out.

Terminal devices

A challenge for the scalability of electronic applications is reducing the cost of devices through economies of scale. Mobile equipment, both on the network infrastructure side as well as devices, has grown in sophistication while continuing to drop in price. The emergence of Chinese equipment vendors, such as Huawei and ZTE, has driven competition in the infrastructure segment, dramatically reducing the cost of installing a mobile network. Innovations in handset technology include the development of sophisticated smartphones, which are driving demand for mobile data services. In low-income countries, falling prices of low-end mobile phones continue to make access more affordable. Increased access to second-hand mobile devices, at a much lower cost than new devices, has also improved affordability of mobile services among the LDC population.

The low literacy levels among LDCs' population will require developing user-friendly interfaces that take into consideration this limitation, focusing perhaps on voice activated applications that provide an additional trust-building element. Since some end-users can only dial a number and press the answer key for an incoming call,[26] another option could be the use of relatively inexpensive labour to serve as intermediaries in call centres, until user-friendly interfaces for illiterate persons are developed.

Experts point out that the challenge of providing voice and data connectivity to dispersed populations with little disposable income in the LDCs can be met if it is properly understood as an affordable-technology challenge. Such an understanding will create the environment for appropriate policy and regulatory actions by States and also for the necessary innovations by operators and manufacturers.

5   Implementing the Brussels Programme of Action (BPoA)

The international community has played an important role in helping LDCs address the many challenges of development discussed above. This chapter introduces some of the contributions the International Telecommunication Union has made to advance the implementation of the Brussels Programme of Action from 2001 to 2010.[1] As mentioned in Chapter 1, the BPoA provides a strategic framework for partnership that defines activities considered necessary to achieve the main goals of making substantial progress in reducing by half the number of people living in poverty and suffering from hunger by 2015, and of helping LDCs in their path to sustainable development. The programme's framework is articulated around seven interconnected commitments: (a) fostering a people-centred policy framework; (b) good governance at national and international levels; (c) building human and institutional capacities; (d) building productive capacities to make globalization work for LDCs; (e) enhancing the role of trade in development; (f) reducing vulnerability and protecting the environment; and, (g) mobilising financial resources. This chapter examines the synergies between these commitments and the development priorities the ITU has set up for the LDCs in its activities for the 2001-2010 period.

Since the adoption of the Brussels Programme in 2001, ITU has worked hand in hand with LDC Member States to help them meet the BPoA 2010 targets focused specifically on telecommunications and ICT. Moreover, to consolidate the ITU commitment to support LDC integration into the world economy through ICT, the ITU adopted in 2002 the Special Programme for the Least Developed Countries, known since 2010 as the Programme for Least Developed Countries, Countries in Special Need, Emergency Telecommunications, and Climate Change Adaptation (ITU LDC Programme, hereafter). The ITU LDC Programme aims to provide focused and differentiated assistance to LDCs to help them meet their Millennium Development Goals (MDGs) through telecommunications and ICT, thus hastening the pace towards the creation of the Information Society by the year 2015. To this end, the ITU LDC Programme promotes universal access to ICT in LDCs, SIDS and LLDCs by implementing actions to increase the average telephone density and Internet usage penetration in these countries,[2] while raising awareness of the development advantages of new technologies. Moreover, taking into consideration the increased vulnerability of LDCs and particularly of SIDS to climate change, the programme also provides assistance in disaster risk reduction, focusing on activities relating to disaster prevention, preparedness and relief, as well as on the adaptation to climate change. For those countries affected by disasters and those with special needs due to the devastation of war or civil strife, the programme also provides support in infrastructure reconstruction.

Overall, besides the targeted aid provided to LDCs through the ITU LDC Programme, the three sectors of the Union – Standardisation (ITU-T), Development (ITU-D) and Radiocommunication (ITU-R) – and the General Secretariat, have carried out major initiatives and activities that support the achievement of BPoA commitments. Through its sectors, the Union has assisted this group of countries in various areas of telecommunication development, including network expansion and modernization, planning, management, and the development of human capacity. Most of this assistance was provided on an ad-hoc basis to meet particular needs of the requesting administrations. The following sections highlight diverse activities ITU has undertaken for the benefit of LDCs since 2001, centred on the axis of the seven BPoA commitments. While the focus is primarily

on actions conducted through the ITU LDC Programme, activities implemented by other divisions of the Telecommunication Development Sector, as well as by the other two ITU sectors are also featured.

5.1   The role of ITU in supporting LDC development through ICT

The ITU has supported the development goals of the LDCs since the United Nations General Assembly adopted this category of countries in 1971. At that time, the Union accorded special assistance to LDCs through the implementation of relevant plenipotentiary conference resolutions, responding to an administration request on an ad hoc basis to finance experts, equipment procurement and fellowships.[3] As the number of countries under the LDC status grew in the 1990s, ITU assistance approach changed from providing funds on an ad hoc basis to a programme approach that provided assistance based on clearly defined priority areas.

In 1998, the Union decided to concentrate its efforts and resources on a small number of countries selected each year and, since 2002, under the ITU LDC Programme, its strategy has followed a biennial approach, concentrating assistance on an average of twelve countries for a period of two years.[4] By extending the period of assistance, ITU and its beneficiary countries are able to follow-up on actions taken, giving more time to monitor progress, conduct evaluations, mobilize needed resources and muster partnerships through round tables. Activities funded through the ITU LDC Programme regular budget are completed within the two-year period; meanwhile, extrabudgetary funds can be used to support longer-term projects, depending in the set implementation period. In addition, within the constraints of available resources, the programme also provides ad hoc assistance to requesting countries not selected for concentrated assistance during a particular period.

In 2006, the programme was expanded to include Small Island Developing States and emergency telecommunications,[5] and it currently comprises also a parallel initiative dedicated to 12 LDCs with special needs whose telecommunication infrastructure has been seriously affected by civil strife, war and armed conflict. Because of the state of their telecommunication sector, these countries require larger financial resources and technical support delivered through the special initiative, although they can still receive funds under the ITU LDC Programme.[6] The countries assisted under the special needs initiative are identified based on relevant resolutions of the ITU. Currently, Afghanistan, Burundi, Dem. Rep. of the Congo, Timor Leste, Eritrea, Ethiopia, Guinea, Guinea-Bissau, Liberia, Somalia, Rwanda and Sierra Leone received additional support through this initiative.

The ITU LDC Programme is currently focusing on the following priority areas:

1) *Concentrated assistance to LDCs and countries with special needs*: Promotes universal access to telecommunications/ICTs in LDCs, SIDS and LLDCs to help them meet the MDGs by the year 2015. It also focuses on the rehabilitation and reconstruction of telecommunication infrastructure.

2) *Universal access*: Under this priority area, LDCs are assisted in establishing national mechanisms to achieve ubiquitous, equitable and affordable universal access to telecommunications and ICT in both underserved rural and urban areas. Activities include the development of rural telecommunications to bring ICT access to rural areas where the majority of the LDC population lives; assistance on technological choice to develop infrastructure and promote the introduction of

new technologies and services into the sector; promotion of faster network growth and improvements in sector management through restructuring, bringing about liberalization, competition and, possibly, privatization as applicable; development of ICT policies and strategies; human capacity development; and the facilitation of financing and partnerships to pool resources destined to LDCs, avoiding duplication of effort and wastage of resources.

3) *Emergency telecommunications*: This global priority area provides assistance to all ITU Member States in disaster preparedness, early warning, dissemination of understandable warnings to those at risk, disaster relief/response and telecommunication network rehabilitation.

4) *Climate change adaptation:* The programme also provide assistance to developing countries in the use of ICTs to mitigate and address the effects of climate change, taking into account the impact of ICTs on the environment.

Based on these four priorities, during the last decade the ITU LDC programme has provided concentrated assistance to 42 least developed countries, of which 16 are also LLDCs and 9 are SIDS (Figure 5.1). The assistance was aimed at promoting universal access and bridging the gap between urban and rural areas to include introduction of new technologies, human resource development, rural communication development, spectrum management, and drawing up of appropriate ICT strategies based on sound policies, regulatory regime and legal framework.

Figure 5.1: LDCs receiving concentrated assistance through the ITU LDC Programme (2000 – 2010)

Region	Total LDCs	Beneficiary countries to concentrated assistance from ITU (2000 – 2010)
Africa	29	Angola, Burkina Faso, Burundi, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Djibouti, Eritrea, Ethiopia, Guinea, Guinea-Bissau, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Rwanda, Sao Tome & Principe, Sierra Leone, Somalia, Sudan, Uganda, United Republic of Tanzania, Zambia (+ Cape Verde - already graduated).
America	1	Haiti
Asia and Pacific	12	Afghanistan, Bangladesh, Bhutan, Cambodia, Kiribati, Lao People's Democratic Rep., Myanmar, Nepal, Samoa, Solomon Islands, Tuvalu, Yemen.

Source: ITU.

Following the strategy set up in 2002, the LDC programme has delivered concentrated assistance to an annual average of 12 beneficiary countries during the last ten years (Figures 5.2 and 5.3) and its

2011 plan will deliver assistance to 16 other countries, including Timor Leste, which had not been supported during the previous decade.[7]

Figure 5.2: Beneficiary countries to concentrated ITU assistance to LDCs, 2001-2005
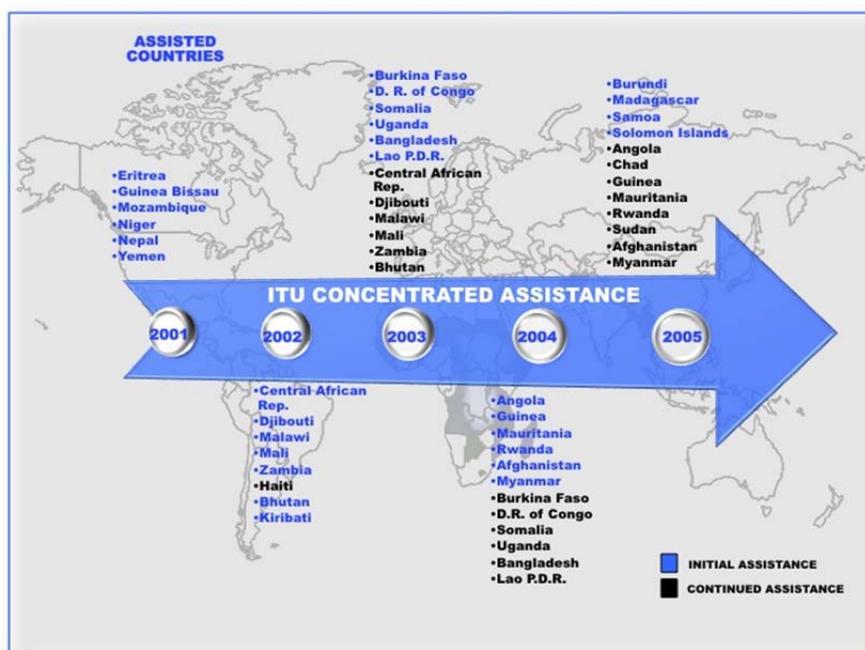
Source: ITU. Countries listed alphabetically by region (Africa, Americas and Asia-Pacific).

Figure 5.3: Beneficiary countries to concentrated ITU assistance to LDCs, 2006-2010
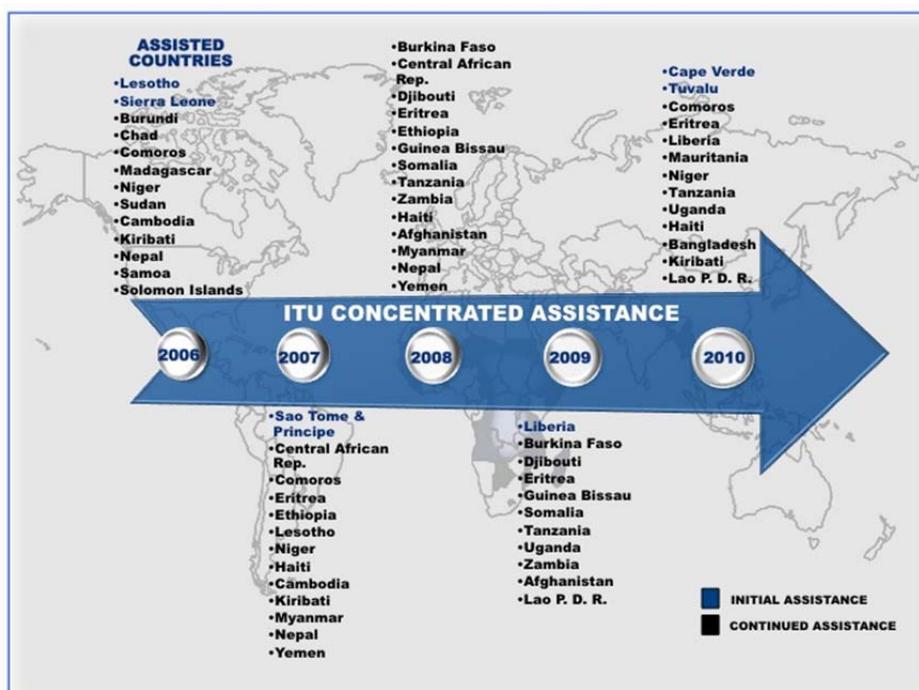
Source: ITU. Countries listed alphabetically by region (Africa, Americas and Asia-Pacific).

The distribution of concentrated assistance provided through the programme during the last decade reflects the current proportion of LDCs worldwide, with Africa receiving the bulk of the assistance

(69 per cent), followed by the Asia and Pacific region (29 per cent), while Haiti, the only LDC in the Americas, received two per cent of the aid (Chart 5.1).

Chart 5.1: Distribution of concentrated ITU assistance to LDCs, by region, 2000-2010
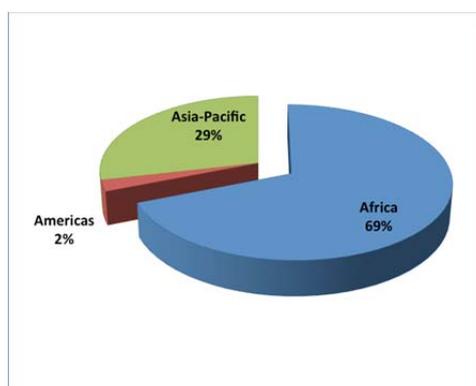
Source: ITU.

The distribution of continued assistance, that is, of countries receiving concentrated assistance for more than one biennial during the ten year period being analysed, does not change significantly, except for the case of Americas (Chart 5.2). Haiti is the LDC that has received the most continuous aid through the programme, both in the form of concentrated assistance and through ad hoc assistance, partly due to the exceptional situation of the 2008-2009 hurricanes and the January 2010 earthquake that have devastated the country. Detail of the assistance provided to Haiti since the earthquake is provided in section 6.5.

Chart 5.2: Distribution of continued concentrated ITU assistance to LDCs, by region, 2001-2010
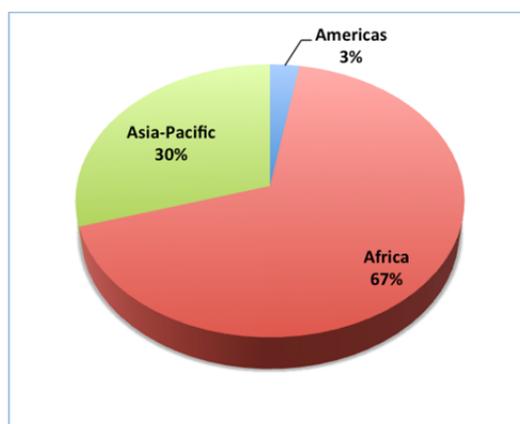
Source: ITU.

5.2   Implementation of ITU deliverables relating to the BPoA commitments

As part of its deliverables to the Third United Nations Conference on the LDCs, held in Brussels in 2001, the ITU pledged to mainstream the BPoA in all its activities, providing special assistance to countries affected by war, civil strife and natural disasters, assisting countries in the elaboration of strategies to harness ICT applications and services, and helping LDCs achieve universal access. In accordance to these commitments, the ITU has undertaken a series of activities that have fostered

the implementation of the BPoA in LDCs. This section provides a brief overview of the concentrated assistance and ad-hoc activities delivered by the ITU LDC programme from 2001 to 2010, as well as other activities conducted by the three ITU sectors to promote growth and enhance the ICT capabilities of least developed beneficiary countries.

A more thorough description of the activities implemented during the 2001-2005 period is provided in the ITU *Mid-term Review for the Decade 2001-2010* report, presented as input to the Midterm Comprehensive Global Review of the Programme of Action for the Least Developed Countries for the Decade 2001-2010, which took place in 2006. Table 5.1 lists the confluences between the commitments included in the BPoA framework for partnership and the almost two hundred activities undertaken by the ITU LDC Programme as part of its priority areas during the 2001-2010 period.

Table 5.1: Synergies between BPoA commitments and priority areas of the ITU LDC Programme, 2001-2010

Commitment 1: Fostering a people-centred policy framework		
Year	**Nature of key assistance provided to countries**	**Beneficiary LDCs**
2001	Development of a universal service / access policy	Mozambique
	Sector restructuring	Eritrea
	Study of telecommunication policy and regulation	Guinea Bissau
	Assistance in numbering plan	Uganda
	Cost and tariff policy workshops	Gambia, Guinea Bissau, Sierra Leone
	Training in frequency spectrum and management	Chad, D.R. Congo, Djibouti, Equatorial Guinea, Liberia, Somalia
2002	Assistance in sector reform	Central African Rep., Djibouti
	Assistance in frequency management (FM frequency band)	Malawi
	Assistance in strengthening of the regulatory body	Haiti
	Support to Société de Télécommunications du Mali, the telecommunication operator in Mali, implementation of a strategy for its privatization	Mali
	Emergency support in spectrum management	Afghanistan
	National sector policy and drafting of regulatory framework project for LDC	Pacific Islands
2003	Assistance to enhance the frequency management and radio monitoring system	Burkina Faso, Guinea, Yemen
	Support in the implementation of sector reform	Central African Rep., D.R. Congo, Equatorial Guinea
	Assistance in strengthening the spectrum management unit	Malawi, Mali, Zambia
	ICT regulatory harmonization	Economic Community of West African States (ECOWAS countries)

Year	Nature of key assistance provided to countries	Beneficiary LDCs
2004	Assistance in restructuring the telecommunication sector	Angola, Mauritania
	Assistance in sector reform of the Ministry of Post, Telephone and Telecommunications	D.R. of Congo
	Assistance in developing frequency management plans and radio monitoring, and in the creation of a National Directorate for Communication and Information	Guinea
	Assistance in establishing a frequency monitoring station service to the Ministry of Communication	Afghanistan
	Assistance in establishing points of interconnection for hybrid networks	Bangladesh
	Assistance in establishment of a regulatory authority	Lao P.D.R., Myanmar
2005	Assistance in sector restructuring	Angola, Madagascar, Mauritania, Rwanda, Sudan
	Subregional meeting on sector restructuring	Myanmar, Lao P.D.R.
	Assistance to the regulatory authority of Cape Verde, to the Société Centrafricaine de Télécommunications of Central African Republic, and to the Eritrea Telecommunications Services Corp. (Eritel)	Cape Verde, Central African Rep., Eritrea
	Holding of the Global Symposium for Regulators for regulators from the developed, developing and least developed countries	LDCs
2006	Development of a telecommunication policy and regulatory framework	Cambodia
	Development of a numbering plan	Niger
	Setting up the national telecommunication commission of Sierra Leone	Sierra Leone
	Assistance in sector reform and spectrum management	Sudan
2007	Assistance in regulatory reform and in economic and finance	Comoros
	Assistance in frequency management, costs and tariff issues	Ethiopia
	Ad hoc assistance and assistance in developing suitable policies and regulations required in a modern ICT sector	Haiti
	Telecommunications development plan and telecommunications Act	Kiribati
	Assistance in adopting ECOWAS regulatory guidelines	Niger
	Adapting Sierra Leone's regulatory regime to ECOWAS regulatory guidelines	Sierra Leone
	Assistance in spectrum management	Yemen
2008	Infrastructure sharing arrangements at hill tops	Afghanistan
	Ad hoc assistance in the regulation on VoIP and NGN	Bhutan
	Strengthening of capacity of staff in the regulatory authority	Central African Rep.
	Assistance in economics and finance	Yemen
2009	Assistance in regulatory reform and in economics and finance	Djibouti
	Assistance on policy and regulation to ANPT	Lao PDR
	Institutional support	Liberia
	Assistance to the Communications Authority of Zambia on capacity building on costing and pricing	Zambia
2010	Interconnection framework, cost modelling and tariff policies	Bangladesh
	Expert judicial principal in spectrum management	Burkina Faso
	Assistance in regulatory reform	Comoros, Mauritania
	Assistance in strengthening the regulatory authority	Haiti
	Conducive and enabling ICT legal framework	Kiribati
	National ICT Strategic Plan (2010-2015)	Lao P.D.R.
	Assistance in radio spectrum planning and pricing	Liberia

Commitment 2: Good governance at national and international levels		
Year	**Nature of key assistance provided to countries**	**Beneficiary LDCs**
2001	Rebuilding of the rural telecommunication infrastructure	Burundi, Rwanda
	Assistance in the strengthening of the policy and regulatory environment in the telecommunications sector	Burundi, D.R. Congo, Liberia, Rwanda, Sierra Leone, Somalia
2002	Ongoing assistance in the strengthening of the policy and regulatory environment in the telecommunication sector	Burundi, D.R. Congo. Liberia, Rwanda, Sierra Leone, Somalia
2003	Implementation of IP-based platforms for the governments	Burkina Faso, Mauritania
2004	Assistance in the establishment of sector governance in telecommunications	Timor-Leste
2005	Assistance in sector restructuring	Angola, Madagascar, Mauritania, Rwanda, Sudan
	Subregional meeting on sector restructuring	Myanmar, Lao P.D.R.
	Assistance to the regulatory authority of Cape Verde, to the Société Centrafricaine de Télécommunications of Central African Republic, and to the Eritrea Telecommunications Services Corp. (Eritel)	Cape Verde, Central African Rep., Eritrea
	Organization of a Global Symposium for Regulators	LDCs
2006	Strengthening the capacities of the regulatory authority	Chad
	Assistance in sector restructuring	Comoros
	Strengthening the capacity of the telecommunication authority	Kiribati
	Assistance in computerized post service management	Nepal
	Creation of a website for the Ministry of Communications	Niger
	Assistance in the restructuring of the national telecommunication company	Sierra Leone
2007	Strengthening of the functional capacities of the regulatory body with respect to planning and frequency planning, management and classification	Central African Rep., Sao Tome and Principe
	Strengthening the operations and functional capacities of the regulatory body	Central African Rep., Sao Tome and Principe
	Assistance in economics and finance	Comoros
	Assistance to Eritrea in sector restructuring	Eritrea
2009	Providing institutional support for ICT sector restructuring	Guinea Bissau, Zambia
	Universal access to telecommunications/ICT for all	Uganda/ Multiple (AFR)
	Assistance to Communications Authority of Zambia in reviewing, updating and implementing its Corporate and Strategic Plan	Zambia
2010	Assistance in improving access to ICT for marginalized groups	Haiti

Commitment 3: Building human and institutional capacities		
Year	**Nature of key assistance provided to countries**	**Beneficiary LDCs**
2001	Establishment of a telecommunication and ICT training institute	Eritrea
	Training in the use of a network planning tool (PLANITU) for the national telecommunication operator Société des Télécommunications du Tchad (SOTEL)	Chad
	Support for the reorganization of the training centre of the telecommunication operator in Mali (SOTELMA)	Mali
2002	Assistance through training management for the Société Centrafricaine des Télécommunications (SOCATEL) from Burkina Faso	Burkina Faso
	Establishment of telemedicine links	Senegal
	Telemedicine pilot project	Guinea
	Assistance in the elaboration of distance learning and dissemination of information on tropical disease	Tanzania, Uganda
	Workshop and training in human resources development /management	Bhutan, Djibouti, Malawi, Zambia
2003	Establishment of Internet training centres	Afghanistan, Angola, Burkina Faso, Cape Verde, Ethiopia, Maldives, Mozambique, Uganda
	Establishment of an ICT training centre for returnees	Liberia
	Assistance in strengthening skills and capacities of Somali Telecom operators	Somalia
	Establishment of Internet for schools	Mali
	Support in the rehabilitation of the information and communication training institute in Kabul	Afghanistan
	Assistance in the establishment of a telemedicine link	Mozambique
2004	Assistance in human resources development / management	Mauritania, Myanmar, Somalia
	Establishment of Internet training centres	Bhutan, Cape Verde, Liberia, Malawi, Rwanda, Tanzania, Yemen
	Telemedicine project	Mauritania
2005	Establishment of Internet training centres in partnership with European Commission	Ethiopia, Gambia, Rwanda, Uganda, Zambia
	Establishment of ITU-CISCO Internet training centres	Angola, Bangladesh, Bhutan, Lao P.D.R., Mali, Mauritania, Samoa
	Development of a TTS software adapted to the Ethiopian local language, Amharic, in support of the Adaptive Technology Center for the Blind (ATCB)	Ethiopia
2006	Training of staff of the regulatory authority in frequency and spectrum management	Burundi
	Assistance in human capacity-building	Sierra Leone

Year	Nature of key assistance provided to countries	Beneficiary LDCs
2007	Assistance in increasing the capacity of national staff to plan and manage the use of the radio frequency spectrum	Haiti
	Assistance in human capacity building	Myanmar
2008	Assistance in capacity building	Somalia
2009	Assistance in Spectrum Management System for Developing Countries (SMS4DC) software	Eritrea and Liberia
	Provide assistance in the establishment of a training institution for information and communication technologies	Eritrea
2010	Global ICT reports with case studies for the LDCs for 2002-2010	All LDCs
	Establishment of a regional ICT training centre	Uganda

Commitment 4: Building productive capacities to make globalization work for LDCs		
Year	Nature of key assistance provided to countries	Beneficiary LDCs
2001	Guidance in the preparation of tender documents for cellular networks and implementation of the network	Bhutan
	Assistance in the establishment of a pilot hybrid PSTN/IP network	Nepal
	IP network assistance	Mauritania
	Establishment of Multipurpose Community Telecentres	Burkina Faso, Cape Verde, Mali, Senegal
2002	Implementation of Multipurpose Community Telecentres	Haiti, Madagascar, Mali, Myanmar, Niger
	Establishment of a telekiosk for e-Post services	Bhutan
	Financial assistance for the purchase and installation of equipment for the Lomé Regional Telecommunication Maintenance Centre (CMTL SA)	Togo
	Assistance in developing a broadcasting system	Bhutan, Ethiopia
2003	Establishment of Multipurpose Community Telecentres	Haiti, Malawi, Niger, Sudan, Tanzania, Uganda
	Conduction of a study for a submarine optical fibre network	Maldives, Myanmar
	Assistance in telekiosk for e-post services	Afghanistan, Bhutan, Myanmar
2004	Assistance in the expansion of the MCT projects	Guinea, Haiti, Myanmar, Uganda
	Development of rural ICT infrastructure	Bhutan
2005	Assistance in the establishment of Multipurpose Community Telecentres	Samoa, Solomon Islands
	Implementation of VSAT network	Bhutan
	Wireless IP project	Uganda, Yemen
2006	Assistance in the development of infrastructure and introduction of new technologies and services	Comoros, Sudan
	Implementation of ICT centres project	Lesotho
	Assistance in establishing Multipurpose Community Telecentres	Niger, Samoa, Solomon Islands
	Assistance in the development of rural telecommunications	Sudan

Year	Nature of key assistance provided to countries	Beneficiary LDCs
2007	Improving distribution and quality of access to ICT networks and services	Cambodia
	Assistance through the establishment of Multipurpose Community Telecentres	Haiti
	ICT Centres projects	Lesotho
	Development of rural communications	Nepal
	Assistance in the introduction of new technologies and services/NG technologies	Yemen
2008	Assistance in the introduction of new technologies and services	Djibouti
2009	Assisting in carrying out a feasibility study on a network project connecting that country and its neighbours	Burkina Faso
	New proposed fibre optic landing station/gateway site survey Feasibility study for Eritrea's fibre optic gateway	Eritrea
	MCT development for rural telecommunication development	Haiti
	Design and implement five Multipurpose Community Telecentres	Tanzania
2010	Assistance in the introduction of new technologies and services	Comoros, Mauritania
	Capacity building for technical Eritel staff Eritrean Master Plan of the backhaul system/network to the submarine cable Master plan connectivity for domestic and international fibre optic link project	Eritrea
	Rural Internet Connectivity System (RICS) in Kiribati	Kiribati
	Assistance to update feasibility study for national backbone transmission link	Niger
	Establishment of five Multipurpose Community Telecentres	Tanzania

Commitment 5: Enhancing the role of trade in development

Year	Nature of key assistance provided to countries	Beneficiary LDCs
2001	Assistance in the upgrade of ICT networks with advanced security and trust technology	Burkina Faso, Cape Verde, Mali, Senegal
2002	Assistance in establishing an e-commerce legal framework	Burkina Faso
	Assistance in an e-commerce project	Cape Verde
	Assistance on e-commerce training in the development and management of a public key infrastructure	Cambodia
2003	Assistance to African LDCs in issues related to General Agreement on Trade in Services (GATS)	African LDCs
2004	Establishment of e-commerce projects	Burkina Faso, Senegal
	Implementation of e-agriculture projects	Mauritania, Myanmar, Samoa
	e-Security projects and trust technology based on PKI	Bhutan, Burkina Faso, Cambodia, Senegal, Zambia
	Assistance in developing a legal framework for e-commerce	Tanzania
2005	Conduction of a study on the economic integration of the Communauté Economique et Monétaire de l'Afrique Centrale (CEMAC countries)	Central African Republic, Chad, Equatorial Guinea
2007	Assistance in e-Strategies and ICT applications	Comoros
	Assistance in WTO/GATS issues	Ethiopia

Year	Nature of key assistance provided to countries	Beneficiary LDCs
2009	Afghanistan Cyber Emergency Response Team Establishment of national Internet exchange of Afghanistan (NIXA)	Afghanistan
2010	Assistance in the organization of a Public Key Infrastructure (PKI) project to secure e-commerce	Cape Verde

Commitment 6: Reducing vulnerability and protecting the environment		
Year	**Nature of key assistance provided to countries**	**Beneficiary LDCs**
2002	Publishing of the first edition of the Disaster Communications Handbook	All LDCs
	Launch of ITU/INMARSAT project on emergency telecommunications for deploying satellite terminals in countries when disasters strike	All LDCs
2003	Establishment of an "Environment Information Circulation and Monitoring System on the Internet Programme for Africa" (SISEI)	Gambia, Ghana, Guinea, Mali, Mauritania, Niger, Uganda
2004	Publication of the Handbook on Emergency Telecommunications	All LDCs
2005	Deployment of satellite terminals to tsunami hit countries and Pakistan, following the Kashmir earthquake	Pakistan, tsunami hit countries
	Assessment, rehabilitation and reconstruction of telecommunication infrastructure	Bangladesh, Maldives
2006	Workshop on Emergency Telecommunications for Disaster Management	Bangladesh
	Using ICT for Effective Disaster Management Caribbean Forum	Haiti
	Joint ITU--ESCAP Regional Workshop on Disaster Communications	Multiple (ASP)
2007	Regional workshop on emergency telecommunications and disaster relief in the Arab region	Arab states
	Central African region project for 14 countries on emergency telecommunications and Tampere Convention ratification and implementation	Multiple (AFR)
	Global forum on effective use of telecommunications/ICT for disaster management: Saving lives	Multiple LDCs
2008	Training workshop on disaster management to integrate emergency telecommunications plans into national disaster management plans for the Central African countries	Central African region / Rwanda
	ITU Southern and Eastern Africa workshop on the use of telecommunications/ICT for disaster management	Eastern & Southern Africa / Zambia
	3rd Asian ministerial conference on disaster risk reduction	Multiple (ASP)
	Guidelines and related tools for emergency telecommunications	Multiple LDCs
2009	Training workshops on disaster management to integrate emergency telecommunications plans into national disaster management plans for the West African region, Americas and a Regional Forum on National Emergency Telecommunications Plan	Multiple LDCs
	Preparation of guidelines and related tools for the integration of geographic information systems into emergency telecommunications	Multiple LDCs
	Training workshop on emergency telecommunications	Sao Tome and Principe
	National stakeholder training workshop on disaster management	Tanzania

Year	Nature of key assistance provided to countries	Beneficiary LDCs
2009	Technical assistance to prepare a National Emergency Telecommunications Plan	Tanzania, Zambia
	Assistance to Uganda and other Member States in emergency telecommunications	Uganda
2010	Round table on the reconstruction of Haiti	Haiti
	Assistance for an ICT emergency plan	Cape Verde

Commitment 7: Mobilizing financial resources

Year	Nature of key assistance provided to countries	Beneficiary LDCs
2001	Partnership roundtables	Eritrea, Guinea Bissau, Mozambique, Nepal
2002	Fellowships given to LDCs to attend events and workshops, and participate in training courses	LDCs
2003	Partnership roundtables	Bhutan, Central African Rep., Djibouti, Haiti, Kiribati, Malawi, Mali, Zambia
2004	First Global ICT Forum for Least Developed Countries	LDCs
2005	Fellowships for LDCs to attend events, such as ITU private sector events, providing forums for partnership building	LDCs
2006	Assistance in forging partnerships for resource mobilization to include bilateral and multilateral initiatives	Multiple LDCs
2007	Assistance in forging partnerships for resource mobilization to include bilateral and multilateral initiatives (LDC and SIDS)	Multiple LDCs
2008	Forum on next generation telecommunications for the Pacific Region	Multiple (ASP)
	Partnership roundtables for LDCs and SIDS	Multiple LDCs

Source: ITU. Note: AFR=African region, ASP=Asia and Pacific region.

The analysis of the allocation of activities of the ITU LDC Programme according to the BPoA commitments shows that the majority of actions implemented by the Programme in the 2001-2010 period have focused on Commitments 1 (27 per cent), 4 (19 per cent) and 3 (15 per cent), which are the commitments with the closest association to the LDC Programme's priorities of promoting universal access. Commitments 2 and 6 followed closely (13 per cent each), the latter being the Commitment more closely related to the ITU LDC Programme focus on emergency telecommunications (Chart 5.3).

It should be clarified that, although the number of actions accorded by the ITU LDC Programme to the mobilization of financial resources (Commitment 7) and the enhancement of the role of trade in development (Commitment 5) were relatively limited during the last ten years, these activities were implemented as priorities by other programmes within ITU-D.[8]

The following subsections describe in more detail the type of activities and ad hoc assistance provided under the ITU LDC Programme, as well as activities undertaken by other divisions and programmes within the ITU Development Sector and the other two ITU sectors in implementing the BPoA.

Chart 5.3: Implementation of BPoA commitments by ITU, based on number of actions, 2001-2010
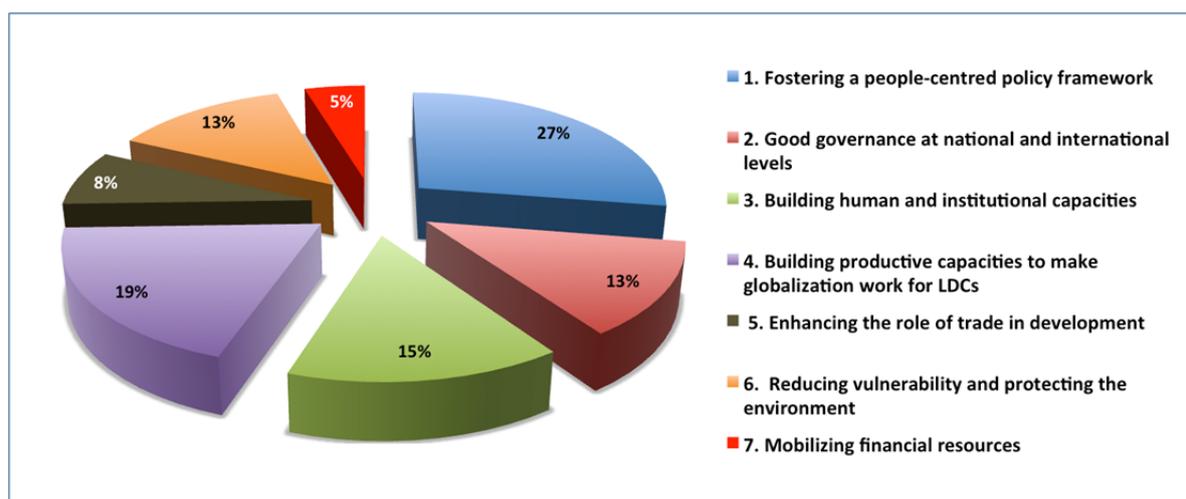
Source: ITU.

Advancement in Commitment 1: Fostering a people-centred policy framework

The BPoA Framework for Partnership, under Section 1 (f) of Commitment 1 calls on development partners to support "LDCs in gaining access to ICT, necessary physical infrastructure and critical capacity-building that would facilitate bridging the digital divide, bearing in mind the need for diffusion and transfer of technology."[9] The ITU, as the leading UN agency for ICT issues and the major forum for bringing together diverse stakeholders to develop telecommunication networks and services, plays a key role in assisting LDCs and coordinating with other development partners in meeting this goal.

The commitment to foster a people-centred policy framework converges with the ITU priority of promoting universal access in LDCs through diverse mechanisms. In particular, during the 2001-2010 period the LDC programme has helped LDCs in developing enabling ICT policy frameworks, including universal access policies, national ICT Strategic Plans and strengthening the regulatory framework on issues such as interconnection, cost modelling, and spectrum management. The main goal of these activities is to improve the strategic management of the sector in LDCs, developing the necessary regulatory clarity to attract local and foreign private investment and advancing in the achievement of universal access.

Under this aegis, the ITU LDC Programme has assisted Cambodia, Comoros, Djibouti, Guinea Bissau, Haiti, Lao P.D.R., Mauritania and the Pacific Islands in conducting regulatory reform. In Comoros, for example, the ITU LDC Programme supported the creation of a regulatory authority through the analysis of the existing regulatory and legislative frameworks and building capacity among the staff that would occupy posts at the agency. Similarly, in Lao P.D.R., Myanmar and Sierra Leone, the ITU LDC Programme assisted in setting up their regulatory authorities or national telecommunication commission. In 2004, Angola received concentrated assistance in restructuring its telecommunication sector, especially in moving from a monopolistic regime to a competitive environment. In this regard, a new strategy was adopted to adapt and transform Angola Telecom to the new changing environment. The transformation of Angola Telecom divisions into strategic business units was funded by ITU, through its TELECOM Surplus project. Other recipients of

concentrated assistance were the Dem. Rep. of Congo, which carried out a sector reform of its Ministry of Post, Telephone and Telecommunications, and Guinea, where assistance was provided in the form of frequency management planning, radio monitoring and the creation of a National Directorate of Communication and Information. This same year, Bangladesh received concentrated assistance to create an enabling policy and a legal, regulatory and operational environment through the planning and establishing of interconnection hybrid networks (National Internet Exchange in Bangladesh) point(s), with support from UNDP and private operators.

Kiribati, Samoa, Solomon Islands, Tonga and Tuvalu have benefited also from projects designed to help them develop their national sector policy and regulatory framework. The projects provided expertise for the development of a national sector policy and a regulatory framework for each participating country, as well as policy harmonization at the subregional level (including the development of competences in the area of telecommunication policy, regulation and legislation). Fourteen Pacific Island countries participated in the subregional project.[10] Moreover, since 2010, the ITU LDC Programme is assisting Lao P.D.R. in developing a clear national framework on telecommunication development, including the establishment of physical targets and the identification of the best strategies to meet such targets.

For countries that already have a regulatory agency, the focus of ITU assistance has been on strengthening their regulatory capacity on issues referring to universal service and access policies, spectrum management, costs and tariffs, as well as promoting the harmonization of the LDCs' regulatory environment with regional regulatory guidelines, such as those proposed by the ECOWAS in its Supplementary Acts on the Harmonization of policies and of the regulatory framework for the ICT sector. Twenty-seven LDCs received this type of support during the 2001-2010 period, including Bangladesh, Burkina Faso, Central African Republic, Gambia, Haiti, Liberia, Mozambique, Niger, Sudan, Yemen and Zambia.

In 2003, the countries of the Economic Community of West African States (ECOWAS), (Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo) received assistance for a project on ICT market harmonization to create an integrated ICT market policy. This project, co-financed by ITU and the European Commission, also sought to build human and institutional capacity in the field of ICT through a range of targeted training, education and knowledge sharing. Regulatory guidelines addressing interconnection, licensing, numbering, spectrum management, universal access, ICT policy and legislation for the project were formally approved in 2005.

Due to the centrality of spectrum management for future development of wireless services and devices, ITU, as part of its regular activity, carries out studies and establishes recommendations related to spectrum management, including long-term strategies for spectrum utilization and on issues related to the introduction of ultra-wideband devices. In particular, the ITU-R is currently studying new regulatory measures to provide additional flexibility and improved efficiency in the usage of the radiofrequency spectrum, in order to enable the introduction of software-defined radio and cognitive radio systems.

Moreover, in response to the interest of regulators and operators in cost modelling, ITU-D has organized dedicated training programme for regulators focusing on costing methodologies and cost calculation models. In 2009, ITU-D conducted three regional cost and tariff seminars in Africa, Asia

and Pacific and the Americas, together with the ITU-T regional tariff group meetings, as well as four ITU Expert-Level Training seminars on this topic for national regulatory authorities and operators.[11]

Advancement in Commitment 2: Good governance at national and international levels

Commitment 2 of the BPoA framework for partnership encourages LDCs to implement institutional development processes and key governance reforms to "foster just, transparent and well-functioning Governments accountable to the people" and to empower and enable the participation of the poor in the governance process by strengthening their social networks.[12] To help LDCs meet these goals, the ITU LDC programme has undertaken since 2001 several activities that strengthen the operations and functional capacities of the regulatory body in countries like Chad, Central African Republic, Comoros, Kiribati, Sao Tome and Principe, Timor Leste and Zambia. In addition, Burundi, Democratic Republic of Congo, Liberia, Rwanda, Sierra Leone and Somalia received assistance to strengthen the policy and regulatory environment in their telecommunications sector and to improve rural access to services by encouraging investment in those areas. Similarly, assistance provided during the 2006 biennial in Chad aimed at improving the efficiency of the regulatory authority through the provision of computers and related equipment, enabling the staff to go online and computerise current manual activities.

VoIP for e-Government convergence is a reality now in Mauritania.
Source: ITU.

Improving the transparency in the decision-making process and day-to-day operations of the telecom regulatory bodies in LDCs is also essential to improve network investment and to reduce frictions among diverse operators serving the LDC telecom markets. In 2003, ITU assisted in the implementation of IP-based platforms on the government optical fibre network in Ouagadougou, Burkina Faso, and in Mauritania, to develop government services and applications by covering the national territory. As a result of these projects, participating countries will benefit from more secure, accessible, transparent and efficient government operations and services. In Mauritania, the target was to install 6 000 internet-connected PCs in government offices (ministries and other administrative offices) by 2006, as part of the implementation of the National ICT Strategies project developed with ITU's assistance. Within this area, in 2006, the ITU supported the development of a website for the Ministry of Communications of Niger, as well as the computerization of the postal service management in Nepal. In 2009, the ITU helped the Communications Authority of Zambia draft a corporate and strategic plan that will improve its operations.

As discussed in Chapter 4, sector restructuring has been an essential process to promote the deployment and upgrade of telecommunication networks in LDCs. During the 2006-2010 period, the LDC programme delivered assistance in this area to Comoros, Eritrea, Guinea Bissau, Sierra Leone and Zambia. In the case of Guinea Bissau, for example, the ITU provided institutional support to regarding legal and technical issues referring to traffic control and management.

With respect to rural communications, and within the framework of Commitment 2, ITU implemented in 2002 rebuilding projects for rural telecommunication infrastructure in Burundi and Rwanda, which had been destroyed by war. The projects, financed by ITU TELECOM Surplus Fund with ONATEL and RWANDATEL as partners, involved the installation of telecommunication equipment in rural areas and ICT training of personnel on the operation and maintenance of telecom networks. These projects were meant to improve nationwide access to telecommunications services in both urban and rural areas. As of today, these services have already positively impacted the development of other sectors, such as education, health, e-commerce, agriculture and business.

Activities under this commitment included the implementation of an e-Government project in Rwanda, in partnership with the European Commission. The first phase has provided Internet access, visa and passport control facilities at the Kigali airport, and secured e-mail services to main government offices. Other planned applications include video-conferencing among public institutions, as well as online systems, available at post offices, for issuing such government documents as passports and work permits. This project will give people, in both rural and urban areas, new access to administrative services. The project will help to ensure that the government is effective, accessible and accountable – and thus support Rwanda's goal of strengthening democratic institutions that were shattered by war.

Moreover, in Uganda, ITU supported the provision of ICT services and applications in remote and rural areas, focused specifically on including women, indigenous people and people with disabilities. The action included the implementation of universal access pilot projects in diverse locations, procuring ICT equipment. In this same line, in 2010, the LDC programme procured equipment to established multi-purpose community centres in Haiti, continuing with previous concentrated assistance delivered to this SIDS.

In the framework of capacity building, the ITU-D has organized also annual sessions of the Forum on Telecommunication and ICT Regulation and Partnership (FTRA), covering themes such as "Connect Africa: challenges for regulators and operators" in 2008 and "Universal Service/Access Fund" in 2009. The 11th FTRA, held in The Gambia, in July 2010 examined the role of fibre optic broadband, sharing capacity and open access principles to achieve goal 1 of Connect Africa, which relates to achieving the interconnection all African capitals and major cities with ICT broadband infrastructure and strengthen connectivity to the rest of the world by 2012. The forum provided the opportunity to analyse in depth the policy, regulatory and technical issues that could help the Africa region to secure the roll out of networks and access of affordable services in the continent.

Other symposia organized regularly by the ITU where policymakers can exchange experiences and learn best practices include the Global Symposium for Regulators (GSR), the Global Industry Leaders Forum (GILF), and the World Telecommunication Policy Forum (WTPF). In 2009, for example, WTPF-09, held in Lisbon, and attended by delegates of 118 Member States, including 29 of the LDCs, covered issues of great relevance to policymakers, such as convergence, next-generation networks and Internet, as well as emerging telecommunications policy and regulatory issues.[13] Similarly, the 10th Global Symposium for Regulators (GSR10), held in Senegal in November 2010, in collaboration with the Regulatory Authority for Telecommunications and Post (ARTP) of Senegal, focused on the challenges for regulators to stimulate nationwide broadband deployment through adaptive and targeted regulations and out-of-the-box tools.[14] The Symposium also discussed the need to keep up

with the pace of convergence and integration of ubiquitous networks, in particular through adapting institutional structure and mandates, adopting cutting-edge best practices and embracing new tools such as innovative dispute resolution techniques.

Advancement in Commitment 3: Building human and institutional capacities

Capacity building is one of the ten cross-cutting issues of the Brussels Programme of Action, and as such, it is involved in the achievement of all commitments. Among the goals included in its Commitment 3, the BPoA calls on LDCs and their development partners to improve "the collection and dissemination of relevant information, including in the establishment and improvement of national health facilities and statistics in LDCs", while building national capacity to access and use appropriate technology and know-how. This commitment also encourages institutional capacity building for the formulation of institutional development policies, improving the capacity for local knowledge creation in LDCs.[15]

In this respect, the ITU LDC Programme has supported capacity building efforts in Bhutan, Burkina Faso, Burundi, Chad, Djibouti, Haiti, Kiribati, Malawi, Myanmar, Sierra Leone, Somalia and Zambia. In Chad, for example, Personnel in the national telecommunication operator in Chad (SOTEL) received training on the use of the network-planning tool called PLANITU, used in finding minimum-cost solutions. ITU has assisted also in the establishment of ICT training centres in Eritrea and Uganda. In Eritrea, for instance, the ITU assisted developing a business plan for the establishment of the ICT Training Institute in 2001. The goal was to equip telecommunication staff with smart skills for the reform of the telecommunication sector in the country, after the Eritrean-Ethiopian war finished in 2000. Subsequently, ITU procured digital switch system equipment to support the training platform that will facilitate the provision of e-learning activities and the establishment of the training institution. Meanwhile, Mali received ITU support in the reorganization of the training centre for its telecommunication operator, SOTELMA.

The partnership between Cisco and ITU, launched in 2003, has enhanced human capacity building in government and public administration, in the field of IP networking. The project targeted least developed countries and assisted non-profit training and educational institutions in establishing the Cisco Certified Networking Associates of the Cisco Networking Academy Program. Through a train-the-trainer approach, ITU has provided affordable and relevant training, using both face-to-face

ICT training at an Internet Training Centre established by ITU in Bhutan.
Source: ITU.

workshops and e-learning methods. LDCs that benefited from this initiative since 2003 include: Afghanistan, Angola, Bangladesh, Bhutan, Burkina Faso, Cape Verde, Ethiopia, Lao P.D.R., Mali, Maldives, Mauritania, Mozambique, Samoa and Uganda.

In Bhutan, the ITU also supported, in collaboration with the European Commission, the establishment of Internet Training Centres (ITCs) in 2004. The ITCs provided two streams of Internet and ICT training programmes to end-users and advanced users, including courses on "How to design and set up an e-secure web-based service" and an "Introductory computer, software and digital technology" course.

To improve the LDCs' national capacity for using appropriate technology, ITU-D has developed a harmonized, automated technical administrative tool to support developing and least developed countries on spectrum management. The tool, named SMS4DC (Spectrum Management System for Developing Countries), covers terrestrial fixed, mobile, sound and television broadcasting services in the bands above 30 MHz, including GE-06 as well as satellite Earth stations in space service.[16] As part of its support to Eritrea and Liberia, the ITU LDC Programme provided these countries with access to the latest version of the SMS4DC software, which was released in November 2009.

ITU has fostered also capacity building for policy makers and regulators in developing and least developed countries through diverse regional regulatory meetings, workshops, training events and direct assistance activities. In 2007, the ITU, together with *info*Dev and the World Bank, launched the Global Capacity-Building Initiative (GCBI),[17] to "empower regulators with tools to establish an enabling environment to stimulate investment and innovation and build confidence in the telecommunications and ICT market."[18] Through the GCBI, ITU carried out many training programmes to build the capacity of policymakers and regulators to address regulatory challenges.

The Union's Human Capacity Building programme also organizes regional and international trainings, workshops, and provides regulators access to e-learning toolkits and networks of experts. ITU continues to support and expand the African Centres of Excellence (CoE) network for English- and French-speaking countries, linking training providers in Africa to facilitate resource sharing in terms of facilities, expertise and training materials among institutions (Figure 5.4). The network expanded from 2 to 6 institutional nodes in 2009. Additionally, a CoE network for Spanish- and Portuguese-speaking countries in Africa was established with two new nodes in Angola and Mozambique, using government funds from Spain and Portugal.

Figure 5.4: ITU Academy Centres of Excellence Network

Source: ITU.

That same year, ITU launched a series of ITU Regional Human Capacity Development Forums, with the objective of promoting excellence in human capacity development in the ICT and telecommunication sector. Moreover, during the WSIS Forum 2009, ITU officially launched the ITU Academy, an initiative that pulls together the diverse education, training and information efforts of

the ITU in order to develop a harmonized and streamlined approach to capacity building on cutting-edge ICT innovations in areas such as NGN and mobile. The ITU Academy provides a common portal and platform[19] to allow for a single access point for ICT training opportunities, whether delivered face-to-face, through an instructor or via self-paced distance learning.

Finally, regarding capacity building and the improvement on the use of technology in the area of health, known as telemedicine and eHealth, an ITU TELECOM Surplus Fund pilot project was established in 2002 to link the University Hospital of Dakar-Fann in Senegal with the Regional Hospital in Dioubel. Thanks to ITU, the Government of Senegal and SONATEL, the transmission of medical images, as well as patient data records and other medical information, is now available. This project makes possible distance-consultation and the exchange of medical information. The same fund source was used to support a telemedicine pilot project in Guinea, connecting a hospital in Conakry, Guinea's capital, to two other hospitals based in rural areas. Also in 2002, Ethiopia, Tanzania and Uganda received assistance in the elaboration of distance learning and dissemination of information on tropical diseases. In Ethiopia, 10 hospitals were networked to a hub at the Tikur Anbesa Hospital of Addis Ababa, enabling health professionals to get training through the use of ICTs as shown in Figure 5.5 below.

Figure 5.5: Ethiopia's network of ICT linked hospitals (2002)

Source: ITU.

In addition, in 2003, Mozambique received assistance in the extension of telemedicine facilities from Beira (central region) and Maputo (capital) through ISDN links. Two central hospitals, one in Maputo and one in Beira, were connected by a telemedicine link using the existing telecommunication infrastructure. The establishment of a link between the two sites was for clinical and educational purposes. Doctors are now able to discuss cases that require high-level interpretation. The transmitted images are used to obtain a second opinion and to assess whether hospitalization is required before the transfer of patients to Maputo.

Moreover, the Union's Standardization Sector is supporting the deployment of eHealth applications by coordinating the development of a set of open global standards for those applications. It has developed the first version of a Roadmap for Telemedicine, which provides an overview of technologies and issues for the provision of telemedicine services.[20] Wide deployment of eHealth

applications, in particular in least developed countries, will require achieving interoperability among systems and reducing the cost of devices through economies of scale. The work of ITU-T in facilitating the development of global international standards with the participation of key stakeholders, such as governments, inter-governmental organizations, medical institutions and doctors, is essential to promote the use of ICT in the provision of health services in LDCs.

Advancement in Commitment 4: Building productive capacities to make globalization work for LDCs

Two of the targets included in Commitment 4 of the BPoA are of particular importance to the ITU: (1) "Increasing LDCs' communication networks, including telecommunication and postal services, and improving access of the poor to such services in urban and rural areas to reach the current levels in other developing countries" (Target 25); and "fostering concerted international partnership to bring the benefits of ICT to LDCs so as to improve connectivity and reduce the "digital divide" (section 4.B (d)).[21]

ITU is implementing several activities and country specific projects to promote the development of rural communications and infrastructure, and the introduction of new technologies and services in LDCs, including next generation networks planning. In this latter area, the ITU LDC Programme has worked since 2001 with Bhutan, Burkina Faso, Cambodia, Comoros, Djibouti, Eritrea, Mauritania, Nepal, Niger, Sudan and Yemen supporting the planning process for new ICT networks, including mobile cellular networks, fibre optics, VSAT networks, transmission backbone links and submarine cables, as well as providing training and developing feasibility studies for the introduction and management of new technologies and services that can help them bridge the digital divide. For instance, in 2001, Bhutan was given guidance in the preparation of tender documents for its cellular networks that resulted in their implementation. In Nepal, a pilot hybrid PSTN/IP network was set up this same year to enable migration from PSTN to IP, while Mauritania was also a beneficiary of IP network assistance. In 2003, a feasibility study was carried out for a submarine optical fibre network to link the Maldives and Myanmar to existing or planned submarine optical fibre networks, and Mali received assistance in the implementation of a VSAT network.

More recently, in Cambodia, the LDC programme supported a pilot project for the installation of village phones in underserved communities and the topological restructuring of the fixed and mobile communication network in the country. Meanwhile, in Eritrea, the Programme dedicated regular and ad hoc funds during 2009 and 2010 to study the feasibility of a fibre optic gateway, including cost and overall equipment requirements, and support the development of a master plan for connecting the backhaul link from the selected landing station to the international switch and to provide connectivity through the optical link between the capital Asmara and the capitals of all six regions in the country.

Rural infrastructure projects were implemented also in Nepal, Kiribati and Sudan. The Nepalese project continued work initiated during the 2000-2005 period, and included the installation of wireless radio equipment in eleven additional villages in remote areas of Nepal, as well as a collaborative e-Post project between ITU, the Universal Postal Union (UPU), the Nepal Telecommunications Authority and the Ministry of Information and Communication of the Government of Nepal. By 2008, the Nepal Wireless Networking project,[22] then in its third phase, had

connected more than 30 mountain villages in the Myagdi, Parbat and Kaski districts of Nepal using a Wi-Fi network. The villages connected to the network have gained access to ICT facilities and services, such as communications using Voice over IP (VoIP), Internet and e-mail services. ICT has provided them access also to educational opportunities through online e-learning, improved healthcare through telemedicine, as well as employment and business opportunities through e-commerce and community telecentres.[23]

The wireless network gives Nepalese rural communities access to eLearning and eHealth.
Source: ITU.

Meanwhile, the project currently being implemented in Kiribati aims to provide access to ICT services and applications through the establishment of four rural Internet connectivity system (RICS) sites on outer islands of Kiriba. This project is part of a larger initiative between the Union and the Department of Broadband Communications and the Digital Economy (DBCDE) of the government of Australia to assist member countries in the Asia Pacific region in addressing infrastructure and policy issues, while considering also initiatives in the areas of cybersecurity, gender, youth and disabilities. The project includes specific actions to respond to the unique telecommunication/ICT needs of Pacific Islands and SIDS through capacity building, workshops, and emergency disaster relief efforts.

Connectivity has also been improved in rural and underserved areas of LDCs through the installation of multipurpose community telecentres (MCT) during the 2001-2010 period in Bhutan, Burkina Faso, Cape Verde, Haiti, Lesotho, Madagascar, Malawi, Mali, Myanmar, Niger, Samoa, Senegal, Solomon Islands, Sudan, Tanzania and Uganda. These centres were designed to run along commercial lines with generated funds being injected back into the project. They provide Internet access, access to libraries and databases, as well as government services and information. Benefits from this initiative include: easy access to education materials through e-education; access to medical information and services; and the dissemination of business-related information that has tended to stimulate the rapid growth of local businesses and enabled farmers to easily access market data (e.g. prices of products, government online information). The facilities have gone a long way towards the training of the local population in ICTs and preparing unemployed persons for new job challenges and opportunities coming with the new information age.

Some of these MCT projects have taken advantage of existing infrastructure in postal offices to support, at the same time, the introduction of ePost services, as was the case in Bhutan and Lesotho. The ePost facility in Bhutan, for example, allows e-mail messages that are sent to the post office to be delivered as local mail.[24] Similarly, the network of ten MCTs established in the Solomon Islands

with the support of the ITU LDC Programme, installed a server, computers and software in diverse educational centres, including high schools and higher education campuses, to facilitate the provision of distance education and maximise the exposure of students to the benefits of ICT (Figure 5.6). The MCT network is expected to benefit students and nearby communities through training and mentoring, as well as by providing the community with relevant information captured from the Internet.

Figure 5.6: Network of multipurpose community telecentres in Solomon Islands

ITU-D is committed to enhancing awareness of, access to and skills in the use of ICTs among women, youth, indigenous people and people with disabilities as a development tool to support their social and economic activities. To promote the achievement of the Brussels Programme's cross-cutting priority issue of gender equality, ITU has implemented several projects destined specifically at supporting women, and introduced a special initiative programme focused on gender issues. Through the ITU LDC Programme, ITU procured computer equipment and training for a Multipurpose Community Centre (MCT) in Niamey, Niger, that benefitted the Anfani Mata Women's Group of Niamey.

As part of Bhutan's goal to add ICT to the curricula of all schools by 2010, and with the support of ITU, a project was carried out in 2005 to distribute computers to schools and religious colleges across the country. The Korea Agency for Digital Opportunity and Promotion (KADO) provided 200 used computers for that purpose, and recipients were selected from among those institutions with a low (or zero) ratio of computers to students. ITU's support involved liaising between the partners in the project, transporting the computers to Bhutan, and providing equipment for Internet connection. The Bhutan Information, Communication and Media Authority was responsible for arranging Internet connections, with the assistance of Bhutan TELECOM, as well as for organizing power supplies, installation and maintenance for the computers and appropriate training. In total, 13 secondary schools received computers under the project, some of which had never had such equipment before. In addition, 18 religious institutions nationwide were given computers. Although a private body, the Rigsum Institute of Information Technology, in the capital Thimphu, was also

included in the project. This public-private partnership resulted in the establishment of a small cybercafé to provide free Internet access at weekends for students of the institute and other schools.

Similarly, in Malawi, ITU equipped 12 multipurpose telecentres benefiting women in 2008 and 2009 and similar MCT projects were scheduled for implementation in Zambia and Sierra Leone during 2010. During the years 2008 and 2009, ITU also provided ICT training to businesswomen in Asia Pacific and developed training materials for women in the ASP region that can be disseminated in MCTs.

Blind graduates from the ATCB in Addis Ababa, Ethiopia. Source: ATCB.

MCTs designed to provide ICT access to persons with disabilities (PwDs) were implemented in Ethiopia, and similar projects were developed for implementation in Burkina Faso and Mali. In the case of Ethiopia, ad hoc assistance was given for the development of TTS software for the Ethiopian local language, Amharic, in supporting the Adaptive Technology Centre for the Blind (ATCB), based in Addis Ababa. This project is a joint initiative of ITU and the United Nations Educational, Scientific and Cultural Organization (UNESCO), which trained blind students, government employees and others to use computers equipped with adaptive devices such as voice synthesizers, magnifying hardware and software, as well as Braille embossers, scanners and printers. The objective of this project is to enable the visually impaired population in Ethiopia at large to use IT in reading documents written in the local language.

Support has also been delivered to youth, refugees and persons with disabilities in LDCs. The Union provided ICT equipment to three public schools in Tanzania (2 secondary and 1 school for blind children), using sponsorship funds from the Netherlands; equipment and training were provided also to a school in Zambia using sponsorship funds from the Czech Republic. In addition, in collaboration with the UN High Commissariat for Refugees (UNHCR) and a local NGO, ITU purchased, delivered and installed ICT equipment in Tanzania, in 2003, benefiting an estimated population of 135,000 refugees – mostly from Burundi.[25]

Access to ICT has stimulated the development and growth of local businesses, provided access to education facilities and medical information, among other benefits. The MCTs also catered for the needs of the local community, educational institutions, schools, international aid agencies and NGOs involved in relief work in the area. A similar project was implemented in Liberia starting in 2005 to assist refugees in acquiring ICT skills to improve their chances of finding a job. In 2009, a

Refugees, including women, have been trained to run the MCT themselves. Source: UNHCR.

project for a Training Centre for Returning Refugees in Liberia was launched. ICT equipment for a telecentre for youth and child soldiers was also provided in Dem. Rep. of the Congo.

Advancement in Commitment 5: Enhancing the role of trade in development

Among its targets, Commitment 5 encourages development partners and LDCs to "improve international competitiveness, including through trade facilitation measures and the use of electronic commerce and other facilities based on modern technology."[26] An essential facilitation measure is ensuring that the electronic transactions that take place over public telecommunication networks remain secure, reliable and user-friendly. As the sole Facilitator of WSIS Action Line C.5,[27] which focuses on "building confidence and security in the use of ICTs", the ITU is deeply committed to meet this WSIS goal through a range of activities.

Telecentre established in Sta. Catarina, Cape Verde.
Source: ITU/M. Mingues.

In 2001, ITU provided assistance and expertise to Burkina Faso, Cape Verde, Mali and Senegal in the design, development and implementation of secure e-commerce solutions, in addition to training courses and seminars to increase awareness on the potential of ICTs in enhancing business and trade. The ICT networks already established in these countries were upgraded with advanced security and trust technology and e-business platforms capable of meeting the needs of enterprises worldwide were established. In addition, Internet protocol applications were implemented in Burkina Faso that same year to render operations and services in government administration more secure and transparent. The General Delegation on ICT (DELGI) in Burkina Faso partnered with ITU and UNDP in the implementation of this project.

Starting in 2003, ITU has provided ongoing assistance to African LDCs for restructuring their telecommunication sector, including issues related to the General Agreement on Trades in Services (GATS), a World Trade Organization treaty. The ITU LDC Programme also provided assistance to Afghanistan, Cape Verde, Comoros and Ethiopia with activities that enhanced their ability to engage in electronic commerce and secure the environment in which those transactions occur. In Afghanistan, for instance, the ITU LDC Programme provided technical assistance, including equipment, for the establishment of the national Internet exchange of Afghanistan (NIXA), aimed at improving quality of service to the consumer. The NIXA will help reduce delays and data loss, improve peering of domestic traffic, boost traffic within Afghanistan and saving costs on international bandwidth. At the urgent request of the country's Ministry of Communications and Information Technology, the programme also delivered ad hoc assistance to Afghanistan by sending a team of experts from IMPACT to help the country on a cyber emergency response event.

During the 2002-2005 period, Burkina Faso, Mauritania and Tanzania were given assistance in the establishment of e-commerce legislation. The Union also supported Cambodia in 2002 and Cape Verde in 2010 with the organization and management of a Public Key Infrastructure (PKI) project to secure e-commerce. PKI is an infrastructure that verifies the validity or quality of a presented public-key certificate by checking digital signatures and certifying or authenticating the identity of the involved parts. The infrastructure provides end-to-end protection for all applications using this end-

to-end connection.[28] Projects using advanced security and trust technology based on PKI, including digital certificates and digital signature techniques, were carried out in 2004 in Bhutan, Burkina Faso, Cambodia, Senegal and Zambia.

It should be noted that connectivity projects mentioned under Commitment 4 have also opened opportunities for communities to engage in e-commerce activities. In Nepal, for instance, some of the communities connected to the Wi-Fi network through the Wireless Networking Project, have taken advantage of their Internet access to connect to the national business-to-business (B2B) e-commerce service called e-Haat Bazaar, an electronic gateway where rural communities can offer local products for sale online, promoting trade and market linkages within the country and at the international level.[29] The site also provides access to agricultural market prices, improving the efficiency of economic transactions.

Within the framework of ITU's e-strategy programme, many projects were implemented to build e-transaction infrastructures and Internet Protocol (IP)-based services and applications such as e-commerce and e-agriculture. To develop their information and telecommunications infrastructure, Uganda and Yemen implemented wireless IP networks in 2004. ITU supported also the implementation of e-agriculture projects in Mauritania, Myanmar and Samoa in 2004, enabling rural farmers to access information about the market price of their products to facilitate the establishment of direct relationships with buyers and the collection and distribution of agriculture information to the rural population. Access to information has improved farming and marketing methods for their products.

Creating a secure environment for e-transactions will require collaboration among policy makers, private sector, regulators, the judiciary and civil society associations. As facilitator of WSIS Action Line C5, ITU launched in 2007 the Global Cybersecurity Agenda (GCA), designed as an international framework for cooperation and response, where all these players can work together, sharing best practices and actively seeking global solutions to cybersecurity problems. The GCA focuses on building partnership and collaboration between all relevant parties in the fight against cybercrime.

Moreover, ITU is developing an integrated approach in cybersecurity, aimed at facilitating the establishment of national strategies and cybersecurity capabilities. Through its Development Sector, the Union is implementing activities to facilitate the deployment of IMPACT – the International Multilateral Partnership Against Cyber-Threats – services, specifically the Global Response Centre, to Member States (Figure 5.7). The Centre provides the global community with a real-time aggregated early warning system that helps member countries quickly identify cyberthreats and provide critical guidance on effective counter measures. In addition, in 2007, the ITU-D Study Group on "Securing information and communication networks: Best practices for developing a culture of Cybersecurity" developed a report on *Best Practices for a National Approach to Cybersecurity*, outlining a framework for organizing a national approach to cybersecurity. The Union has conducted also a series of regional capacity-building events on frameworks for Cybersecurity and Critical Information Infrastructure Protection (CIIP) and released a National Cybersecurity/CIIP Self-Assessment Toolkit and a Botnet Mitigation Toolkit, as part of its Cybersecurity Work Programme.

Figure 5.7: Network Early Warning System (NEWS) of IMPACT's Global Response Centre
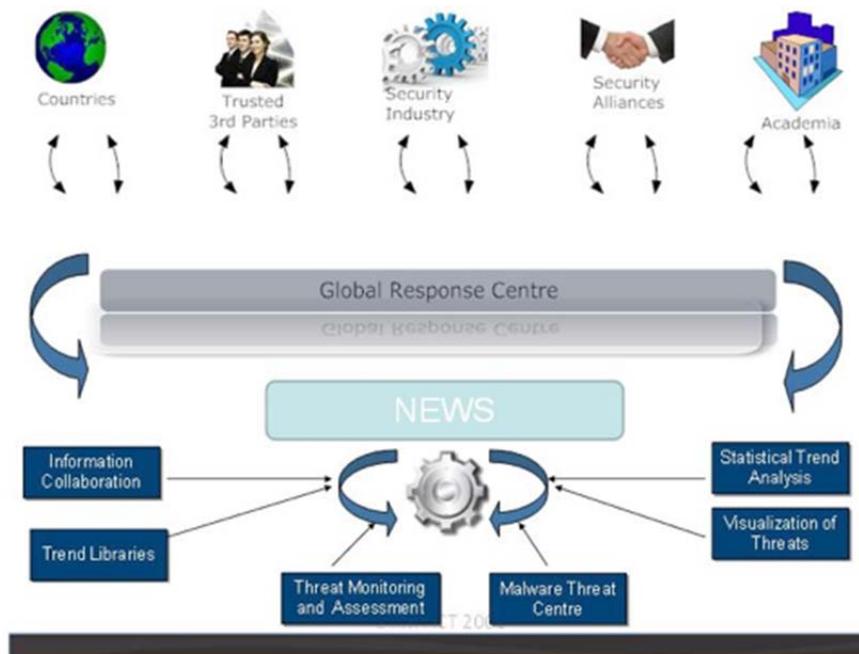
Source: ITU Cybersecurity site (http://www.itu.int/ITU-D/cyb/cybersecurity/impact.html).

In the area of radiocommunication, ITU has established clear security principles for IMT-2000 (3G) networks and, following the approval by the World Telecommunication Standardization Assembly in 2008, it is working on developing Recommendations for secure solutions in mobile banking and mobile commerce environments, including authentication methods and models of secure interaction between parties. It has also issued Recommendations on security issues in network management architecture for digital satellite systems and performance enhancements of transmission control protocol over satellite networks.

Finally, recognizing the pressing need to ensure users' safety of the Internet, particularly that of its most vulnerable users, in 2008 the Union launched, in conjunction with other UN agencies and partners, the Child Online Protection Initiative (COP). This global initiative is part of the Union's GCA framework and aims to promote the online protection of children and young people by providing guidance on safe online behaviour.[30] In 2009, four guidelines on the online protection of children were prepared in close collaboration with numerous UN agencies and other organizations, including INTERPOL and the European Network Information Security Agency (ENISA). Through this initiative, ITU is working with policymakers, educators, industry, the media, NGOs, and with children themselves, to promote awareness and develop effective strategies to protect young people from cybercriminals of all kinds.

Advancement in Commitment 6: Reducing vulnerability and protecting the environment

Commitment 6 of the Brussels Programme of Action encourages LDCs and their development partners to pursue or intensify "efforts to strengthen national early warning and forecasting mechanisms, implementing preventive measures and sensitizing relevant parts of the population to the benefits of disaster preparedness and prevention".[31] ITU is actively working in this area with

LDCs to improve social, economic and technical resilience and increasing flexibility within systems. In particular, ITU assists least developed countries in incorporating into national sustainable development strategies appropriate adaptation and mitigation measures against weather-related events, such as hurricanes and cyclones.

In 2003, ITU launched a collaboration with the United Nations Institute for Training and Research (UNITAR) on an "Environment Information Circulation and Monitoring System on the Internet Programme for Africa (Système d'information et de suivi de l'environnement sur Internet – SISEI)". It is a capacity-building programme to assist countries, subregions and organizations to validate, circulate and harness relevant environmental information. It is an attempt to meet the information needs of the environmental component of the New Partnership for Africa's Development (NEPAD). The ITU TELECOM Surplus Fund supported about 10 country projects between 2003 and 2005. Other partners who collaborated in this Programme were the Observatory for Sahel and Sahara (OSS) and the United Nations Environment Programme (UNEP). The programme will assist African countries to achieve a rapid and effective appropriation of modern ICTs to secure the management of national environmental data for environmental protection and sustainable development.

Since emergency telecommunications is one of its priority areas, the ITU LDC Programme has undertaken multiple activities to assist countries in disseminating alert messages, setting up early warning systems, designing national emergency telecommunications plans and climate change adaptation plans, designing standard operating procedures, training, and establishing national operations and coordination centres. The ITU LDC Programme's preparedness assistance includes activities for the setting up and integrating ICT into early warning systems and reliable alerting systems, as well as designing of National Emergency Telecommunications Plans covering technical, legal, and regulatory issues, including Standard Operating Procedures.[32] In addition, the Programme facilitates access to various Geographic Information System-based modelling and simulation tools.

On 8 January 2005, the Tampere Convention on Emergency Telecommunications came into force. This was an ITU-initiated treaty, whose ratification enables the trans-border use of telecommunication equipment by humanitarian organizations. Prior to the treaty, regulatory barriers that made it extremely difficult to import and rapidly deploy telecommunications equipment for emergencies often impeded humanitarian efforts. ITU and the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) were the driving forces in drafting this treaty. During the 2006-2007 biennium the ITU LDC Programme designed also National Emergency Telecommunications Plans guidelines and assisted 95 countries in ratifying and implementing the Tampere Convention, draft emergency telecoms laws, develop national emergency telecommunications plans and conducting damage assessments. In Bangladesh, for example, the ITU worked closely in 2006 with the Bangladesh Telecommunication Regulatory Commission and the Asian Disaster Preparedness Center to assess the current situation of the country's emergency communications and give recommendations on the setup for a National Emergency Telecommunication and/or National Early Warning System (Figure 5.8). As part of the project, ITU also organized a local workshop on Emergency Telecommunication for Disaster Management.[33] More recently, ITU responded to the request of Cape Verde (2010), Tanzania and Zambia (2009) to help them design National Emergency Telecommunications Plans to address the adverse impact of climate change in their countries.

Figure 5.8: Proposed dissemination/communication network of the Flood Forecasting and Warning Center in Bangladesh
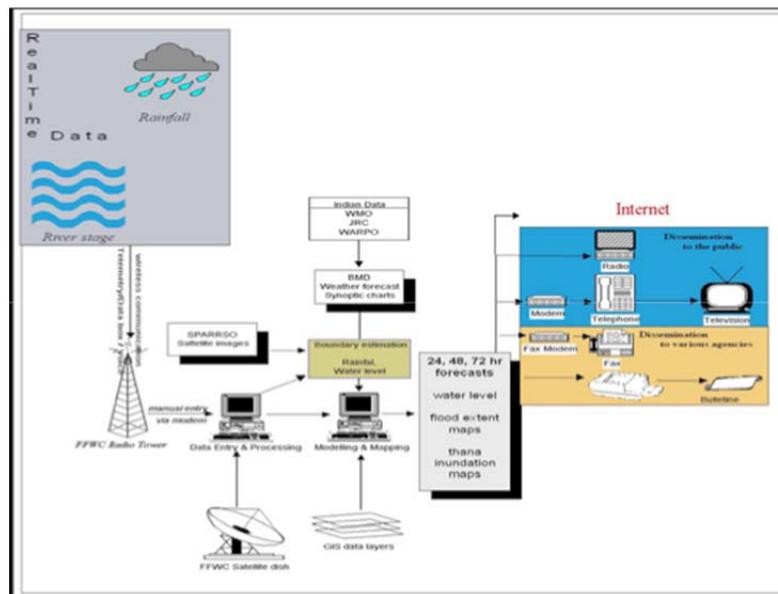
Source: ITU.

To build capacity in the area of emergency communications, ITU organized, in collaboration with various partners, nineteen regional and global forums on emergency telecommunications between 2006 and 2010.[34] In 2007, for example, it organized the Global Forum on Effective Use of Telecommunications/ICT for Disaster Management: Saving Lives[35] in Geneva, bringing together the main stakeholders active in developing, deploying and using Telecommunications/ICT for disaster mitigation to serve as a forum where they could identify concrete strategies and adopt practical measures. Regional and international events were also held this year in Indonesia, Cameroon and Egypt. In 2008, the ITU LDC Programme provided assistance to 14 Central African region countries on disaster preparedness through a training workshop in Rwanda, to all the southern and eastern African countries through training in Zambia and a workshop for the West African region in Senegal; it also hosted a high level session at the 3rd Asian Ministerial Conference on Disaster Risk Reduction.[36] In 2010, as part of ITU's WSIS Forum 2010, the LDC Programme organized a high level debate on ICTs for Disaster Management that explored the role ICT can play on disaster prediction, monitoring and detection, in the coordination of search and rescue operations, as well as in providing critical information for victims of disasters.

Examples of ITU national and regional events on disaster management and mitigation.
Source: ITU.

In the area of disaster relief, ITU signed in 2002 a technical cooperative agreement with Inmarsat for the co-financing of activities aimed at providing practical solutions in this area. In the arrangement, Inmarsat contributed funds, matched by ITU, that were used in the procurement of Inmarsat Global Area Network (GAN) satellite terminals with the capability of supporting mobile ISDN and mobile packet data services. This equipment has been successfully used in disaster situations in the framework of implementing Resolution 34 and Resolution 36 on telecommunications in the service of humanitarian assistance, that were adopted by ITU's third World Telecommunication Development Conference in 2002 and ITU's Plenipotentiary Conference of 2002, respectively.

Assistance has been provided through the deployment of satellite terminals for voice and high-speed data for disaster response and relief to a number of countries struck by disasters, for use in coordinating rescue operations and for telemedicine purposes.[37] This equipment was deployed in Sri Lanka in 2005 at the time of the South-East Asia earthquake and consequent tsunami; in Pakistan, after the 2005 earthquake; in Bangladesh following floods of September 2007; in Uganda following floods of October 2007; in Zambia during the January 2008 floods; in Myanmar following the May 2008 floods; in more than 20 countries in 2009 and in Haiti, after the 2010 earthquake.[38]

To promote coordination of emergency relief efforts, ITU has established a coordination group called the Partnership Coordination Panel on Telecommunications for Disaster Relief (PCP-TDR) gathering people working with standardization of telecommunications technologies for disaster relief (ISO and OASIS, for example) and representatives of relief organizations, such as UNHCR, the UN Office for Coordination of Humanitarian Affairs, the International Federation of the Red Cross and Red Crescent, and Telecoms Sans Frontière.

Other coordination and partnership activities in this area include the designation of international numbering resource 888 to the UN for use in disaster relief in 2007 and the establishment of more than 16 Cooperation Agreements with industry partners, resulting in funds and equipment being provided to ITU for use in responding to emergencies for the benefit of countries in 2009.[39]

The ITU LDC Programme has also published several reports on emergency telecommunication topics. In 2002, ITU published the first edition of the *Handbook on Disaster Communications*, as adopted by ITU-D Study Group 2 Question 16/2. This publication provides guidance for those involved in humanitarian assistance using telecommunications to mitigate the effects of disasters. The first part is intended to provide a background framework for policy-makers who have responsibilities in the area of disaster communications planning and for those who have an operational role. In 2004, ITU prepared the *Handbook on Emergency Telecommunications*, which is a manual being used by many actors involved in disaster relief work. Three years later, ITU launched the *Compendium of ITU Work on Emergency Telecommunications*, which compiles the work being done by ITU's three Sectors in the field of emergency telecommunications. Other relevant publications released during the 2006-2010 period include the report on *Best Practice on Emergency Telecommunications* and the report on *Question 22/2: Utilization of ICT for disaster management, resources, and active and passive space-based sensing systems as they apply to disaster and emergency relief situations - Guidelines on the Common Alerting Protocol (CAP)*.[40]

ITU involvement in climate change dates back to the adoption of Res. 35 at the Kyoto Plenipotentiary Conference on "Telecommunications Support for the Protection of the Environment". To support the combat against climate change, ITU organized two symposia in 2008

focusing on ICTs and climate change and has participated actively since then in the work of the UN system, including the United Nations Framework Convention on Climate Change (UNFCCC) and the UN's Environmental Management Group, to bring the ICT perspective to global discussions of climate change. The Union is acting also to attain climate neutrality in its own operations. As part of its work in this area, the ITU developed the scoping study *ICTs for e-environment,*[41] to promote the use telecommunication and ICTs in the adaption to and mitigation of the effects of climate change.

Figure 5.9: ITU-D publications on emergency telecommunications (2004-2010)
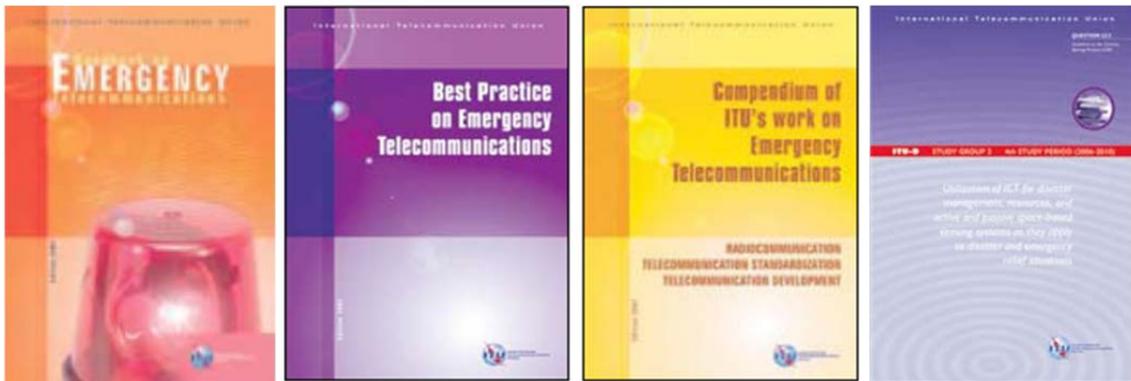
Source: ITU.

Through its Standardization sector, ITU develops Recommendations that are fundamental to the implementation of interoperable systems and telecommunication facilities, allowing relief workers to smoothly deploy telecom equipment and services. ITU has created an Action Plan for Standardization on Telecommunications for Disaster Relief and Early Warning, motivated by the identification of the need for new telecommunication standards following the Indian Ocean tsunami of December 2004.[42] Efforts to develop standards for more energy-efficient ICT equipment also play a large role in mitigation. Some of ITU Recommendations promote the use of more energy efficient devices and networks and the development of technical standards to limit and reduce the power requirements of ICT equipment and services.

Finally, through the ITU Radiocommunication Sector, ITU has actively studied areas such as wireless Internet access (terrestrial and satellite broadband); emergency radiocommunications to support disaster prediction, detection, mitigation and relief; and remote sensing systems for providing information on environment control and climate change.[43] Radiocommunication agreements contribute to the monitoring of climate change. The Union allocates radio-frequency spectrum to foster operations without interference of radiocommunications systems and satellites used for climate monitoring and control, weather forecasting, remote sensing and disaster prediction and detection.

Advancement in Commitment 7: Mobilizing financial resources

The final Brussels Programme of Action Commitment focuses on the mobilization of financial resources. Of particular importance to the ITU are the targets of strengthening partnerships and enhancing the effectiveness of ODA, and "supporting LDCs' efforts to attract foreign businesses and their affiliates, encouraging the appropriate dissemination of tangible and intangible assets, including technology, to domestic enterprises in LDCs".[44]

ITU has been very active in mobilizing resources for the benefit of LDCs, particularly building private-public partnerships. Various strategies were used, including the holding of roundtables in order to bring development partners together to discuss the funding of development projects. For example, in 2001 roundtables were held for Eritrea, Guinea-Bissau, Mozambique, and Nepal to promote their ICT and telecommunication projects to development partners. The aim was to establish private-public co-financing of infrastructure, so as to bring increased investment into the telecommunication sector of these countries. An array of projects were presented on rural telecommunication development through the use of privately operated pay phones for the public, capacity building to increase the efficiency and productivity of telecommunication professionals and the development of new technologies and infrastructure to establish direct links to different African countries aimed at attaining low charges, among other benefits.

In 2003, a partnership roundtable was held in Arusha, Tanzania, for the benefit of the Central African Republic, Malawi, Mali and Zambia. Another partnership roundtable took place in Coventry, UK, for Bhutan and Kiribati. Haiti and Djibouti also benefited from partnership roundtables held in Mexico City and Beirut, respectively. In the same spirit, ITU and the Commonwealth Business Council organized the first Global ICT Forum for the Least Developed Countries in Mauritius in July 2004. The meeting attracted 150 participants, including 20 Ministers from LDCs, business leaders, civil society and donor agencies, to consider ways to help LDCs join the information society. The Forum enabled LDCs to present ICT projects to development partners. Ninety per cent of the projects that were negotiated during the Forum have either been implemented or are ongoing, thanks to co-financing arrangements involving ITU, the private sector, development banks, and the countries themselves. Representatives from almost all the LDCs attended the Forum with fellowships provided by ITU. Some of the projects executed by ITU include assistance to Bhutan in establishing a "train-the-trainers" programme under the ITCI-DC. Assistance was provided to the Royal Institute of Management for Training in April 2005. Also as a result of the meeting, the ITU/I-linx/Inmarsat Global e-Learning Project merged with NEPAD's e-schools initiative to provide rural schools in developing African countries with suitable IT equipment and connection to the internet. The first NEPAD e-school for the Inmarsat consortium was launched in 2005 in Mali.

Building on achievements of partnership roundtables organized between 2001 and 2005, the ITU LDC Programme held partnership roundtables on bilateral and multilateral levels for LDCs and SIDS in Geneva, Switzerland in 2006, 2007 and 2008. These activities were successful in mobilising resources that were used to finance projects in some SIDS in the Pacific and the organization of a forum on next generation technologies. The forum, held in Sidney, Australia in October 2008, brought together 126 delegates, including policymakers, regulators, industry representatives and international organizations.

The ITU LDC Programme itself has provided funds, in the form of fellowships, to increase the participation of LDC representatives at events, workshops and training courses organized by the Union during the 2001-2005 period (Chart 5.4).

Chart 5.4: ITU's contribution towards the implementation of Commitment 7, 2001-2005
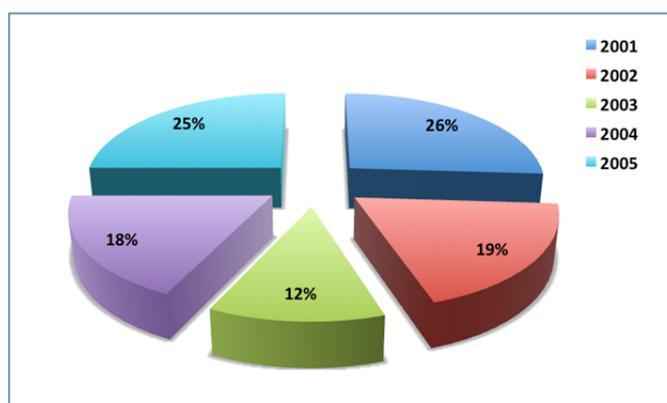
Source: ITU.

In 2006, 95 per cent of the requests for fellowships were met. Most of the beneficiaries were from the regulatory bodies, which sent staff to other institutions for training.[45] Between 2007 and 2010, the ITU LDC programme provided a total of 105 fellowships to LDC representatives from the four ITU regions concerned to cover their participation expenses at regional and international events organized by the programme. Chart 5.5 shows the distribution of fellowships supported in each of the ITU regions since 2006, using funding from the ITU LDC Programme specifically. Most of the fellowships provided during the 2006-2010 period went to the African region (41 per cent), where several regional events took place during this period. Importantly, 27 per cent of the fellowships were granted to representatives of diverse regions to attend international events, particularly those held in Geneva at ITU headquarters.

Chart 5.5: Fellowships granted through the ITU LDC Programme, by ITU region, 2006-2010
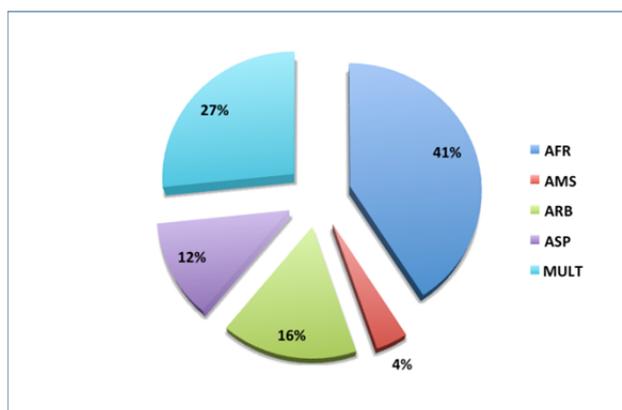
Note: AFR=Africa, AMS= America, ARB= Arab States, ASP= Asia and Pacific, MULT= Multiple regions.
Source: ITU.

The mobilization of financial resources and the promotion of partnerships have been the central focus of an initiative called "Connect the World"[46] that was launched by ITU in 2005. This initiative seeks to mobilize human, financial and technical resources for the implementation of the connectivity targets of the WSIS and the Regional Initiatives adopted by Member States at the ITU World Telecommunication Development Conference (WTDC). As part of the Connect the World initiative, ITU has organized a series of regional CONNECT summits to stimulate ICT development

partnerships with key global and regional institutions, including development banks and agencies and major industry players among others. So far, these summits have been held for Africa and the Commonwealth of Independent States, but others are planned for the Asia and Pacific, the Americas and the Arab States regions.

The first in the series, the Connect Africa Summit took place in Kigali, Rwanda, in October 2007, gathering representatives of 43 countries in Africa, including 23 at the ministerial level. Some 20 industrial leading companies also participated, along with development banks, international organizations and other stakeholders. The Summit – organized by ITU, the African Union, the World Bank Group and the United Nations Global Alliance for ICT and Development, in partnership with the African Development Bank (AfDB), the African Telecommunication Union, the UN Economic Commission for Africa (UNECA) and the Global Digital Solidarity Fund – debated issues related to broadband ICT networks, rural connectivity, capacity building, applications and services, and an enabling environment.

During the summit, partners pledged USD 55 billion to implement the agreed goals. The mobile industry, for instance, announced its plans to invest more than USD 50 billion in sub-Saharan Africa over the following five years to provide more than 90 per cent of the population with mobile coverage. The investment would be used to extend the reach of GSM mobile networks, enhanced with GPRS, EDGE and HSPA technologies, to provide a rich suite of mobile multimedia services, including Internet access. Since 2007, GSMA[47] has invested USD 20 billion in wireless infrastructure and services across Africa, and several other partners of the series have invested in the African LDCs, either on their own or through multi-stakeholder partnerships. Africa Summit partners have reported so far investments of over 21 billion in infrastructure and services (Box 5.1).

In Mali, ITU has helped provide Internet access to secondary schools in rural areas, in collaboration with the Mali government and private-sector partner, Swisscom. Located in the trans-Saharan desert, 1,000 km. from the capital of Mali, the Timbuktu High School is now connected to the Internet, and students receive a world of information. This is part of ITU's overall scheme to connect as many schools as possible across the world to the Internet in order to make the most of this educational technology.

In 2009, within the framework of the Connect the World initiative, the ITU launched three additional initiatives to build upon and strengthen promising projects that start in one region or with one industry partner. These initiatives seek to provide an attractive, open platform and a brand that can be promoted to additional partners globally or in various regions. The *Wireless Broadband Partnership*[48] builds on the wireless broadband project in Africa mentioned in Box 5.1 and aims at providing high-speed connectivity for developing countries, with extra capacity for public uses, including schools and hospitals. The *Connecting Villages*[49] initiative seeks low cost solutions for basic connectivity in rural areas. As part of this initiative, ITU has entered into an agreement with the Nokia-Siemens Network (NSN) to implement up to 30 sites of Village Connection Solution worldwide, of which the first four sites have been undertaken in the Asia and Pacific region. Finally, the *Connect a School, Connect a Community*[50] initiative focuses on partnership efforts to promote broadband school connectivity to serve both students and the communities in which they live, with a special emphasis on disadvantaged and vulnerable groups, such as women and girls, indigenous people, persons with disabilities, and youth and children.

Box 5.1: Selected examples of ITU projects related to the Connect Africa Initiative

ITU is actively playing its catalytic role by promoting the creation of public and private partnerships. Some of the projects being implemented by ITU with partners, under the umbrella of the Connect Africa initiative, include:

- *Wireless Broadband Infrastructure project*: In partnership with the McCaw Foundation, this USD 6.4 million project aims to connect underserved populations in rural and remote areas, and provide free or low-cost wireless broadband connectivity to public service providers, such as hospitals, libraries, and schools. The first phase, targeting Burundi and five other sub-Sahara African countries, will also develop ICT applications, train local experts on wireless communication networks and develop a national ICT broadband network plan for the beneficiary countries. The World Health Organization has joined in partnership to further support the deployment of health care applications.

- *ITU/UN Economic Commission for Africa projects:* The partners are jointly implementing an e-employment project in Congo, in addition to the Central African backbone project being implemented by ITU, the Central African States, AfDB and the World Bank.

- *West-Africa*: Activities included technical assistance in the transposition of the Additional Acts of the Economic Community of West African States (ECOWAS) and the Union Economique et Monétaire Ouest Africaine (UEMOA) Directives, including in Côte d'Ivoire, Guinea and Liberia; and sub-regional workshops on cybersecurity and undersea cable regulation for the West Africa Telecommunications Regulators Assembly (WATRA), in collaboration with the German development agency, GTZ.

- *Central Africa:* Ministers in charge of Telecommunications and ICT adopted five Directives in November 2008, with the financial support of the *Organisation Internationale de la Francophonie* and in coordination with the World Bank's Central African Backbone project (CAB).

- *Southern Africa:* Update of the Southern Africa Development Community (SADC) Policy Guidelines on universal service and development of a SADC cybersecurity framework.

Source: ITU-D Partnership programme.

Beyond these initiatives, the ITU will continue its efforts to mobilize financial resources to LDCs for the development of their telecommunication and ICT sectors. At its last World Telecommunication Development Conference, held in Hyderabad, India in June 2010 – where the programme of activities to be implemented from 2011 to 2014 were adopted –, the ITU called on Member States and Sector Members to establish partnerships with the LDCs, either directly or through ITU, to "bring increased investment into the ICT sector and to stimulate the modernization and expansion of networks in those countries in a bold attempt to reduce the digital divide and to achieve the ultimate goal of universal access in line with the Geneva Plan of Action, the Tunis Commitment and the Tunis Agenda."[51]

The following chapter describes some of the projects ITU has undertaken to support LDCs in the last ten years.

6 Project highlights

Concurrent with the activities undertaken through the ITU LDC Programme, the Union has implemented 60 projects that, while mostly centred in developing economies in general, have benefitted also least developed countries. As shown in Table 6.1, like the LDC Programme, several of these projects focus on the development of ICT policy frameworks, sector reform, the deployment of rural communications and Multipurpose Community Telecentres (MCT), telemedicine projects, capacity building and environmental related topics.

In contrast to the activities conducted through the LDC Programme, which are subject to a two-year funding cycle, these projects are usually implemented over several years. Some of them are regional in nature and have served as the umbrella for specific actions undertaken by the LDC programme during a particular biennial. Also because of this mostly regional nature, it can be stated that all the LDCs have benefitted from the implementation of these projects, even when not individually listed in Table 6.1.

Table 6.1: BPoA Commitments and their relation to ITU-D projects implemented in LDCs, 2001-2010

Commitment 1: Fostering a people-centred policy framework		
Year	**Nature of key assistance provided to countries**	**Beneficiary LDCs**
2000-2008	Liberia telecommunication sector reform	Liberia
2000-2009	Advancement of national policies for universal access	Cape Verde, Malawi, Nepal
2001-2008	Emergency support to the Ministry of Communications of Afghanistan	Afghanistan
	Telecommunications sector development and reform in countries in special need	Burundi, Liberia, Rwanda, Somalia, Sierra Leone
2007	ITU- French Ministry for Foreign and European Affairs: Directives Application of the ECOWAS in Burkina Faso and Senegal	Burkina Faso, Senegal
	ITU-Ministry of Information and Communication: Feasibility study on digital broadcasting roadmap in Africa	Africa
2008	Support for harmonization of the ICT policies in Sub-Sahara Africa	Africa
	Enhancing competitiveness in the Caribbean through the harmonization of ICT policies, legislation and regulatory procedures	Haiti
2008-2009	ICT Policy and regulatory cooperation in the Asia Pacific region and addressing the unique ICT needs of the Pacific Island countries	Afghanistan, Bangladesh, Bhutan, Cambodia, Kiribati, Lao, Maldives, Myanmar, Nepal, Samoa, Solomon Islands, Tuvalu and Vanuatu
2008-2011	Support for the establishment of harmonized policies for the ICT market in the ACP	Africa, Caribbean and Pacific group of States
	Capacity building and ICT policy, regulatory and legislative frameworks support for Pacific Island states	Kiribati, Samoa, Solomon Islands, Timor Leste, Tuvalu and Vanuatu
	Enhancing competitiveness in the Caribbean through the harmonization of ICT policies, legislation and regulatory procedures	Haiti

Year	Nature of key assistance provided to countries	Beneficiary LDCs
2009	Direct assistance to Benin and Sierra Leone, for transpositions of ECOWAS, Supplementary Acts on the Harmonization of policies and regulatory framework for the ICTs	Benin, Sierra Leone
	Support for harmonization of ICT regulatory guidelines in Southern Africa on universal access/service	Angola, Botswana, Dem. Rep. of the Congo, Lesotho, Malawi, Mozambique, Tanzania, Zambia

Commitment 2: Good governance at national and international levels

Year	Nature of key assistance provided to countries	Beneficiary LDCs
2002-2008	Reconstruction of rural telecommunication infrastructure destroyed by the war in Burundi	Burundi
2004-2008	ICT infrastructure for rural communities in Bhutan	Bhutan
2006-2009	Assistance for the establishment of sector governance in telecommunications in East Timor	East Timor
2008	Capacity building and ICT policy, regulatory and legislative frameworks support for Pacific Island States	Kiribati, Samoa, Solomon Islands, East Timor, Tuvalu, Vanuatu
	Policy and regulatory assistance in Asia and the Pacific	Asia and Pacific
2008-2010	Rural telecommunications, ICT services and entrepreneurship development	Angola, Burundi, Benin, Burkina Faso, Botswana, CAR, Chad, Cape Verde, Dem. Rep. of the Congo, Equatorial Guinea, Eritrea, Ethiopia, Gambia, Guinea Bissau, Guinea, Lesotho, Liberia, Madagascar, Mali, Malawi, Mozambique, Niger, Rwanda, Senegal, Sierra Leone, Sao Tome and Principe, Togo, Uganda, Tanzania and Zambia

Commitment 3: Building human and institutional capacities

Year	Nature of key assistance provided to countries	Beneficiary LDCs
1998-2008	Regional workshop on telemedicine for English speaking African countries (Phase 2)	Mozambique
	Teleradiology and medical consultations	Ethiopia
	Telemedicine link in Senegal	Senegal
	Centre of Excellence in Western and Central Africa (Dakar)	Western and Central Africa
	Centre of Excellence in the Asia-Pacific region	Asia and Pacific region
2001-2008	Telemedicine pilot project in the Republic of Guinea	Guinea
	Telemedicine link between Yangon and Mandelay, Myanmar	Myanmar
2003-2008	Telemedicine project in Mauritania	Mauritania
2004-2010	Rehabilitation of the Information Communication Training Institute	Afghanistan
2006-2010	Partnership on measuring ICT for development in developing countries	Multiple countries

Year	Nature of key assistance provided to countries	Beneficiary LDCs
2007	Strengthening the collaboration between ITU-T and ITU-D to transfer skills on ICT Standardization to Asia Pacific countries	Asia and Pacific
2007-2009	Centre of Excellence network in the Asia-Pacific region	Afghanistan, Bangladesh, Bhutan, Cambodia, Kiribati, Lao, Maldives, Myanmar, Nepal, Samoa, Solomon Islands, Tuvalu, and Vanuatu
	Caribbean Nodes for Centre of Excellence in the Americas Region	Caribbean (Haiti)
2007-2010	Educational assistance to the Information and Communication Training Institute (EA-ICTI)	Afghanistan
	Centre of Excellence network in the Arab region – Phase II	Arab States
	Strengthening the collaboration between ITU-T and ITU-D to transfer skills on ICT standardization to Asia Pacific countries	Afghanistan, Bangladesh, Bhutan, Cambodia, Kiribati, Lao, Maldives, Myanmar, Nepal, Samoa, Solomon Islands, Tuvalu and Vanuatu
	ITU-AMD Learning Labs	Selected LDCs
2008	Capacity building and ICT policy, regulatory and legislative frameworks support for Pacific Island States	East Timor, Kiribati, Samoa, Solomon Islands, Tuvalu, Vanuatu
2008-2009	Policy and regulatory assistance in Asia and the Pacific	Afghanistan, Bangladesh, Bhutan, Cambodia, Kiribati, Lao, Maldives, Myanmar, Nepal, Samoa, Solomon Islands, Tuvalu and Vanuatu
2009	Basic PC and training course in Zambia	Zambia
2009-2011	Translation and Arabisation of ICT terminology	Arab States
2010	IICT Indicators and capacity building for ICT measurement in the Arab region	Arab States
Commitment 4: Building productive capacities to make globalization work for LDCs		
Year	Nature of key assistance provided to countries	Beneficiary LDCs
1997-2008	Regional project for assisting the development of the telecommunications in Africa (INDAFTEL)	Africa
1998-2008	Multipurpose community telecentre	Mali and Tanzania
	Pilot project for a Multipurpose Community Centre (MCT) in Benin	Benin
	Planning and implementation of the Nakaseke Multipurpose Community Telecentre in Uganda	Uganda
1999-2008	Feasibility study for the INTELCOM II programme (CEDEAO)	Africa
2003-2008	Wireless IP in Uganda	Uganda
	Preliminary assistance to NEPAD	Africa
2004-2008	ICT infrastructure for rural communities in Bhutan	Bhutan

Year	Nature of key assistance provided to countries	Beneficiary LDCs
2008-2010	Rural telecommunications, ICT services and entrepreneurship development	Angola, Burundi, Benin, Burkina Faso, Botswana, CAR, Chad, Cape Verde, Dem. Rep. of the Congo, Equatorial Guinea, Eritrea, Ethiopia, Gambia, Guinea Bissau, Guinea, Lesotho, Liberia, Madagascar, Mali, Malawi, Mozambique, Niger, Rwanda, Senegal, Sierra Leone, Sao Tome and Principe, Togo, Uganda, Tanzania and Zambia
2009	Project for the creation of a cybercafé for people with blindness and vision problems, and strengthening of a formation cell on adapted ICT	Burkina Faso
2009	Malawi Multipurpose Community Telecentres project	Malawi
2010	Multipurpose Community Telecentres for Zambia	Zambia
2010	Multipurpose Community Telecentres for rural and underserved areas of Sierra Leone	Sierra Leone

Commitment 5: Enhancing the role of trade in development

Year	Nature of key assistance provided to countries	Beneficiary LDCs
2008-2009	Policy and regulatory assistance in Asia and the Pacific	Afghanistan, Bangladesh, Bhutan, Cambodia, Kiribati, Lao, Maldives, Myanmar, Nepal, Samoa, Solomon Islands, Tuvalu and Vanuatu

Commitment 6: Reducing vulnerability and protecting the environment

Year	Nature of key assistance provided to countries	Beneficiary LDCs
2004-2011	Emergency telecommunications and universal access for LDCs	Multiple LDCs
2005-2008	Rehabilitation and reconstruction of telecommunication infrastructure and contribution to the establishment of an Early Warning System in Earthquake/Tsunami-hit countries	Asia and Pacific
2008-2009	Policy and regulatory assistance in Asia and the Pacific	Afghanistan, Bangladesh, Bhutan, Cambodia, Kiribati, Lao, Maldives, Myanmar, Nepal, Samoa, Solomon Islands, Tuvalu and Vanuatu

Source: ITU.

Regarding the distribution of projects across the areas of the BPoA commitments, Chart 6.1 shows an emphasis on the implementation of Commitment 3 (37 per cent), which focuses on building human and institutional capacities, followed by Commitments 1 and 4 (23 per cent, respectively). The higher number of projects in the area of capacity building is due in part to the establishment of several Centres of Excellence in the different ITU regions throughout the 2006-2010 period.

Chart 6.1: Implementation of BPoA commitments by ITU, based on number of projects, 2001-2010
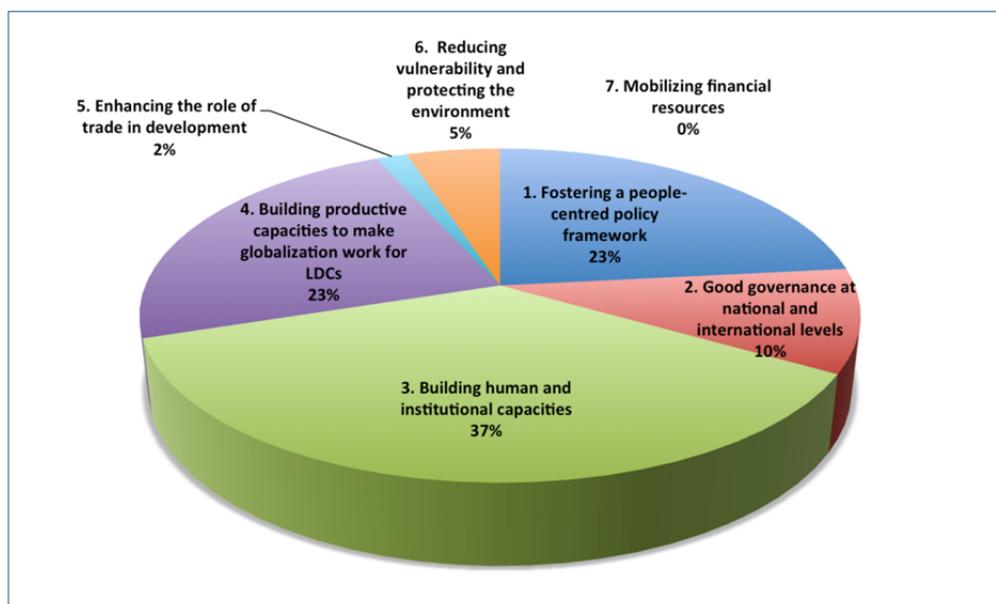
Source: ITU.

The following sections provide highlights of five projects implemented by the ITU in support of the least developed countries during the 2001-2010 period. They are representative of the type of actions implemented through the ITU LDC Programme, as well as of the projects implemented by the ITU as a whole.

6.1 Harmonization of policies for the ICT market in sub-Sahara African, Caribbean and Pacific countries

In December 2007, the ITU and the European Commission (EC) agreed to implement jointly a large-scale initiative for establishing harmonized policies and guidelines for the ICT market in sub-Saharan Africa, the Caribbean and Pacific Island (ACP) countries, while building human and institutional capacity in the field of policy and regulation in these three regions. The initiative scales up a pilot project on ICT Market Harmonization for the Economic Community of West African States (ECOWAS) and the Union Economique et Monétaire Ouest Africaine (UEMOA), which was successfully implemented in West Africa, using funds from the EC and the ITU from 2004 to 2007.[1]

The global initiative addresses the regulatory challenges facing the beneficiary countries, with the goal of creating an environment conducive to massive investments in ICT infrastructure and ICT-enabled applications, which the countries will adopt for day to day use in their economic and social activities. It also fulfils the capacity building needs expressed by the beneficiaries in the domains of e-readiness and ICT policies and regulations. In particular, the initiative seeks to support regional

organizations and the sub-regional economic groupings in promoting the use of harmonized ICT market policies and regulations; developing and promoting ICT market policies and guidelines for individual ACP countries, and providing the associated training to develop local competence and share existing knowledge. As a whole, the initiative benefits a total of 73 countries, including the graduated Botswana and Cape Verde and 34 current LDCs.[2]

This initiative pays specific attention to linking the substance of policy and regulation to capacity building. Given the step-by-step approach of most policy and regulation, "one off" capacity building for policy makers and regulators does not adequately equip them to make the sequential, complex and locally-adapted decisions necessary to guide a long and complicated process of sector reform. In general terms, short-term workshops, courses and seminars count for the majority of capacity building initiatives. Additionally, lessons that have been learned from one project are poorly carried over to other projects due to the absence of institutions that systematically gather and disseminate knowledge on what is taking place in ICT policy and regulation. This initiative seeks to overcome these limitations. For these reasons it focuses on three related aspects of ICT policy and capacity building: (i) advocacy, (ii) training and (iii) technical assistance (transposition/implementation).

To customize this global project to the specific needs of each of the regions it encompasses, the project is being implemented under three sub-projects: *Support for Harmonization of the ICT Policies in Sub-Sahara Africa* (HIPSSA); *Enhancing Competitiveness in the Caribbean through the harmonization of ICT Policies, Legislation and Regulatory Procedures* (HIPCAR); and *Capacity Building and ICT Policy, Regulatory and Legislative Frameworks Support for Pacific Island Countries* (ICB4PAC).

Figure 6.1: Beneficiary countries of the three ITU/EC ICT policy harmonisation sub-projects

Source: ITU.

Beyond this vertical implementation, the project seeks to develop trans-regional synergies (horizontal implementation), in order to promote shared solutions and best practices. In addition, to avoid duplication and to increase efficiency, the project identifies and takes into account – where feasible and pertinent – past and current initiatives undertaken by other organisations, such as the European Commission, UN agencies, and the World Bank.

The initiative has a time frame of the 57 months, between January 2008 and September 2012, and operates with a budget of € 8 million funded by the EC and a complement of USD 500,000 provided by the ITU.[3]

The Sub-Sahara project (HIPSSA)

Building on the success of the West Africa project, the *ITU/EC project on the Harmonization of ICT policies in Sub-Saharan Africa* (HIPSSA) aims to create a harmonized ICT market in the region, by supporting the African Union, the Regional Economic Communities (RECs) and their respective member countries. The HIPSSA sub-project, with a budget of 6 millions USD, was officially launched during a multi-stakeholder kick off meeting held in Ethiopia in December 2008. It targets 43 sub-Saharan countries,[4] including the graduated LDCs Botswana and Cape Verde and 28 current LDCs.[5]

Although HIPSSA does not cover North Africa, it creates a dynamic regarding the development of an enabling environment in the region taking into account the high degree of heterogeneity of its various sub-regions. It is an important contribution to the implementation of the Reference Framework for Harmonization of Telecommunication and ICT Policies and Regulation in Africa (African Union Framework) adopted in May 2008 at the second Conference of African Ministers in charge of Communication and Information Technologies (CITM-2) in Egypt.

Launch of the ITU-EC HIPSSA Project, Addis Ababa, Ethiopia, 2008.
Source: ITU.

The participants to the multi-stakeholders meeting discussed the methodology for implementation of the project aiming at facilitating and consolidating ownership of the project by the beneficiary countries as well as adopted the following nine priority areas: licensing; universal service and access; frequency management, with a particular focus on cross border frequency planning (HCM); numbering management; interconnection, cost modelling (including access to submarine cable) and financial auditing; cybersecurity; analogue to digital broadcasting migration; regional statistics reporting and monitoring (implementation report).

A modular implementation of the above priorities has been planned, based on the four geographical sub-regions defined by the African Union (AU) – West, Central, Eastern and Southern Africa – in

order to reflect the sub-regions' heterogeneity in terms of development of their ICT regulatory harmonization initiatives.

The first major milestone has been a comprehensive assessment of the current regional frameworks based on the aforementioned priorities, including the identification of main constraints towards establishing an ICT market under harmonised policies. Detailed analysis and recommendations were compiled in the report "ICT Regulatory Harmonization: a Comparative Study of Regional Initiatives".[6] Based on the results of this report, in a first phase, the HIPSSA project supports the regional organizations in updating or developing new regional guidelines–model legislations. In a second phase, the project is offering technical assistance to the Member States for national transposition of the developed regional guidelines. Where regional guidelines–model legislations are already available, technical assistance is offered directly.

Since 2008, the ITU and HIPSSA Member States have held diverse meetings and training workshops to develop model laws and guidelines and review and update existing ICT legal frameworks. Regional and national trainers who participated in training courses under HIPSSA, will use their expertise to enhance the required skills and capacity of all target groups at the national level in order to facilitate the transposition of the models and guidelines into national policy, regulation and legislation.

During the last two years, the Central Africa members have developed ECCAS model laws on telecommunications and ICT; an assessment of the current situation in the ECCAS countries Members was conducted and a draft Model Legislation has been prepared. These documents have been distributed to the country focal points for their preliminary comments and will be discussed for their validation during a workshop in Gabon, in April 2011.

In Southern Africa, the detailed HIPSSA action plan and its associated activities related to Southern Africa was presented and endorsed by the meeting of the SADC Ministers responsible for Telecommunications, Postal and ICT (Swakopmund, Namibia, June 2009). The first activity was to review and update the SADC ICT Policy and Legal framework, which was drafted in 1998 in a pre-liberalization environment. The assessment of the current situation in the SADC Members States has been finalized and a draft of model legislation has been prepared. In order to proceed with the endorsement of these documents by the appropriate regional organizations, these documents were presented at several meetings during 2010.[7] The second set of activities include updating the SADC ICT policy and legal framework, updating the Communications Regulators' Association of Southern Africa (CRASA) guidelines on universal access and service (UAS) and develop a toolkit of best practices using the UAS funds. The latter activity seeks to review the shortcomings of some of the models currently implemented to identify best practices.

In East Africa, HIPSSA held a Computer Emergency Response Team (CERT) training workshop for East African Community (EAC) Partner States. Finally, the West Africa region has worked on the development of the West Africa Telecommunications Regulators Assembly (WATRA) Guidelines on Access to Submarine Cables. The HIPSSA project team, in collaboration with Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), supported the organization by WATRA of a workshop on undersea cable regulation in Ghana, in November 2009. Further to this workshop, the assessment of the current situation and draft guidelines has been circulated to the regulators for their preliminary comments. These regional guidelines were discussed and validated during a workshop held in Monrovia, Liberia, in December 2010. In addition, the 3rd Conference of African Ministers in charge

of Communication and Information Technologies (CITM-3), held in Nigeria in August 2010, discussed and endorsed the proposal of using these regional guidelines afterwards as an input for Pan-African Guidelines under the African Union aegis.

In parallel, the HIPSSA project is supporting ECOWAS to monitor and measure the quality of the transposition of the regional guidelines-models into the national policies, laws and regulations. It will offer a yearly snapshot with the individual country profiles implementation as well as the evolution of the ICT markets.

In addition to the above sub regional activities, the project is currently supporting the regional organizations, under the aegis of the African Union, to develop a yearly statistical report with ICT market indicators. The ultimate objective is to assist the regional organizations and their individual Member States to assess the impact of regional and national regulatory reforms and formulate policies based on evidence. Additionally, it should also encourage the promotion of the emergence of a regional market.

Finally, the HIPSSA project is launching a cross-border frequency harmonization activity. The aim is to develop, in close collaboration with all the concerned stakeholders, a harmonised methodology in order to coordinate frequencies between 29.7 MHz and 39.5 GHz to prevent mutual harmful interference at the borders among different services, to optimise the use of the frequency spectrum and to provide proper protection for existing networks, stations, and links or for future services.

After the adoption of the above regional guidelines–model legislations, the HIPSSA project is offering technical assistance to the Member States for their national transposition. Countries will validate policies, models, recommendations and guidelines developed by a team of experts through face-to-face workshops.

The HIPSSA project was specifically highlighted during the ICT Ministerial meeting in August 2010, in Abuja, Nigeria (CITMC-3). In particular, the Abuja Declaration contains a Request addressed to the African Union Commission to "work with the ITU and with all the development partners to continue activities on harmonisation of policy and regulations in Africa based on the platform created by HIPSSA project in order to implement the remaining components of the Reference Framework adopted by the CITMC-2."

The Caribbean project (HIPCAR)

The sub-project *Enhancing Competitiveness in the Caribbean through the Harmonization of ICT Policies, legislation and regulatory Procedures* (HIPCAR) responds to a request from CARICOM (Caribbean Community) and the Caribbean countries to the ITU and the EC for cooperation to harmonize ICT policies, legislation, regulatory processes and procedures within their respective territories, in the framework of the Caribbean Single Market and Economy (CSME).

Between 1999 and 2002, most of the CARICOM Member States enacted telecommunications laws and took the necessary steps to establish regulatory bodies and dismantle existing monopolies. However, full liberalisation is limited and differs across the various Member States. Each country has independently adopted different approaches, practices and methodologies for developing the sector to the exception of the Eastern Caribbean, where the Eastern Caribbean Telecommunications

Authority (ECTEL) has already taken important steps to promote market liberalisation and competition within its five Member States.

HIPCAR targets 15 beneficiary countries,[8] including Haiti, and aims to assist the regional organisations and the respective countries in developing and promoting the use of harmonized ICT policies and regulatory frameworks in relation to ICT markets in the region. It also seeks to provide human and institutional capacity building in the field of ICT through a range of knowledge transfer measures, with the global objective of creating a harmonized ICT market in the region. ITU is the Executing Agency and the Caribbean Telecommunication Union (CTU) is the project advisor on behalf of CARICOM. HIPCAR was officially launched during a multi-stakeholders (Kick Off) meeting held in Grenada in December 2008. At this event, the participating countries adopted the following priority areas: e-transaction, e-Evidence, access to public information, privacy and data protection, cybercrimes, the interception of communications, as well as Universal Service/Access, licensing, interconnection and cost modelling.

During its first phase, the HIPCAR project supported Members States, in close collaboration with CARICOM and the CTU, in developing new regional guidelines. Various teams of experts have assessed the current situation in each of the beneficiary countries on the aforementioned priorities. Commonalities and differences have been identified, regional best practices highlighted and compared with international best practices. Further to this analysis, a Policy has been developed, discussed and validated during various workshops. Based on the approved policies, guidelines (model legislations) have been developed and validated during a series of workshops. The participating countries and the regional organisations organized five consultation regional workshops in total.

During its second phase, currently under implementation, the HIPCAR project is offering technical assistance for national transposition. Seven HIPCAR beneficiary countries[9] have requested so far support to transpose the regional Model Policy Guidelines and Model Legislative Texts into national legislative frameworks through direct in-country assistance. Taking into consideration the dynamism created by the project in the Caribbean, it is expected that the partners will recommend an extension of this project.

The Pacific project (ICB4PAC)

In November 2009, ITU launched the third sub-project for the Pacific Countries, known as ICB4PIS and renamed during its implementation process as *Capacity Building and ICT Policy, Regulatory and Legislative Frameworks Support for Pacific Countries* (ICB4PAC), at the request of the stakeholders. This sub-project responds to a request from these countries for support and cooperation to promote and implement closer collaboration and harmonization of telecommunication policies, legislation, strategies and regulations that would empower them to implement the necessary reforms.

The sub-project aims at building human and institutional capacity in the field of ICT trough a range of targeted training, education and knowledge sharing measures, as well as developing background material for possible harmonized policies for the ICT market.[10] The ICB4PAC has 15 beneficiary countries, including Kiribati, Samoa, Solomon Islands, Tuvalu and Vanuatu[11] and was officially launched during a multi-stakeholders (Kick Off) meeting held in Fiji, in November 2009. The

stakeholders adopted as priority areas: national ICT policy; interconnection and international roaming; cybersecurity; licensing; universal access; and numbering.

A number of trainings were carried out based on an assessment of the current situation in each of the beneficiary countries on the aforementioned priorities. Commonalities and differences have been identified, regional best practices highlighted and compared with international best practices.

In 2010, five regional workshops were organized under ICB4PAC dealing on issues of interconnection and cost modelling (Australia, December 2010), universal access and services policies (Samoa, October 2010), licensing and numbering (Cook Islands, August 2010), national ICT policy for decision makers (Tonga, June 2010) and national ICT policies (Solomon Islands, April 2010). During the first half of 2011, two regional workshops on cybersecurity (Vanuatu, March 2011) and roaming (New Caledonia, April 2011) were organized. In parallel, the ICB4PAC project is offering in country assistance to all the 15 beneficiary countries regarding the regional priorities of national ICT policy and licensing.

The ICB4PAC project was specifically highlighted during the ICT Ministerial meeting in Tonga in June 2010. In particular, the Tonga Declaration contains a recommendation requesting "the ITU to liaise with the European Union and ACP Secretariat to extend the ICB4PAC project beyond the original two year timeframe".

Next steps

In view of the success achieved so far by the three sub-projects, the ITU is planning to develop a strategy to mobilise the resources and funding, so that in partnership with the ACP Secretariat, the EC and/or other interested partners, the current project methodology is extended to a series of new topics and the dynamism created under the global policy harmonization project can be perpetuated in the three ACP regions.

6.2   Reconstruction and rehabilitation work in Afghanistan

As a land locked LDC that has suffered the devastation of decades of invasion, civil war and political instability, Afghanistan is considered a country with special needs. As such, it has been the recipient of additional assistance from ITU, receiving support from the ITU LDC Programme and diverse ITU projects in the last decade. The assistance has focused on supporting the country with the reconstruction of its telecommunications infrastructure and rehabilitating its human capacity and ICT legal framework to provide an environment conducive for private investment and technological innovation.

Before 2001, the Afghan telecommunication infrastructure had been mostly demolished, leaving only about 15,000 fixed local main lines, and lacking international calling facilities, Internet connectivity and ISPs. In the last ten years, Afghanistan has made significant progress in rebuilding its telecommunication and ICT sectors. The interim government, established in 2001, recognized the essential role of ICT in meeting nation-building objectives, which ranged from restructuration of national institutions to disarmament, and from the repatriation of refugees to the provision of regular health and education services. ICT was expected to enable the Afghan government to successfully carry out a broad reconstruction effort, stimulating all sectors of the economy and

facilitating administrative reforms, considered as one of the major challenges for the government of Afghanistan. This recognition provided sufficient political impetus to mobilise resources toward the telecommunication sector.[12] The commitment to rebuild the sector was equally shared by the transitional government in 2002-2003, and later by the government elected in 2004.

The Ministry of Communication and Information Technology (MCIT) of Afghanistan has led the reconstruction process, supporting the design of new strategy and policy for the sector and encouraging the entry of private investment into the market. From 2001 to 2008, ITU worked with the Government of Afghanistan on strengthening the institutional competence to govern the sector, establishing an operational structure for the MCIT, advising the minister and senior ministry staff on day-to-day operations.[13] Through these efforts, a number of policies and regulations were put in place for the promotion of the sector. The Union assisted MCIT in drafting a Telecommunications Act, developing a regulatory structure and drafting basic rules and sector policy. Among the latter were national radio regulations, a national radio frequency plan, and a guide for spectrum monitoring and station inspection that prepared the country for a wide-scale deployment of wireless communication services. Local staff was also trained in frequency spectrum planning and management.

The updated regulatory and policy framework has encouraged private investment. By the end of 2008, the sector had received foreign direct investment in the amount of USD 1.2 billion, dedicated mostly to improving physical infrastructure and basic services. By 2009, the country's four mobile operators and one fixed-line operator were serving almost 10 million subscribers, which is equivalent to a penetration rate of more than 30 per cent of the population.[14]

Yet, many Afghan communities remain unconnected due to their remoteness. To support the Afghan Government in this area, the Union contributed to the establishment of multipurpose community telecentres (MCTs). In cooperation with the Universal Postal Union (UPU) and the Governments of India and Afghanistan, ITU launched in 2007 a project to modernize post offices in 11 provincial towns.[15] MCTs were set up in post offices to provide a variety of services, including community access to ICTs, e-post, email, money transfer, and salary payments. The project took advantage of the synergies offered by a number of ongoing

ITU training programmes for the modernization of postal services in Afghanistan (Kabul, December 2007). Source: ITU.

projects, such as the Government of India's Emergency Restoration of Telecommunications in 11 cities and the World Bank's Government Communication Network, which covered connectivity costs for the project. The ITU contributed with the organization of two intensive training programmes for the staff of the post offices.

This project is an integral part of the international efforts towards the reconstruction of Afghanistan. By focusing on dissemination of government information and community access, it assists in the

democratization process of the country and strengthens the government's capacity to deliver services in provincial towns.

To foster capacity building, the Union also coordinated the rehabilitation of the Information and Communication Training Institute (ICTI) in Kabul from 2004 to 2010, with funds donated by the Government of the I. R. of Iran to the Government of Afghanistan. The project involved rehabilitation and construction work for the Institute's buildings and for a dormitory for 120 students; training courses for instructors who would be responsible for developing new training programmes and updating existing ones; the establishment of related laboratories to meet actual and long-term training needs of the country in the area of information and communication technologies. The new ICTI will improve the level of knowledge of students and technical personnel of the Ministry of Communications, Afghan Telecom and Afghan Mobile. The public and private sectors will also use the rehabilitated institute. Current curricula, developed with the support of ITU, includes short training courses on ICT related subjects for young Afghan students, including women; on-the-job refresher training course for MICT staff; a two-year full time telecommunications technician academic programme; and a four-year full time engineering training programme. Forty-nine courses were held at the ICTI, as part of a parallel educational assistance project coordinated by ITU between 2007 and 2010.

Finally, as the country moves forward on the installation of its national fibre optic backbone network and the adoption of electronic applications for eGovernment and eCommerce, it becomes essential to secure the integrity of the access networks and of the data transmitted through them. By facilitating access to IMPACT services and enabling the establishment of the Afghanistan Cybersecurity Response Team, the ITU is assisting the Afghan Government in adoption of new technologies for the delivery of public services and improving national connectivity to the rest of the world.

6.3   Rural connectivity no longer a dream in Samoa

Samoan rural population are now enjoying the benefits of ICTs.
Source: Government of Samoa.

People in rural villages in Samoan islands of Upolu and Savaii, who had previously never seen a computer, are now using the Internet to communicate with their family members working in Apia, the capital city, or living overseas. Women have created their own local committees to manage nine of the MCTs, and a youth group runs the tenth. The centres are being used to transmit information for a national programme to promote healthy living. A train-the-trainers programme was provided. A local expert conducted training in the Samoan language. Training materials were translated into Samoan, and this has proved very used for the women. When the trainer is away, they can teach themselves using translated manuals.

Ten MCTs in Samoa are now functioning as telephone and Internet access points not only for personal communications, but also educational, business and community applications. The role of ITU in bridging the digital divide and improving rural connectivity is now a reality in Samoa.

6.4   ICT training for returning Liberians

On 19 April 2006, ITU and UNHCR launched an Information and Communication Technology Training Centre in Monrovia, Liberia, to help equip people with skills that make them more employable. Liberian refugees go back to urban centres, most of them to the capital city, Monrovia.

The training centre is equipped with 20 computers, peripherals, a backup power supply, a projector, a photocopying machine, a television and video/DVD unit, and a video camera. The centre has the capacity to train about 60 students every two months. It offers training free of charge to returnees, but charges a nominal fee for other

Returnees learning the use of ICTs.
Source: UNHCR.

community members wishing to receive training in ICT. The centre also provides related services, such as e-mail, Internet access, word processing, photocopying, and basic desktop publishing. Modest fees will be charged for these services, so as to make the venture financially viable and sustainable. This collaboration between ITU and the UN refugee agency is an important effort towards extending ICT access and training to returnees.

6.5   Emergency telecommunications

Emergency telecommunications is one of the three priority areas of the ITU LDC Programme. This section provides a more detail account of the type of emergency assistance the Union is able to provide when a country has been affected by natural shocks, such as earthquakes, hurricanes, and tsunamis. As the cases discussed below illustrate, ITU's aid is not limited to providing telecommunications equipment after a disaster to support rescue efforts of first responders, but extends well into the future, helping the country re-establish basic communication services and fostering new partnerships for reconstruction.

South East Asia

After the devastating tsunami that followed the major earthquake off Indonesia in December 2004, ITU provided expert services to the disaster struck countries surrounding the Indian Ocean. After assessment of the situation in Maldives, a plan to rehabilitate telecommunication infrastructure was compiled, and training provided towards its implementation. ITU also sent Global Area Network (GAN) satellite terminals to Sri Lanka under the ITU-Inmarsat partnership in the aftermath of the tsunami, and an expert to Thailand to train government-designated technicians in the use of these terminals. In addition, to help establish and improve emergency communications, ITU cooperated with the national authorities concerned to help establish systems that will be part of a tsunami early-warning system for the region.
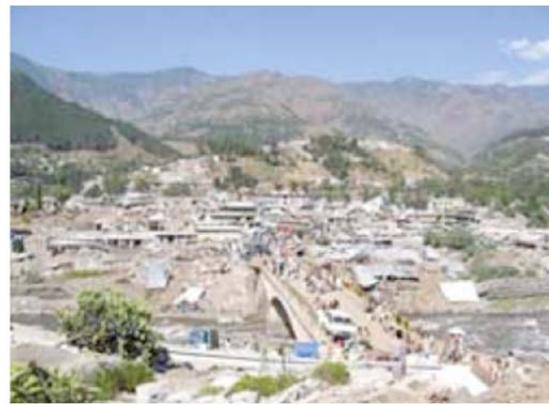
Aftermath of the 2004 tsunami in South East Asia (left) and the 2005 earthquake in the Pakistan-India border (right).
Source: ITU.

South Asia

Immediately following the massive earthquake that struck the Pakistan-India border area in October 2005, ITU sent 55 satellite terminals to help restore vital communication links. ITU paid for all the air-time arising from the use of these terminals. The GAN terminals are capable of providing voice, data and video services. Terminals were used to coordinate relief and rescue operations, and helped establish public call centres to provide essential information to families and friends searching for loved ones. Pakistani officials, responsible for communications, were trained by ITU in basic operations, as well as in technical aspects of the satellite terminals. Training was also provided to medical teams helping injured people in remote areas. Diagnostic information on patients was transmitted via satellite to hospitals, for expert analysis and advice.

Haiti

Haiti's telecommunication network was severely affected by the earthquake that hit the island on January 12, 2010. The force of the earthquake brought down many towers of the mobile cellular network on which Haiti's telecommunication infrastructure is based. The remaining towers were insufficient to handle with the high number of calls needed to coordinate rescue teams. Within the first 24 hours of the disaster, ITU deployed 40 satellite terminals. Sixty additional satellite and broadband centres were established around Port-au-Prince a few days later for use by humanitarian aid agencies, government authorities and the local population. Subsequently, more satellite terminals mounted on motor vehicles for on-the-move communications were installed and commissioned. Along with the equipment, ITU provides detailed instruction manuals for its installation and operation, allowing local authorities to use them efficiently and start communications in a short time.

An essential part of ITU's Framework for Cooperation in Emergencies[16] is the possibility of tapping into resources from Sector Members and non-Sector Members that can partner ITU to strengthen response capabilities on the ground in terms of technology, financial support and logistics. In Haiti, for instance, ITU established a new partnership with Singapore-based smart-Bridges Solutions, a provider of wireless broadband equipment, to provide broadband and voice connectivity to internally displaced people, as well as to aid workers and local authorities. The new partnership set up 10 WiMAX base stations and 40 customer premises equipment devices in over 100 hot spots

around the disaster zone. Moreover, a cooperation agreement between ITU and Collabria LLC provided emergency personnel with a system that allowed them to communicate and collaborate quickly across wired, wireless and private networks and the Internet, combining text, voice, video, data and large-file transfer capabilities into a common platform for desktop computers, laptops, mobile phones and other Internet protocol-based devices.

Coordination with local telecommunication authorities is also fundamental. ITU worked with the Communications Ministry and the local regulator, CONATEL, to alleviate interferences and network congestion caused by the large number of relief organizations and media outlets from around the world using frequencies for broadcasting without applying for licenses. ITU also partnered with regional telecommunication organizations, such as the Caribbean Association of National Telecommunication Organizations (CANTO) to help restore Haiti's telecommunication infrastructure.

The emergency telecommunications programme also provides assistance in terms of expertise. In Haiti, ITU experts helped restore telecommunication networks, and later on, another team assessed the extent of the damage to the telecommunication network to help determine long-term reconstruction needs.[17] Based on this assessment, ITU and the Government of Haiti organized a Round Table on the Reconstruction of Haiti's telecommunications sector, with the support of the Government of Barbados and that of the Caribbean Community (CARICOM).[18] The meeting convoked development partners to discuss an ICT strategy for Haiti's recovery, reconstruction and development. As a result, a cooperation framework was established to encompass the commitments and projects of the diverse partners for the mobilisation of resources in support of Haiti's reconstruction.

Aftermath of Haiti's earthquake.
Source: ITU.

As part of this framework, ITU is currently working with the Department of Communications of Haiti, as well as CONATEL and telecommunication operators, to build state-of-the-art broadband infrastructure that will enable the country to attract investment and facilitate the provision of basic education and health services to the population using electronic applications.

In sum, during the last five years, ITU has helped least developed countries strengthen their human and technical capabilities to bring their populations and economies into the digital age. ITU's

commitment to foster the implementation of the BPoA targets has been expressed in over 150 projects and activities implemented across all LDCs. Yet, bottlenecks and constraints for development remain, as is discussed next, underscoring the need for continued assistance and better coordination of efforts among development partners.

7 Addressing identified bottlenecks and constraints

The implementation of actions and projects in LDCs during the last decade has allowed ITU to identify some of the bottlenecks and constraints that impede progress in the deployment and upgrade of ICT and telecommunication networks in these countries. The 2006 mid-term review of the implementation of the BPoA identified six areas that required attention to make universal access possible. Five years later, the same constraints remain, but actions taken by the LDC governments and the intervention of the development community have made some inroads in lessening their pervasiveness in some cases. Building on the concerns expressed in 2006, this chapter overviews some of the actions that LDCs, along with the ITU and other development partners have undertaken in the last five years to reduce the impact of such bottlenecks and constraints on the telecommunication sector's growth, with the goal of, eventually, eliminating them.

7.1 The availability of affordable, adequate and reliable bandwidth on international links

The 2006 review identified the lack of affordable and adequate access to international Internet bandwidth as a critical constraint limiting the ability of most LDC population to take advantage of a growing number of multimedia and graphics-rich content available on the Internet. This infrastructure dictates the speed at which Internet content from other countries can be downloaded. Low connection speeds make it time consuming and unaffordable to connect to the Internet. In 2008, Africa as a whole had around 12 Gigabits per second (Gbps) of international bandwidth, which corresponded to less than one third of India's total international connectivity (Chart 7.1). While some LDCs have increased their rates of bits per Internet user in the last years, international Internet bandwidth is very low (See Table A1 in the Annex). This constraint is even more pronounced in landlocked countries, like Lao P.D.R., Nepal and Afghanistan, and in some SIDS where geographical characteristics make it necessary to use high-cost satellite links or to connect to a third country network to gain access to high-capacity submarine cables. In Afghanistan, for instance, it is estimated that Internet access comparable to the speed of digital subscriber lines (DSL) delivered through a VSAT satellite system costs USD 1,500 a month.[1] Countries with access to undersea fibre optic cable networks had significantly higher levels of per capita bandwidth than those without.

Governments have taken different strategies to improve access to international bandwidth and reduce the cost of connectivity. One option has been the deployment of national fibre optic networks that can be linked to regional and international high capacity networks or to submarine cables. Due to the large investments involved, this option has been usually undertaken with the support of the development community and at the regional level. Since 2008, the NEPAD e-Africa Commission is leading the development of a high-capacity submarine cable, UHURUNET, and the associated terrestrial network, UMOJANET, in its effort to connect all African countries by broadband optical fibre and thus minimize the cost of communications across Africa and to the rest of the world. In 2009, a detailed feasibility study[2] on the terrestrial network, covering Eastern and Southern Africa found that 60 per cent of the required fibre was already in place and 30 per cent was at that time being planned or under construction.

Chart 7.1: International Internet bandwidth (bits per Internet user), 2008
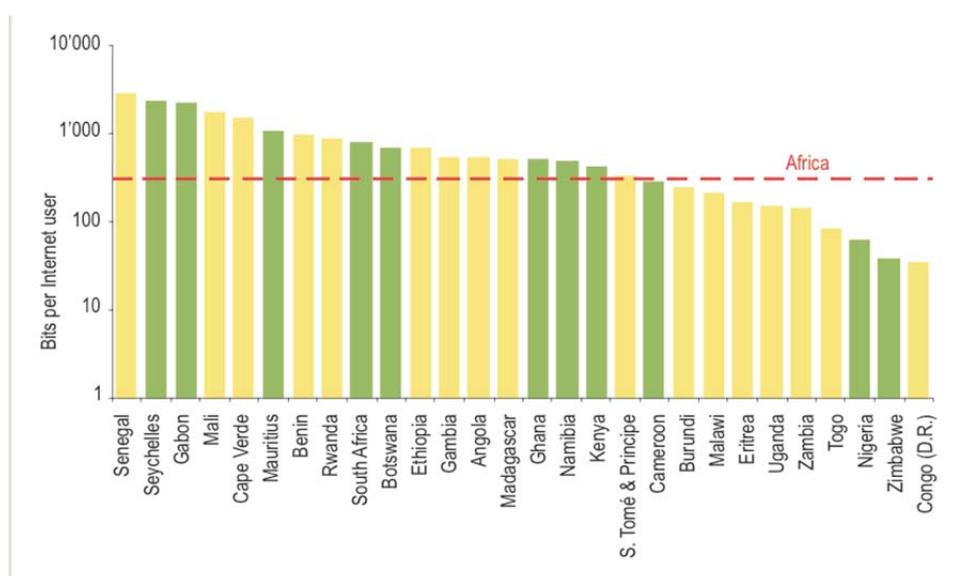
Note: Logarithmic scale. Countries in yellow are LDCs.
Source: ITU World Telecommunication/ICT Indicators database.[3]

Similarly, the World Bank and the African Development Bank are using public-private partnerships to increase access to affordable high speed Internet in the continent through the on-going Eastern Africa Submarine System (EASSy). Both organisms are jointly implementing the Central Africa Backbone Project by funding the first phase of a USD 215 million programme to connect countries in Central Africa, the third phase of a USD 424 million Regional Communications Infrastructure Programme (RCIP) for East and Southern Africa, and USD 900,000 for preparatory work on ECOWAS regional Broadband. The European Commission, on the other hand, has provided funds to deploy EASSY and is investigating the possibility of financing the AXIS project, which should provide better Internet connectivity and access in Africa and will also finance the connection of the African National Research Networks to the European GEANT network, so that academics and scientists in Africa can communicate with their peers globally.

Other improvements in international Internet bandwidth have been the result of investments from national and international operators. Maldives, for example, has accelerated the uptake of Internet and broadband services through its connection to the Dhiraagu-SLT submarine cable system, inaugurated in 2006 to link Maldives and Sri Lanka. The latter cable system represented an USD 20 million investment by Sri Lanka Telecom and Dhiraagu, aimed at enhancing economic growth through the provision of improved telecommunications in South Asia.[4]

Another trend used by LDCs to reduce bandwidth cost has been reducing the amount of outgoing Internet traffic by keeping national traffic from leaving the country. The establishment of national Internet exchanges (NIX), like to one Afghanistan has deployed with the support of the ITU, allows ISPs to route domestic Internet traffic within the national networks, instead of having to go through a third country. Meanwhile, for countries where the size of the market is small, like in several SIDS, they have the option of pooling their bandwidth requirements to leverage lower connectivity costs.[5]

7.2   Investment in telecommunication and ICT infrastructure

The 2006 review highlighted the constraint that inadequate and poorly maintained ICT infrastructure imposes on the LDCs' ability to provide services, letting their populations participate in the Information Society. Institutional weaknesses and lack of resources in LDCs aggravate this bottleneck. As presented in chapters 4 and 6, most LDC governments have and continue taking steps to strengthen the ICT policy frameworks and promote sector investment. Yet, considerable physical and capital investment is still required to continue deploying new networks and upgrading existing ones. The current financial environment, slowly recovering from the economic and financial crises of 2008-2009, is seeing a shortage of investment capital, underscoring even further the need to pool scarce capital and avoid waste, to foster investment in LDCs' telecommunication and ICT infrastructure.

The impact of ICT as a driver of development is profound because it creates opportunities across all segments of the economy and society. Private investors transferred approximately USD 100 billion to governments in developing countries through privatization and license awards between 1997 and 2008. The ICT sector generates annual revenues equivalent to around four per cent of gross domestic product. When indirect and downstream benefits are included, the impact on GDP growth could exceed five per cent in some countries. For every 10 per cent increase in high-speed Internet connections, the increase in economic growth developing countries is even higher, at 1.4 per cent.[6]

Aware of the link between socioeconomic development and access to high-speed, high-capacity broadband technology, the ITU, jointly with the United Nations Educational, Scientific and Cultural Organization (UNESCO), launched the *Broadband Commission for Digital Development* on 10 May 2010. The Commission, composed of global leaders in government, business, civil society and international organizations, aims to accelerate the achievement of the MDGs, as well as other priority development programmes, by facilitating practices, policies and investment for the deployment of and universal access to broadband networks. To this end, it will cooperate with the private sector to support the development of a strategic framework of action that will help identify effective and sustainable projects, and assist on the implementation of advocacy and outreach activities that would facilitate innovation, investment, partnership creation and respond to user needs.[7]

Foreign direct investment in LDCs' telecommunication infrastructure, particularly in Sub-Saharan Africa, is also likely to continue over the next decade, attracted by the improved political and economic stability of these countries, as well as by an enabling regulatory environment supported by major steps towards ICT policy harmonization taken through the HIPSSA project. The magnitude of the financial resources flowing from countries like China, India and the Gulf states into Africa is estimated to be equivalent to that of official development assistant provided by the OECD.[8] Furthermore, the intensified south-south trade and investment relations between Asia, the Middle East and Africa is giving African least developed and developing countries an opportunity to establish a solid foundation for sustainable development and poverty reduction.

During the 2001-2007 period, China financed ICT projects in 16 African LDCs,[9] with commitments estimated by the World Bank at USD 2.16 billion.[10] The financed initiatives ranged from GSM projects of diverse extension in Benin, Burundi, Ethiopia, Niger and Togo to the establishment or

rehabilitation of fixed-line telecom networks in Eritrea and rural networks in Sierra Leone; and from building the e-government network in Senegal to the deployment of CDMA networks in The Gambia and fibre transmission backbone in Ethiopia.[11] Among the African countries receiving Chinese funds, Ethiopia is at the top, due to a USD 1.5 billion project to deploy the national transmission backbone and roll out mobile coverage to rural areas with the support of ZTE, Huawei, and China International Telecommunication Construction Corporation. According to the World Bank, if completed, the project, agreed upon in 2006, is expected to "more than double the country's optical fibre deployment, more than triple mobile network expansion capacity, double rural telecom coverage, and quadruple the length of the fixed telephone network."[12]

Other opportunities to support the deployment of ICT and telecom infrastructure in LDCs have come from more traditional sources of official development assistance. In Asia, for example, the Asian Development Bank (ADB) has assisted its member countries, which include 14 of the 15 LDCs in Asia,[13] in using ICT for various sector programs. From 2000 to 2009, ADB provided USD 6.66 billion[14] to fund 245 ICT-supported projects across its members.[15] The Bank's funds and technical assistance has promoted investment in ICT networks, infrastructure, applications, and equipment, as well as supported activities to enhance ICT policy, strategy, and capacity building. Similarly, since 2000, the World Bank has committed USD 1.8 billion for investment in ICT projects. A further USD 45 million was spent on analytical work and technical assistance in the ICT sector.[16]

While their status as least developed grants LDCs increased access to official development assistance, the challenge remains for these countries to open their territories and infrastructure to investment while keeping national development objectives and a defined ICT strategy at the forefront to help them decide upon the technologies, applications and ICT investment projects that could bring the greatest benefit to their populations, in view of such national strategies and international commitments, such as the MDGs.

7.3   Access to applications

Information and communication technologies offer LDCs an opportunity to introduce improvements in health, education, and public service delivery, meeting broader developmental goals that have a positive impact on the quality of life of the population. There is now wide consensus that ICT provide opportunities to reduce social and economic disparity and to support the creation of efficient and transparent administration mechanisms.[17] Increased access to information in rural and remote areas in LDCs through mobile phones, telecentres and information kiosks is helping empower women, youth and other groups, and giving them reach to education on topics relating to their daily activities, such as agriculture and health.

The boom of mobile cellular telephony in LDCs has transformed this technology from a communication tool into a platform for service delivery able to transform lives through innovative applications and services.[18] An emerging body of research shows that the reduction in communication costs associated with mobile phones has tangible economic benefits, improving agricultural and labour market efficiency and producer and consumer welfare in specific circumstances and countries.[19] Mobile communications create a sustainable infrastructure that can be leveraged to extend other vital development services to LDC citizens, such as e-banking and other financial services, facilitating also access to health care, education and government services. With

the right public private partnerships, mobile technologies can provide a sustainable infrastructure to support other development initiatives for LDCs.

In the area of e-applications, for example, the African Union Commission, jointly with the AfDB and NEPAD Secretariat, is pursuing the Programme for Infrastructure Development in Africa (PIDA) study and the Pan African e-Network project for Telemedicine and Tele Education. In the area of health, the ITU launched its *Mobile Health Initiative* to support developing countries make the best use of mobile technologies for assisting patients and improving health services. Through this initiative, ITU will work with a range of partners to facilitate the launch of demonstration projects and build capacity to develop simple and cost-effective mobile applications that respond to critical national health priorities. The World Health Organisation, on its part, has completed a study with UNECA covering 17 African countries and 51 districts leading to the development of the Africa Health Infoway (AHI) Business Plan, which provides implementation details to assist African countries to strengthen health systems. The WHO is also working with ITU to align the AHI deployment activities with the ITU Broadband Wireless project in participating countries.

The World Bank's International Finance Corporation (IFC) invests in innovative business models that use ICT applications to help deliver public services, effectively operating as a venture capital or private equity group. In Africa, the IFC has contributed USD 32.7 million to fund EASSy; it has invested also USD 1.5 million in the Village Phone programme and is focusing significant resources under RCIP for rural connectivity.

The adoption of ICT applications in LDCs' public sector has opened up a number of opportunities, including efficiency gains, quality service delivery, transparency and accountability. Usually being the larger user of IT systems in the country, LDC governments can play a leading role in ICT diffusion, improving communication processes between citizens and bureaucrats. In this sense, ICT can help governments advance in their democratization processes, while lessening the digital divide.[20]

7.4   Political and regulatory instability

As the 2006 review underscored, civil strife and war damage existing infrastructure and severely inhibit infrastructure development, as no development work can be undertaken in unsafe circumstances. Similarly, lack of regulatory clarity and stability acts as a disincentive for private investment in the telecommunication sector. GSMA estimates in this respect that a stable regulatory environment would increase private sector investment by as much as 25 per cent and reduce costs of the total cost of owning and using a mobile phone by 10 per cent.[21] For example, since sub-Saharan governments began liberalising their telecommunication sectors at the turn of the millennium, the mobile industry has invested USD 35 billion, providing more than 500 million people (67 per cent of the population) in sub-Saharan Africa with mobile coverage. With a stable regulatory environment, sub-Saharan governments could see an incremental USD 21 billion private capital invested in mobile infrastructure over the same period.

As discussed above, ICT and telecommunication infrastructure is capital intensive, with long pay back times. Political and regulatory uncertainty – where the rules of the game can change overnight – adds a risk premium into the cost of capital. By doing all they can to ensure stability, LDC governments can help lower the cost of capital and render investments in rural infrastructure

sustainable, thus promoting the goal of extending infrastructural access to their poorest citizens. Investment and market entry responds to the implementation of a consistent and transparent regulatory policy that include a clear set of regulatory policy objectives and targets, which, from the investors' perspective, minimize risk and support the development of a stable and predictable environment.

7.5   Local content

Developing and making locally relevant content available to the population in LDCs remains as much a challenge now as in 2006. Access to content in local languages also requires attention. In this area, ITU has carried out a number of activities to support cultural and linguistic diversity and local content. The Union continues studying issues relating to Internationalized Domain Names (IDN) to contribute to easier and greater use of the Internet in those countries where the native or official scripts are not represented in International Reference Alphabet (IRA) characters.

In particular, ITU and UNESCO are developing a set of universal standards aimed at facilitating the creation of multilingual Information Society. This effort includes the development of an internationalized country code Top Level Domain (ccTLD) reference table, which will foster and further facilitate the implementation of projects on Internationalized Domain Names.[22]

7.6   Coordination

The 2006 review noted the proliferation of small-scale pilot studies in LDCs, many of which have failed to reach economies of scale due to lack of interoperability, depleted capital, or incompatibilities with national development priorities. The lack of coordination between the diverse agencies engaging in project implementation resulted in wasted resources and reduced development impact.

Under the umbrella of the MDGs and as a result of the WSIS call in 2005 to harness the value of cooperation and partnership between governments and other stakeholders in ICT deployment, the last five years have seen a rise in the use of multi-stakeholder partnerships to accomplish the goal of a more inclusive Information Society. Funding organisms such as USAID, and regional banks, like the African and Asian Development Banks, are increasingly coordinating their activities with United Nations agencies, as well as with regional and international organizations to avoid duplication of efforts and make better use of limited financial resources.

Diverse global initiatives have emerged in the last few years, focusing on the coordination and mobilization of resources to support the deployment of ICT and the adoption of applications in developing and least developed countries. Continuing with its Connect series, for example, ITU has scheduled the Connect Arab States Summit for November 2011 in Doha, Qatar. Priorities established for the Arab Region include creating a policy and regulatory environment and establishing national strategies to support investment in broadband ICT networks and services; building trust and security in ICT networks; transitioning from analogue to digital broadcasting; improving software affordability and access for SMEs; and, stimulating Arab digital content and developing local applications and services, among others.

The Broadband Commission, referred to in section 7.2, has highlighted also the importance of coordination. Its *Leadership Imperative* report calls for increased coordination within government, as well as between government, the industry and civil society to reach consensus on key issues surrounding access to and use of broadband networks, and to increase the stakeholders' commitment to broadband inclusion for all. The report encourages governments, the private sector and the international community to build a "Broadband Development Dynamic" by harnessing seven convergent and interdependent forces: policy, infrastructure, technology, content and applications, people, innovation and government. ICTs in general, and mobile and wired broadband in particular, are considered drivers for economic recovery from the recent financial crisis.

In sum, while the bottlenecks and constraints identified five years ago remain, the work of LDCs and their development partners during the last quinquennium has made considerable progress in establishing the necessary legal, financial and institutional foundations to bring about noticeable improvements in these countries' telecommunication and ICT infrastructure during the next decade.

8   Conclusions and recommendations

The review of the progress made since 2001 in the implementation of the commitments included in the BPoA makes evident the great effort that LDC governments and their development partners, including the ITU, have made in improving the quality of life of their populations and in facilitating sustainable development through the deployment of information and communication technologies and the upgrade of existing networks. Since the adoption of the BPoA in 2001, LDCs have made inroads in establishing an enabling regulatory environment that fosters competition, network investment and the provision of telecommunication services to a larger portion of their populations. The rapid adoption of mobile cellular technology in these countries has helped narrow the digital gap with developing and developed countries. However, the minimal progress achieved in the deployment of fixed and mobile broadband signals the need to implement more effective strategies to bring technology and international Internet bandwidth costs down, so that by improving affordability, service uptake is able to rise in these countries.

Higher penetration levels of mobile cellular telephony, Internet usage and even broadband services in the three graduated LDCs, and also in those countries recommended for graduation, provide evidence of the connection that exists between ICT/telecommunication deployment and socioeconomic development. While almost all LDCs were able to meet and surpass the BPoA target for telephone main lines, only a handful of countries met the Internet users goal. The vulnerabilities, constraints and bottlenecks discussed in this report have influenced the latter results greatly, underscoring the need for development partners to continue directing funds, expertise and capacity building efforts to overcome these limitations.

The Union, through its three sectors, and particularly through the activities undertaken by its Programme for Least Developed Countries, Countries in Special Need, Emergency Telecommunications, and Climate Change Adaptation, has assisted the LDCs in developing more transparent and well defined ICT policy and regulatory frameworks that address issues of great importance for the future of the sector, such as spectrum management, licensing and the establishment of independent regulatory authorities. Increased liberalisation of markets, combined with improved regulatory clarity and the harmonization of ICT policies at the regional level, are expected to attract investors, as well as new operators and service providers into their telecommunication markets. Increased regional coordination will also help neighbouring LDCs leverage their power in their negotiations with international operators, hardware and software providers, and trade partners.

ITU has strengthened its commitment to the promotion of universal access goals through the implementation of projects focused on rural infrastructure, the establishment of MCTs, and the introduction of new technologies and services, including fibre optic and wireless networks. Particular attention and financial support has been dedicated to countries with special needs, helping them rehabilitate and rebuild national telecommunication infrastructure, rendered useless by years of civil strife and war. Finally, to help LDCs better prepare for emergency situations and address the effects of climate change, ITU has delivered assistance in the development of early warning systems and the design of national emergency telecommunications plans and adaptation plans.

The advancement attained during the last decade encourage us to increase our efforts in the upcoming years to help LDCs move forward in the goal of meeting the MDGs and the WSIS targets by 2015. The Fourth United Nations Conference on the Least Developed Countries (LDC-IV) provides a forum for discussing remaining constraints and identifying effective strategies and practices to eliminate them, with the intention of helping a larger number of LDCs graduate from the status during this decade.

ITU looks forward to its participation at the LDC-IV and proposes the following recommendations to complement the points already delineated in the Final Report of the ITU LDC-IV pre-conference event "Digital Inclusion for Least Developed Countries: Innovation, Growth, Sustainability", presented in Annex 2:

1.   As broadband networks become the essential infrastructure for providing advanced telecommunication services and getting access to electronic applications such as eHealth, eLearning and eGovernment, it would be advisable to include in the Istanbul Plan of Action an additional ICT target, focused on broadband subscriptions per 100 inhabitants. Since mobile broadband subscriptions have grown at a faster rate than fixed broadband in LDCs, it would be preferable for the target to focus also on mobile broadband subscriptions per 100 inhabitants.

2.   To ensure that investment in ICT and telecommunication infrastructure responds to the development goals of an LDC, better integration of and coordination between national development plans and telecommunication/ICT/e-strategies is necessary.

3.   Coordination between the ICT, health, education, and environment sectors, at a minimum, would help develop a common national strategy for the use of ICT technology and applications in health care, distance education and environmental monitoring. Clear mandates regarding the specific contribution of each of these sectors in financing, deploying, and promoting the use of such technologies and applications would help avoid internal conflicts and competition for resources during implementation.

4.   Harmonization of ICT policies, including standards for ICT applications is essential to facilitate the scalability of projects to national and regional levels, as well as interoperability among technological deployments and network upgrades implemented by diverse government agencies, development partners and the industry.

5.   Where politically feasible, it may be useful to devise forms of regional regulation or at least regional collaboration, building on the success achieved so far by the ITU/EC ICT policy harmonisation project.

6.   The slow recovery process from the recent economic and financial crises underscores the need for development partners to share information on planned projects and pool financial and human resources to magnify the development impact of any activities undertaken.

7.   It is indispensable to establish long-term partnerships between governments, regulators and the private sector in the implementation of ICT projects, not only as an efficient source of capital and know-how, but to improve network interconnectivity, technology interoperability and the scalability of such projects.

8. By the same token, inclusion of civil society in the development and implementation of ICT projects enhances the impact of implemented projects by ensuring that the particular needs and interests of the population served are being addressed.

9. ICT development is highly dependent on electricity supply. Where lack of power is an obstacle for service provision, alternative sources of energy need to be devised, such as low-cost integrated solar power and battery recharge systems.

Statistical annex

Table A.1: ICT indicators, LDCs

		Fixed telephone lines per 100 inhabitants		Mobile cellular subscriptions per 100 inhabitants		International Internet bandwidth Bits/s per Internet user		Proportion of households with computer		Proportion of households with Internet	
		2004	2009	2004	2009	2004	2009	2004	2009	2004	2009
1	Afghanistan	0.2	0.5	2.5	42.6	...	16,395	0.6	...	0.6	...
2	Angola	0.6	1.6	4.6	43.8	93	...	3	...	1	...
3	Bangladesh	0.6	0.9	1.8	32.3	200	...	1.2	...	0.2	...
4	Benin	1	1.4	6	56.3	522	1,024	1.4	...	-	...
5	Bhutan	4.8	3.8	3	48.6	300	3,100	2.2	...	1.2	...
6	Burkina Faso	0.6	1	3	24.3	1,203	2,803	0.6	...	...	...
7	Burundi	0.4	0.4	1.4	10.1	160	98	...	...	...	...
8	Cambodia	0.2	0.4	6.3	42.3	439	...	1.4	...	...	...
9	Central African Rep.	0.2	0.3	1.5	13.6	171	...	...	...	...	...
10	Chad	0.1	0.5	1.3	20.4	100	114	0.7	...	0.7	...
11	Comoros	2.5	4.6	1.4	18.1	32	617	2.5	...	0.5	...
12	Congo (Dem. Rep.)	-	0.1	3.5	14.3	44	...	0.2	...	0.1	...
13	Djibouti	1.4	1.9	4.4	14.9	7,283	29,893	6.2	12.1	0.4	1.7
14	Equatorial Guinea	1.8	1.5	10.4	29.6	1,680	...	...	...	...	...
15	Eritrea	0.9	1	0.5	2.8	120	...	0.2	...	0.1	...
16	Ethiopia	0.7	1.1	0.2	4.9	372	...	...	...	-	...
17	Gambia	2.9	2.9	11.8	84	42	...	2.4	...	0.8	...
18	Guinea	0.3	0.2	1.7	34.7	43	...	2	...	0.8	...
19	Guinea-Bissau	0.7	0.3	2.7	34.8	2	54	1.5	...	0.6	...
20	Haiti	1.5	1.1	4.3	36.4	226	...	1.4	...	0.8	...
21	Kiribati	4.8	4.1	0.7	1	...	...	...	...	...	...
22	Lao P.D.R.	1.3	2.1	3.5	51.2	670	3,331	1.1	...	0.8	...
23	Lesotho	1.9	1.9	9.9	32	61	...	2	...	0.5	...
24	Liberia	...	0.1	2.9	21.3	...	...	...	1	...	...
25	Madagascar	0.3	0.9	1.9	32	378	719	2	...	0.6	...
26	Malawi	0.7	1.1	1.7	15.7	100	...	0.5	...	0.4	...
27	Maldives	10.9	15.8	39.3	147.9	789	10,842	24.7	...	6	...
28	Mali	0.6	0.7	3.5	34.2	360	2,482	0.7	...	0.6	...
29	Mauritania	1.3	2.3	18	66.3	1,929	...	1.1	...	0.5	...
30	Mozambique	0.3	0.3	3.5	26.1	134	2,086	0.4	...	0.6	...
31	Myanmar	0.9	1.1	0.2	1	5,222	...	0.7	...	0.4	...
32	Nepal	1.6	2.8	0.4	19.1	249	...	...	...	0.6	...
33	Niger	0.2	0.4	1.4	17	83	...	-	...	-	...
34	Rwanda	0.3	0.3	1.6	24.3	1,184	780	0.2	...	0.1	...
35	S. Tomé & Principe	4.7	4.8	5.2	39.3	100	...	...	...	...	...
36	Samoa	9.2	17.8	8.9	84.4	1,091	...	...	...	...	...
37	Senegal	2.2	2.2	10.2	55.1	965	2,564	2.4	11.5	0.6	4
38	Sierra Leone	0.5	0.6	...	20.4	...	...	...	...	...	...
39	Solomon Islands	1.5	1.6	0.6	5.7	1,533	...	...	...	...	...
40	Somalia	1.2	1.1	6.1	7	35	...	...	...	...	...
41	Sudan	2.7	0.9	2.8	36.3	673	...	2.5	...	0.6	...
42	Tanzania	0.4	0.4	5.1	39.9	48	...	2	...	0.3	...
43	Timor-Leste	0.2	0.2	2.7	29.1	...	...	...	...	...	...
44	Togo	1.1	2.7	5.7	33	65	435	1.2	...	0.7	...
45	Tuvalu	7.7	17.1	5.1	20.1	...	...	...	...	...	...
46	Uganda	0.3	0.7	4.2	28.7	303	366	0.6	...	0.1	...
47	Vanuatu	3.2	3	5	52.7	250	3,118	4	...	...	...
48	Yemen	3.9	4.2	7.2	35.3	33	639	1.6	...	1.2	...
49	Zambia	0.8	0.7	4	34.1	95	558	1.2	...	...	...

Source: ITU World Telecommunication/ICT indicators database.

Table A.2: Fixed main telephone lines per 100 inhabitants in LDCs*

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Afghanistan	0.14	0.14	0.15	0.16	0.21	0.41	0.35	0.31	0.37	0.46
Angola	0.45	0.52	0.53	0.54	0.58	0.58	0.57	0.54	0.63	1.64
Bangladesh	0.35	0.39	0.42	0.50	0.55	0.70	0.73	0.75	0.84	0.94
Benin	0.78	0.86	0.88	0.90	0.96	0.97	0.95	1.32	1.33	1.42
Bhutan	2.52	3.04	3.29	3.84	4.78	5.08	4.75	4.42	4.00	3.78
Botswana	7.89	8.47	8.36	7.33	7.26	7.42	7.08	7.24	7.41	7.05
Burkina Faso	0.46	0.48	0.50	0.52	0.64	0.66	0.67	0.79	0.97	0.97
Burundi	0.31	0.31	0.33	0.34	0.39	0.42	0.37	0.36	0.38	0.38
Cambodia	0.24	0.26	0.27	0.23	0.24	0.24	0.18	0.26	0.30	0.37
Cape Verde	12.45	14.35	15.44	15.51	15.25	15.00	14.77	14.59	14.41	14.22
Central African Rep.	0.25	0.23	0.23	0.24	0.25	0.24	0.29	0.28	0.28	0.27
Chad	0.12	0.12	0.13	0.13	0.13	0.13	0.19	0.30	0.41	0.52
Comoros	1.23	1.57	1.78	2.25	2.50	2.75	3.02	4.03	4.36	4.55
Congo (Dem. Rep.)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.06	0.06
Djibouti	1.33	1.33	1.33	1.31	1.40	1.31	1.38	1.69	1.76	1.95
Equatorial Guinea	1.15	1.27	1.57	1.67	1.77	1.64	1.60	1.56	1.52	1.48
Eritrea	0.84	0.82	0.91	0.92	0.91	0.84	0.81	0.78	0.82	0.96
Ethiopia	0.35	0.42	0.51	0.57	0.67	0.82	0.95	1.12	1.11	1.10
Gambia	2.56	2.60	2.76	2.92	2.90	2.88	2.95	3.01	2.94	2.87
Guinea	0.29	0.30	0.30	0.29	0.29	0.27	0.24	0.23	0.21	0.22
Guinea-Bissau	0.85	0.74	0.82	0.75	0.68	0.65	0.45	0.30	0.29	0.30
Haiti	0.84	0.91	1.45	1.54	1.51	1.54	1.57	1.11	1.09	1.08
Kiribati	3.99	4.24	5.13	4.96	4.76	4.57	4.28	4.21	4.14	4.08
Lao P.D.R.	0.76	0.96	1.11	1.23	1.30	1.54	1.54	1.56	2.06	1.59
Lesotho	1.18	1.12	1.48	1.79	1.88	2.40	2.64	2.34	2.01	1.94
Liberia	0.24	0.23	0.23	-	-	-	-	0.06	0.05	0.05
Madagascar	0.36	0.37	0.37	0.36	0.34	0.52	0.72	0.72	0.86	0.95
Malawi	0.39	0.45	0.58	0.66	0.70	0.75	0.93	1.21	1.18	1.15
Maldives	8.97	9.85	10.21	10.57	10.92	11.04	10.85	10.99	15.38	15.84
Mali	0.37	0.47	0.51	0.54	0.57	0.64	0.68	0.64	0.64	0.65
Mauritania	0.73	0.93	1.15	1.35	1.34	1.37	1.14	1.28	2.37	2.26
Mozambique	0.47	0.47	0.45	0.39	0.37	0.32	0.33	0.36	0.35	0.36
Myanmar	0.58	0.63	0.72	0.76	0.89	1.04	1.17	0.94	1.02	1.10
Nepal	1.09	1.19	1.28	1.42	1.57	1.78	2.20	2.48	2.79	2.77
Niger	0.18	0.19	0.19	0.19	0.19	0.18	0.22	0.29	0.44	0.43
Rwanda	0.22	0.26	0.29	0.29	0.26	0.26	0.25	0.24	0.17	0.33
S. Tomé & Principe	3.29	3.82	4.39	4.72	4.70	4.66	4.89	4.86	4.81	4.79
Samoa	4.83	5.45	6.61	7.44	9.17	10.90	12.63	14.36	16.10	17.84
Senegal	2.08	2.33	2.15	2.14	2.23	2.36	2.44	2.26	1.95	2.22
Sierra Leone	0.45	0.52	0.53	0.53	0.54	0.54	0.55	0.56	0.57	0.58
Solomon Islands	1.85	1.73	1.51	1.39	1.51	1.56	1.56	1.57	1.57	1.57

Somalia	0.34	0.46	0.45	1.25	1.22	1.20	1.17	1.15	1.12	1.09
Sudan	1.11	1.26	1.85	2.52	2.71	1.47	1.26	0.85	0.89	0.88
Tanzania	0.51	0.51	0.45	0.40	0.39	0.40	0.38	0.40	0.29	0.40
Timor-Leste	-	-	-	0.22	0.22	0.24	0.24	0.23	0.22	0.21
Togo	0.81	0.90	0.92	1.07	1.13	1.05	1.34	1.58	2.18	2.70
Tuvalu	6.92	6.78	6.85	7.23	7.72	9.12	11.22	13.20	15.17	17.12
Uganda	0.25	0.22	0.21	0.23	0.26	0.30	0.36	0.54	0.53	0.71
Vanuatu	3.50	3.48	3.31	3.19	3.21	3.22	3.38	3.87	4.45	3.01
Yemen	1.91	2.26	2.81	3.50	3.91	4.29	4.48	4.59	4.19	4.23
Zambia	0.80	0.80	0.80	0.79	0.80	0.81	0.78	0.75	0.72	0.70

*Note: For comparison purposes, this table includes data for Botswana, Cape Verde and Maldives, the three only countries that have graduated from the LDC status as of January 2011.

Source: ITU World Telecommunication / ICT Indicators Database.

Table A.3: Mobile cellular subscriptions per 100 inhabitants in LDCs*

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Afghanistan	0.0	0.0	0.1	0.9	2.5	4.9	9.9	17.8	29.0	42.6
Angola	0.2	0.5	0.9	2.2	4.6	9.7	17.9	28.3	37.6	43.8
Bangladesh	0.2	0.4	0.7	0.9	1.8	5.9	12.3	21.8	27.9	32.3
Benin	0.8	1.8	3.1	3.2	6.0	7.6	13.0	24.4	41.9	56.3
Bhutan	0.0	0.0	0.0	0.4	3.0	5.5	12.4	22.1	36.9	48.6
Botswana	12.9	19.0	18.8	24.8	28.8	30.7	44.1	60.9	77.3	96.1
Burkina Faso	0.2	0.6	0.9	1.9	3.0	4.6	7.1	12.6	19.9	24.3
Burundi	0.3	0.5	0.8	0.9	1.4	2.1	2.6	3.4	6.0	10.1
Cambodia	1.0	1.7	2.9	3.7	6.3	7.7	12.2	18.0	29.1	42.3
Cape Verde	4.5	7.1	9.4	11.5	14.0	17.1	22.5	31.0	55.7	57.5
Central African Rep.	0.1	0.3	0.3	1.0	1.5	2.4	2.6	4.7	5.8	13.6
Chad	0.1	0.3	0.4	0.7	1.3	2.1	4.5	8.6	16.6	20.4
Comoros	0.0	0.0	0.0	0.3	1.4	2.5	5.8	9.6	13.9	18.1
Congo (Dem. Rep.)	0.0	0.3	1.0	2.2	3.5	4.6	7.3	10.5	15.5	14.3
Djibouti	0.0	0.4	2.0	3.0	4.4	5.5	5.5	8.3	13.3	14.9
Equatorial Guinea	0.9	2.8	5.7	7.2	10.4	15.9	19.2	23.4	27.3	29.6
Eritrea	0.0	0.0	0.0	0.0	0.5	0.9	1.3	1.8	2.2	2.8
Ethiopia	0.0	0.0	0.1	0.1	0.2	0.5	1.1	1.5	2.4	4.9
Gambia	0.4	4.1	7.2	10.4	11.8	16.2	25.7	49.5	70.2	84.0
Guinea	0.5	0.7	1.0	1.3	1.7	2.0	-	20.8	28.0	34.7
Guinea-Bissau	0.0	0.0	0.0	0.1	2.7	6.7	10.4	19.2	31.7	34.8
Haiti	0.6	1.0	1.6	3.5	4.3	5.3	12.5	25.7	32.4	36.4
Kiribati	0.4	0.5	0.6	0.6	0.7	0.7	0.7	0.8	1.0	1.0
Lao P.D.R.	0.2	0.5	1.0	2.0	3.5	11.2	16.9	24.3	32.6	51.2
Lesotho	1.1	3.0	7.1	6.4	9.9	12.5	17.8	22.4	28.9	32.0
Liberia	0.1	0.1	0.2	1.5	2.9	4.8	8.1	15.5	19.3	21.3
Madagascar	0.4	0.9	1.0	1.7	1.9	2.9	5.8	11.9	25.3	32.0
Malawi	0.4	0.5	0.7	1.0	1.7	3.1	4.4	7.3	12.0	15.7
Maldives	2.8	6.8	14.9	23.4	39.3	69.6	91.4	104.3	142.8	147.9
Mali	0.1	0.2	0.4	2.2	3.5	6.4	12.5	20.4	27.1	34.2
Mauritania	0.6	4.1	9.0	12.4	18.0	25.0	34.6	45.0	65.1	66.3
Mozambique	0.3	0.8	1.3	2.2	3.5	7.2	11.0	14.1	19.7	26.1
Myanmar	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.5	0.7	1.0
Nepal	0.0	0.1	0.1	0.3	0.4	0.8	4.2	11.6	14.6	19.1
Niger	0.0	0.0	0.5	0.7	1.4	2.5	3.6	6.4	12.9	17.0
Rwanda	0.5	0.8	1.0	1.5	1.6	2.5	3.4	6.7	13.6	24.3
S. Tomé & Principe	0.0	0.0	1.4	3.3	5.2	7.8	11.9	19.1	30.6	39.3
Samoa	1.4	1.4	1.5	5.9	8.9	13.4	25.4	48.1	69.3	84.4

Senegal	2.5	3.0	5.3	7.3	10.2	15.3	25.8	30.5	44.1	55.1
Sierra Leone	0.3	0.6	1.5	2.4	-	-	-	14.3	18.1	20.4
Solomon Islands	0.3	0.2	0.2	0.2	0.6	1.3	1.4	2.2	5.9	5.7
Somalia	1.1	1.1	1.3	2.5	6.1	6.0	6.4	6.9	7.0	7.0
Sudan	0.1	0.3	0.5	1.4	2.8	4.7	11.8	20.3	29.0	36.3
Tanzania	0.3	0.8	1.7	3.5	5.1	7.6	14.0	20.0	30.6	39.9
Timor-Leste	-	-	-	2.2	2.7	3.3	4.8	7.4	11.4	29.1
Togo	1.0	1.8	3.0	4.3	5.7	7.2	11.5	18.9	24.0	33.0
Tuvalu	0.0	0.0	0.0	0.0	5.1	13.3	16.3	18.3	20.2	20.1
Uganda	0.5	1.1	1.5	2.9	4.2	4.6	6.8	13.7	27.0	28.7
Vanuatu	0.2	0.2	2.5	3.8	5.0	5.9	6.8	11.4	15.4	52.7
Yemen	0.2	0.8	2.5	3.4	7.2	10.8	13.8	19.5	28.1	35.3
Zambia	0.9	1.1	1.3	2.1	4.0	8.1	13.8	21.4	28.0	34.1

*Note: For comparison purposes, this table includes data for Botswana, Cape Verde and Maldives, the three only countries that have graduated from the LDC status as of January 2011.

Source: ITU World Telecommunication / ICT Indicators Database.

*Table A.4: Estimated Internet users per 100 inhabitants in LDCs**

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Afghanistan	-	0.00	0.00	0.09	0.11	1.22	2.11	1.90	1.84	3.55
Angola	0.11	0.14	0.27	0.37	0.46	1.14	1.91	2.84	3.05	3.28
Bangladesh	0.07	0.13	0.14	0.16	0.20	0.24	0.29	0.32	0.35	0.38
Benin	0.23	0.36	0.70	0.95	1.18	1.27	1.54	1.79	1.85	2.24
Bhutan	0.40	0.86	1.68	2.44	3.16	3.85	4.52	5.92	6.55	7.17
Botswana	2.90	3.43	3.39	3.35	3.30	3.26	4.29	5.28	6.25	6.15
Burkina Faso	0.08	0.16	0.20	0.37	0.40	0.47	0.63	0.75	0.92	1.13
Burundi	0.08	0.11	0.12	0.20	0.35	0.54	0.66	0.70	0.81	1.90
Cambodia	0.05	0.08	0.23	0.26	0.30	0.32	0.47	0.49	0.51	0.53
Cape Verde	1.82	2.69	3.52	4.32	5.32	6.07	6.81	8.28	20.00	29.67
Central African Rep.	0.05	0.08	0.13	0.15	0.22	0.27	0.31	0.38	0.44	0.51
Chad	0.04	0.05	0.17	0.32	0.36	0.40	0.58	0.85	1.19	1.50
Comoros	0.27	0.44	0.55	0.85	1.33	3.24	3.33	3.42	3.48	3.59
Congo (Dem. Rep.)	0.01	0.01	0.09	0.13	0.20	0.24	0.30	0.37	0.45	0.55
Djibouti	0.19	0.34	0.49	0.63	0.78	0.95	1.27	1.62	2.26	3.00
Equatorial Guinea	0.13	0.17	0.32	0.52	0.84	1.15	1.28	1.56	1.82	2.13
Eritrea	0.14	0.16	0.23	0.73	1.16	1.79	2.16	2.51	4.06	4.93
Ethiopia	0.02	0.04	0.07	0.11	0.16	0.22	0.31	0.37	0.45	0.54
Gambia	0.92	1.34	1.80	2.44	3.31	3.80	5.24	6.21	6.88	7.63
Guinea	0.10	0.18	0.40	0.45	0.51	0.54	0.64	0.78	0.92	0.94
Guinea-Bissau	0.23	0.30	1.02	1.35	1.81	1.90	2.06	2.21	2.35	2.30
Haiti	0.23	0.34	0.89	1.65	5.40	6.38	6.80	9.26	10.13	9.97
Kiribati	1.79	2.34	2.50	3.00	3.50	4.00	4.50	6.00	7.00	8.00
Lao P.D.R.	0.11	0.18	0.27	0.33	0.36	0.85	1.17	1.64	3.55	6.00
Lesotho	0.21	0.26	1.08	1.53	2.18	2.58	2.98	3.45	3.58	3.72
Liberia	0.02	0.03	0.03	0.03	0.03	-	-	0.55	0.53	0.51
Madagascar	0.20	0.22	0.34	0.42	0.53	0.57	0.61	0.65	1.65	1.63
Malawi	0.13	0.16	0.22	0.28	0.35	0.38	0.43	0.97	2.13	4.69
Maldives	2.20	3.62	5.35	5.98	6.59	6.87	11.04	16.30	23.17	27.93
Mali	0.14	0.19	0.23	0.31	0.43	0.51	0.73	0.81	1.57	1.92
Mauritania	0.19	0.26	0.36	0.42	0.48	0.67	0.98	1.43	1.87	2.28
Mozambique	0.11	0.16	0.26	0.42	0.68	0.85	0.84	0.91	1.56	2.68
Myanmar		0.00	0.00	0.02	0.02	0.07	0.18	0.22	0.22	0.22
Nepal	0.20	0.24	0.31	0.38	0.45	0.83	1.14	1.41	1.73	1.97
Niger	0.04	0.11	0.13	0.16	0.19	0.22	0.29	0.39	0.70	0.76
Rwanda	0.06	0.24	0.29	0.36	0.43	0.56	-	2.12	3.09	4.50

S. Tomé & Principe	4.64	6.31	7.58	10.16	13.32	13.76	14.18	14.59	15.48	16.41
Samoa	0.57	1.69	2.24	2.80	3.08	3.35	4.47	4.75	5.03	5.03
Senegal	0.40	0.98	1.01	2.10	4.39	4.79	5.61	7.70	10.60	14.50
Sierra Leone	0.12	0.16	0.18	0.19	0.20	0.22	0.23	0.24	0.25	0.26
Solomon Islands	0.48	0.47	0.50	0.56	0.65	0.84	1.65	1.81	1.96	1.91
Somalia	0.20	0.08	0.12	0.38	1.05	1.08	1.10	1.12	1.14	1.16
Sudan	0.03	0.14	0.44	0.54	0.79	1.29	8.09	8.66	10.16	9.94
Tanzania	0.12	0.17	0.22	0.68	0.88	0.99	0.97	0.97	1.22	1.55
Timor-Leste	-	-	0.00	-	-	0.10	0.12	0.14	0.16	0.19
Togo	1.91	2.78	3.60	3.69	3.78	5.01	5.21	5.42	5.42	5.38
Tuvalu	5.24	10.43	12.97	15.50	20.57	25.61	30.60	40.63	42.98	43.31
Uganda	0.16	0.24	0.38	0.46	0.72	1.74	2.53	3.67	7.90	9.78
Vanuatu	2.11	2.83	3.51	3.90	4.75	5.08	5.85	7.46	7.27	7.09
Yemen	0.08	0.09	0.52	0.60	0.88	1.05	1.25	5.01	6.89	9.96
Zambia	0.19	0.23	0.48	0.98	2.01	2.85	4.16	4.87	5.55	6.31

*Note: For comparison purposes, this table includes data for Botswana, Cape Verde and Maldives, the three only countries that have graduated from the LDC status as of January 2011.

Source: ITU World Telecommunication / ICT Indicators Database.

Table A.5: Fixed Internet subscriptions per 100 inhabitants in LDCs*

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Afghanistan	-	0.00	0.00	0.00	0.00	0.00	-	-	-	0.01
Angola	-	-	0.06	-	0.25	0.27	0.56	0.57	0.59	1.73
Bangladesh	0.04	0.04	0.05	0.05	0.07	0.08	0.10	-	-	-
Benin	0.04	0.06	0.07	0.08	0.09	0.08	0.09	0.11	0.11	0.22
Bhutan	0.13	0.22	0.27	0.34	0.48	0.55	0.88	0.90	0.87	0.95
Botswana	0.87	-	-	-	-	-	-	-	0.52	0.61
Burkina Faso	0.03	0.05	0.06	0.06	0.05	0.06	0.06	0.08	0.10	0.11
Burundi	0.02	-	-	-	-	-	-	-	0.06	0.06
Cambodia	0.03	0.04	0.05	0.05	0.06	0.06	0.08	0.10	0.13	-
Cape Verde	0.56	0.67	0.87	1.08	1.20	1.37	2.71	2.19	1.85	2.56
Central African Rep.	0.02	0.03	0.03	0.04	0.05	0.06	-	-	-	-
Chad	0.01	0.02	0.02	0.02	0.03	-	-	-	-	0.04
Comoros	0.09	0.12	0.16	0.15	0.15	0.20	0.21	0.22	0.23	0.24
Congo (Dem. Rep.)	-	-	0.01	0.02	0.03	0.04	0.06	0.08	0.10	-
Djibouti	0.15	0.21	0.20	0.28	0.38	0.44	0.50	0.59	0.74	1.05
Equatorial Guinea	0.09	0.12	0.15	0.17	-	0.20	-	-	-	-
Eritrea	0.05	0.05	0.06	0.07	0.08	0.11	0.11	0.11	0.13	0.14
Ethiopia	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.09
Gambia	0.27	0.30	-	-	-	-	-	0.22	-	-
Guinea	0.02	0.06	0.11	0.12	-	-	-	-	-	-
Guinea-Bissau	-	0.05	0.02	-	-	-	-	-	0.04	0.04
Haiti	0.08	0.11	0.34	0.55	0.81	-	-	1.03	-	-
Kiribati	0.60	0.64	0.87	-	-	-	-	-	-	-
Lao P.D.R.	0.03	0.03	0.05	0.06	0.10	0.11	0.08	0.09	0.22	0.25
Lesotho	-	-	0.09	0.10	0.12	0.13	-	-	-	-
Liberia	-	-	-	-	-	-	-	0.41	-	-
Madagascar	0.07	0.08	0.11	0.14	0.06	0.05	0.11	0.06	0.06	0.04
Malawi	0.05	0.08	0.11	0.10	0.12	0.11	-	0.59	0.71	-
Maldives	0.39	0.40	0.38	0.41	0.44	1.56	2.73	4.11	5.86	6.49
Mali	-	-	-	-	-	-	0.05	0.06	0.08	0.15
Mauritania	0.04		0.07	0.07	0.07	0.08	0.13	0.18	0.30	-
Mozambique	0.03	-	-	-	-	-	-	-	-	0.06
Myanmar	-	-	-	0.01	0.01	0.01	0.03	0.04	0.04	-
Nepal	0.05	0.06	0.08	0.10	0.11	0.17	0.23	0.28	-	-
Niger	0.02	0.02	0.02	0.02	0.02	0.03	-	-	-	-
Rwanda	0.01	0.02	0.02	0.03	0.03	0.03	0.05	0.06	0.09	1.48
S. Tomé & Principe	0.27	0.39	0.57	0.75	0.46	0.50	1.40	1.60	-	-

Samoa	0.17	0.56	0.74	-	-	-	-	-	-	-
Senegal	0.06	0.07	0.09	0.14	0.18	0.18	0.26	0.33	0.39	0.48
Sierra Leone	0.01	0.02	-	-	-	-	-	-	-	-
Solomon Islands	0.28	0.21	0.23	0.22	0.32	0.40	-	-	-	-
Somalia	0.01	-	0.01	0.03	0.11	-	-	-	-	-
Sudan	-	-	-	-	-	-	0.11	-	-	-
Tanzania	0.03	0.04	0.06	0.14		0.24	0.32	0.44	0.60	0.91
Timor-Leste	-	-	-	0.05	0.05	0.07	0.07	0.07	-	-
Togo	0.11	0.19	0.22	0.22	-	-	-	1.01	1.01	0.90
Tuvalu	1.26	2.09	2.59	3.20	2.57	5.33	7.14	8.13	-	-
Uganda	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.07	0.09
Vanuatu	0.74	0.95	0.75	0.73	0.76	0.74	-	-	-	1.08
Yemen	0.04	0.04	0.08	0.16	0.37	0.52	0.72	0.97	1.34	1.93
Zambia	0.06	0.08	0.11	-	-	-	0.08	0.10	0.14	0.14

*Note: For comparison purposes, this table includes data for Botswana, Cape Verde and Maldives, the three only countries that have graduated from the LDC status as of January 2011.

Source: ITU World Telecommunication / ICT Indicators Database.

Table A.6: Fixed broadband subscriptions per 100 inhabitants in LDCs*

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Afghanistan		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Angola		0.00	0.00	0.00	0.00	0.00	0.04	0.07	0.09	0.11
Bangladesh		0.00	0.00	0.00	0.00	0.00	-	0.03	0.03	0.03
Benin		0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.03
Bhutan		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.44
Botswana	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.19	0.46	0.51
Burkina Faso		0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.07	0.07
Burundi		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia		0.00	0.00	0.00	0.01	0.01	0.02	0.06	0.11	0.20
Cape Verde		0.00	0.00	0.00	0.06	0.20	1.54	1.49	1.48	2.17
Central African Rep.		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
Chad		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Comoros		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Congo (Dem. Rep.)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Djibouti	0.00	0.00	0.00	-	-	0.01	0.02	0.13	0.29	0.61
Equatorial Guinea		0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03
Eritrea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
Ethiopia		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gambia		0.00	0.00	0.00	0.00	0.00		0.02	0.02	0.02
Guinea		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
Guinea-Bissau		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
Haiti		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
Kiribati		0.00	0.00	-	-	-	-	0.00	-	-
Lao P.D.R.		0.00	0.00	0.00	0.00	0.01	0.01	0.08	0.10	0.13
Lesotho		0.00	0.00	0.00	0.00	0.00	-	0.01	0.01	0.02
Liberia		0.00	0.00	0.00	-	-	-	-	-	-
Madagascar		0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02
Malawi		0.00	0.00	0.00	0.00	0.00		0.01	0.02	0.02
Maldives	0.00	0.00	0.07	0.18	0.25	1.11	2.12	3.44	5.13	5.76
Mali		0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.02	0.02
Mauritania		0.00	0.00	0.00	0.00	0.01	0.03	0.13	0.18	0.27
Mozambique		0.00	0.00	0.00	0.00	0.00	-	0.03	0.05	0.05
Myanmar	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03
Nepal		0.00	0.00	0.00	0.00	0.00	0.00	0.04		0.05
Niger		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Rwanda		0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.08

S. Tomé & Principe	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.20	0.47	1.23
Samoa		0.00	0.00	0.00	0.02	0.04	0.05	0.07	0.09	0.11
Senegal		0.00	0.01	0.02	0.07	0.16	0.25	0.32	0.39	0.47
Sierra Leone			0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
Solomon Islands		0.00	0.00	0.00	0.04	0.09	0.13	0.20	0.29	0.38
Somalia		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
Sudan		0.00	0.00	0.00	0.00	0.00	0.01	0.11	0.11	0.38
Tanzania		0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
Timor-Leste		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Togo		0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.04
Tuvalu		0.00	0.00	0.00	0.51	1.54	2.55	2.74	2.93	-
Uganda		0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02
Vanuatu		0.00	0.00	0.01	0.01	0.03	0.04	0.06	0.07	0.21
Yemen		0.00	0.00	0.00	0.00	0.01	0.01	0.05	0.11	0.23
Zambia	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.04	0.06

*Note: For comparison purposes, this table includes data for Botswana, Cape Verde and Maldives, the three only countries that have graduated from the LDC status as of January 2011.

Source: ITU World Telecommunication / ICT Indicators Database.

Table A.7: Mobile broadband subscriptions per 100 inhabitants in LDCs*

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Afghanistan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Angola	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.16	0.77	2.76
Bangladesh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bhutan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	1.70
Botswana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.97
Burkina Faso	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Burundi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	1.03	3.08
Cape Verde	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	0.00
Central African Rep.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chad	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Comoros	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Congo (Dem. Rep.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.05
Djibouti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Equatorial Guinea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eritrea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethiopia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Gambia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24
Guinea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Guinea-Bissau	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haiti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kiribati	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lao P.D.R.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
Lesotho	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liberia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Madagascar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Malawi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maldives	0.00	0.00	0.00	0.00	0.00	0.00	0.10	21.90	32.81	32.52
Mali	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mauritania	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	2.24	3.23
Mozambique	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40
Myanmar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nepal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Niger	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Rwanda	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.15
S. Tomé & Principe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Samoa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Senegal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sierra Leone	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Solomon Islands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Somalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sudan	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.20	0.39	0.79
Tanzania	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.18	0.41	1.37
Timor-Leste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Togo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tuvalu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uganda	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.68	1.10
Vanuatu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yemen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zambia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03

*Note: For comparison purposes, this table includes data for Botswana, Cape Verde and Maldives, the three only countries that have graduated from the LDC status as of January 2011.

Source: ITU World Telecommunication / ICT Indicators Database.

Table A.8: Public payphones per 1000 inhabitants in LDCs*

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Afghanistan	-	-	-	-	-	0.012	0.012	0.014	-	-
Angola	0.027	-	-	-	-	0.026	0.003	0.003	0.040	-
Bangladesh	0.015	0.015	0.015	0.010	0.010	-	-	-	-	-
Benin	0.076	0.094	0.107	0.109	0.105	0.089	0.084	0.081		-
Bhutan	-	-	-	-	0.856	-	-	-	-	-
Botswana	1.679	1.695	1.265	1.059	1.047	0.870	1.609	1.585	0.545	-
Burkina Faso	0.123	0.213	0.405	0.441	0.439	0.873	0.878	-	-	-
Burundi		0.002	0.001	0.001	0.458	-	-	-	0.662	-
Cambodia	0.026	0.024	0.027	0.035	0.032	0.031	0.031	0.032	0.031	-
Cape Verde	0.898	1.003	0.985	0.990	0.917	0.905	0.898	1.200	1.123	-
Central African Rep.	0.024	0.025	0.026	-	-	-	-	-	-	-
Chad	0.008	0.007	0.007	0.007	0.008	0.010	-	-	-	-
Comoros	0.317	0.441	0.512	-	-	-	0.874	1.111	1.221	-
Congo (Dem. Rep.)	-	-	-	-	0.026	0.314	0.428	1.040	3.352	-
Djibouti	0.088	0.375	0.393	0.450	0.506	0.600	1.057	1.752	2.578	-
Equatorial Guinea	-	-	-	-	-	-	-	-	-	-
Eritrea	0.114	0.113	0.112	0.108	0.104	0.101	0.109	0.108	0.124	-
Ethiopia	0.031	0.038	0.050	0.025	0.025	0.035	0.056	0.060	0.061	-
Gambia	-	0.442	-	-	-	-	-	2.041	-	-
Guinea	0.101	0.108	0.143	-	-	-	-	0.104	0.102	-
Guinea-Bissau	0.156	-	-	-	-	-	-	-	-	-
Haiti	-	0.102	0.112	0.132	-	-	-	-	-	-
Kiribati	-	-	-	0.191	-	-	-	-	-	-
Lao P.D.R.	0.047	0.059	-	0.066	0.061	0.054	-	-	0.048	-
Lesotho	0.194	0.266	0.347	0.634	0.651	0.640	1.263	2.826	4.120	-
Liberia	-	-	-	-	-	-	-	0.017	-	-
Madagascar	0.030	0.049	0.048	0.056	0.053	0.054	0.065	0.109	0.143	-
Malawi	0.046	0.047	0.045							-
Maldives	2.310	2.615	2.756	3.227	3.253	2.941	2.533	2.434	2.341	-
Mali	0.225	0.279	0.336	0.399	0.518	0.612	0.559	0.802		-
Mauritania	0.339	1.264	1.837	2.342			1.633		0.596	-
Mozambique	0.102	0.166	0.210	0.320	0.347	0.302	0.199			-
Myanmar	0.029	0.040	0.049	0.086	0.092	0.097	0.105	0.118	0.093	-
Nepal	-	0.033	0.051	0.077	0.084		0.166			-
Niger	0.005	0.005	-	0.006						-
Rwanda	0.101	0.241	0.351	0.461	0.611	0.735	0.869	0.954	0.974	-
S. Tomé & Principe	0.485	0.484	0.558	0.698	0.779	0.773	0.793	0.825		-

Samoa	0.850	0.845	0.842	0.560	-	-	-	-	-	-
Senegal	1.362	1.547	1.534	1.666	1.865	2.172	2.072	1.494	0.549	0.324
Sierra Leone	-	-	-	-	-	-	-	-	-	-
Solomon Islands	0.611	-	-	-	-	-	-	-	-	-
Somalia	-	-	-	-	-	-	-	-	-	-
Sudan	0.150	0.206	-	-	-	0.095	0.093	0.091	0.089	-
Tanzania	0.023	0.045	0.056	-	-	0.128	0.144	-	-	-
Timor-Leste	-	-	-	0.017	0.018	0.017	0.017	0.016	-	-
Togo	1.453	2.063	2.207	2.318	3.816	4.366	3.472	4.671	-	-
Tuvalu	-	-	-	-	2.057	3.073	0.204	0.000	-	-
Uganda	0.135	0.147	0.125	0.129	0.167	0.241	0.374	0.784	1.893	-
Vanuatu	-	-	-	-	-	2.356	-	-	-	-
Yemen	-	-	-	-	-	-	-	-	-	-
Zambia	0.083	0.082	0.080	0.079	0.075	0.064	-	0.442	-	-

*Note: For comparison purposes, this table includes data for Botswana, Cape Verde and Maldives, the three only countries that have graduated from the LDC status as of January 2011.

Source: ITU World Telecommunication / ICT Indicators Database.

Annex 2   Final report of the ITU LDC-IV Pre-Conference Event

Fourth UN Conference on LDCs Pre-Conference Event
Digital Inclusion For Least Developed Countries: Innovation •Growth •Sustainability
8 – 9 March 2011, ITU Headquarters, Geneva, Switzerland

FINAL REPORT (Abridged)

In preparation for the Fourth United Nations Conference on the Least Developed Countries (UNLDC-IV) to be convened in Istanbul, Turkey, from 9 to 13 May 2011, the International Telecommunication Union organized a pre-conference event in Geneva. The meeting sought to review progress made towards the implementation of the 10-year Brussels Programme of Action (BPoA), and to explore innovative ways of using information and communication technologies as a catalyst in alleviating poverty and stimulating growth in least developed countries under the new Istanbul Programme of Action.

Based on deliberations, the participants adopted the following text and recommended that this should be submitted to the second session of the Intergovernmental Preparatory Committee for the Fourth United Nations Conference on the Least Developed Countries that will be convened from 4 to 8 April 2011 at United Nations Headquarters in New York and subsequently to the fourth United Nations Conference for the LDCs in Turkey:

We, the participants, at the Digital Inclusion for LDCs: Innovation, Growth, and Sustainability, ITU pre-conference event for the LDC-IV, firmly believe that:

1. Following the adoption of an international framework for cooperation, which was laid out in the three United Nations programmes of Action (PoAs) for LDCs, the objectives of these three PoAs have not yet been fully met.

2. Progress has been made in many areas particularly in the last decade under the aegis of the Brussels Programme of Action, particularly in the domain of information and communication technologies where governments have put in place an enabling environment for ICT investment, leading to increased investment and growth in mobile networks and services.

3. Information and communication technologies facilitate progress in other sectors such as trade, productive capacities, environment, disaster risk reduction, disaster management, education, gender mainstreaming, health, agriculture, and climate change as these technologies permeate every facet of human life.

4. The inclusive and multi-stakeholder implementation and follow-up process to the World Summit on the Information Society (WSIS) is making positive contributions to the creation of an information society in LDCs which has the potential to contribute to employment generation, job-creation, growth, productivity and long-term economic competitiveness.

5. Information and communication technologies play a catalytic role in the attainment of the Millennium Development Goals (eradicate extreme poverty and hunger, achieve universal primary education, promote gender equality and empower women, reduce child mortality,

improve maternal health, combat HIV/AIDS, Malaria and other diseases, ensure environmental sustainability, and develop a global partnership for development). The target for ICTs is the most advanced of all the MDG targets.

6. New technologies such as broadband have great potential for accelerating the achievement of the Millennium Development Goals by the internationally agreed deadline of 2015. There is an existing broadband divide between the rest of the world and LDCs that needs to be addressed. Regulated access to broadband and broadband enabled services has to be enhanced.

7. Mobile technologies have gone a long way in contributing towards the bridging of the digital divide in LDCs. However, the access gap to ICTs between rural and urban areas remains an issue to be addressed.

8. The seven convergent and interdependent forces of Policy, Infrastructure, Technology, Innovation, Content and Applications, People and Government, which were identified by the Broadband Commission for Digital Development, should be harnessed by the international community to build a Broadband Development Dynamic.

9. Global climate patterns are changing and will continue to change at rates unprecedented in recent human history. The impacts and risks associated with these changes are real and already felt in many countries and communities particularly in least developed countries. Climate change threatens global efforts of achieving the Millennium Development Goals and sustainable development. Information and Communication Technologies are involved in environment and climate change monitoring, data dissemination and early warning.

10. Government-wide leadership and commitment is needed in establishing appropriate legal and regulatory frameworks that include putting in place pro-ICT tax regimes and ensure that ICT are on top of the agenda in national economic planning. Development of national e-strategies as an integral part of national development plans and poverty reduction strategies plays an important role in turning of the LDC Conference outcomes and WSIS targets into action. Development Partners play an important role in bridging the digital divide in LDCs.

11. ICT data collection, dissemination and analysis are essential for benchmarking and monitoring digital divide and information society. Measurement of the impact of ICTs on socio-economic development in LDCs plays an important role for national strategic planning. Repositories to document the best practices in the area of ICTs in LDCs should facilitate implementation of the Programme of Action. In this regard, the work of the Partnership on Measuring ICT for Development should be used as a basis to ensure international comparability of ICT data and statistics. Assistance in the area of ICT data collection and processing should be provided to LDCs through support to National Central Statistical Offices that are already involved in statistical data management.

12. Capacity building in the ICT Sector is needed at national and regional level. This assistance is expected to be provided by International Organizations and other development partners.

13. A multi-stakeholder approach is needed and private sector participation is critical. Policy-makers need to engage with industry and investors to promote policy objectives more broadly and attract domestic and foreign investment into the ICT sector. Global solidarity and

commitment was felt necessary for achieving the goals of Programme of Action by due date. Multi-stakeholder platforms/initiatives, like Connect the World, may help to mobilize the financial, human and technical resources for addressing development challenges with the use of ICTs.

14. The importance of ICT for development in LDCs has been stated, however financing models for implementation of ICT projects still remains as an urgent necessity to ensure sustainability in mid and long term. Sustainable use of ICTs needs to be considered so that it does not pose threats to health and the environment, in particular when the equipment reaches its end of life. Appropriate e-waste management measures such as recycling, re-use and proper disposal mechanisms are needed in partnership with the international community.

15. Intellectual Property to include issues of patents should contribute to the overall access to technology by LDCs. Measures should be taken to ensure that preferential and differential treatment are put in place in favour of LDCs.

16. In addition to the public sector, financing of ICT infrastructure by the private sector plays an important role in many countries and that domestic financing is being augmented by North-South flows and South-South Cooperation.

17. The international community recognizes the 'power-to-unlock' which comes with ICTs and innovation which should be highlighted in the next Programme of Action for LDCs, and the potential of these technologies to accelerate the achievement of the MDGs and other internally-agreed development goals and key knowledge society priorities such as those of the WSIS by 2015, in the context of the new digital realities and opportunities of the networked society and economy.

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Notes

Chapter 1

1   During the decade 2000 -2010, the Programme dedicated to provide concentrated assistance to LDCs changed names at each of the World Telecommunication Development Conference held in 2002, 2006, and 2010. In 2002, the conference adopted a Special Programme for Least Developed Countries. In 2006, the conference adopted a Programme for Least Developed Countries, Small Island Developing States, and Emergency Telecommunications. In 2010, the programme evolved and became known as Programme for Least Developed Countries, Countries in Special Need, Emergency Telecommunications, and Climate Change Adaptation.

2   See UN General Assembly Resolution 2768 (XXVI) of 18 November 1971. The original 25 countries designated under the LDC category included Afghanistan, Benin, Bhutan, Botswana, Burkina Faso, Burundi, Chad, Ethiopia, Guinea, Haiti, Lao People's Democratic Republic, Lesotho, Malawi, Maldives, Mali, Nepal, Niger, Rwanda, Samoa, Sikkim (a protectorate of India in 1971), Somalia, Sudan, Uganda, United Republic of Tanzania and Yemen.

3   The procedure for inclusion in the LDC category has been refined over time, to include three complementary eligibility criteria that reflect measurements of long-term structural weaknesses, as determined from a country's gross national income (GNI) per capita, and two composite indices of structural handicap: a *human assets index* (HAI) that refers to education, nutrition and health levels, and an *economic vulnerability index* (EVI) for measuring the risk of and exposure to natural and trade shocks, economic remoteness and economic smallness. In 1991, a population criterion was added to exclude any country with more than 75 million inhabitants from being considered for LDC status. See: United Nations Conference on Trade and Development (UNCTAD). (2010). *The Least Developed Countries Report 2010*: *Towards a New International Development Architecture for LDCs*. p. ii.

4   UN-OHRLLS. (n.d.). *Least Developed Countries: Criteria for Identification of LDCs.* Retrieved on 24 January, 2011, from www.unohrlls.org/en/ldc/related/62/.

5   As of January 2011, the 16 LLDCs are: Afghanistan, Bhutan, Burkina Faso, Burundi, Central African Republic, Chad, Ethiopia, Lao People's Democratic Republic, Lesotho, Malawi, Mali, Nepal, Niger, Rwanda, Uganda and Zambia. The ten SIDS include: Comoros, Guinea-Bissau, Haiti, Kiribati, Samoa, Sao Tome & Principe, Solomon Islands, Timor-Leste, Tuvalu and Vanuatu. Maldives –also a SIDS– graduated from the LDC status in January 2011.

6   The annual population growth rate in LDCs for the 2010-2015 period is estimated to be slightly more than twice that of the world's rate for the same period. For population data and estimates see: United Nations Department of Economic and Social Affairs (UNDESA). (2008). *World Population Prospects: The 2008 Revision*. Population Division, UNDESA. Available at http://esa.un.org/unpp.

7   *Idem*, pp. 7-9.

8   UNCTAD. (2010). p.ii.

9   Guillaumont, P. (2010, October). From inclusion to graduation: Why the least developed countries were «caught in a trap» and should move «out of the trap». Presentation at the Second Committee Special Event Organized by UN-OHRLLS as part of the preparatory process for the 4th UN Conference on the LDCs. Available at http://www.un.org/wcm/webdav/site/ldc/shared/From%20inclusion%20to%20graduation%20RR.pdf.

10 See: General Assembly resolutions 46/206 (1991) and 59/209 (2004).

[11]   UNCTAD. (2010), p. ii.

Chapter 2

[1]   InfoDev & ITU. (2011, March). Module 7. New Technologies and impacts on regulation. In InfoDev & ITU, *ICT regulation toolkit.* p. 38. Retrieved on 2 March 2011 from www.ictregulationtoolkit.org/en/SectionPDF.1318.html.

[2]   See, for example Vogelsang, I. (2010, January). The Relationship between Wireless and Fixed Line Communications: A Survey. *Information Economics & Policy, 22,*1 Special Issue on Wireless Innovation. Retrieved on 2 March, 2011 from http://businessinnovation.berkeley.edu/Mobile_Impact/Vogelsang_Survey.pdf.

[3]   The number of mobile cellular subscriptions is not identical to the number of mobile users, since one person may have several SIM cards and/or subscriptions. In other cases, one person may only have one subscription, but share services with other people. Reliable data on the number of mobile phone users can only be obtained through official and nationally representative surveys. While the number of countries carrying out official household ICT surveys is increasing, including among the LDCs, many countries, and the majority of LDCs, only collect data on ICT access, not use.

[4]   For more information on ITU's Connect the World and the Connect Africa initiatives, see: www.itu.int/partners/factsheet.html and www.itu.int/ITU-D/connect/africa/index.html in the ITU website.

[5]   See: www.itu.int/ITU-D/connect/arabstates/index.html for the Arab States Connect Summit and www.itu.int/ITU-D/connect/asia/index.html for the Connect Asia-Pacific Summit.

[6]   See, for example: The Broadband Commission for Digital Development (2010). *A 2010 Leadership Imperative: The Future Built on Broadband*. Geneva: ITU/UNESCO. The report is available at www.broadbandcommission.org/outcomes.html.

[7]   Mobile broadband subscriptions refer to subscriptions that have the potential to connect the subscriber to high-speed broadband networks but they may not actually be used for broadband services.

Chapter 3

[1]   Negative growth rates for the 2000-2009 period ranged from -0.01 in Zambia to -0.16 in Liberia. Other LDCs showing negative CAGRs for this period included Guinea, Guinea-Bissau, Mozambique, Solomon Islands, Sudan, Tanzania and Vanuatu. Botswana, graduated from the status in 1994, also had negative growth rates in fixed line teledensity during this period (-0.01%).

[2]   ITU. (2010a). ITU World Telecommunication/ICT Development Report 2010: Monitoring the WSIS Targets, A mid-term review. p. 14. Geneva: ITU.

[3]   ITU World Telecommunication/ICT Indicators Database. Cited in ITU (2009). *Information Society Statistical Profiles 2009: Asia and the Pacific*, Geneva: ITU, p. 49.

[4]   ITU's latest ICT Price Basket combines 2009 fixed telephone, mobile cellular and fixed broadband tariffs for 161 economies into one measure and compares these across countries, and over time. For more information, see: Chapter 4 of the ITU (2010b).

[5]   See: www.nokia.com/NOKIA_COM_1/Corporate_Responsibility/Society_/Expanding_Horizons/Expanding_Horizons_NEW/pdf/Expanding_Horizons_Q2_2009.pdf.

6   Only very few LDCs carry out household surveys and hardly any collect survey data on the number of individuals who use the Internet. The Internet user data are therefore largely estimated – usually based on the number of Internet subscriptions.

7   Tuvalu's high ranking on Internet usage might be related to its high number of Internet hosts, estimated at 248 hosts per 100 inhabitants in 2007. Since 2000, the country has become a "host farm", as a result of its country domain name ending with .tv. In 1999, the government of Tuvalu decided to sell the .tv domain name to Internet entrepreneurs in return for the payment of USD one million every three months. According to ITU, by January 2009, some 100 thousand IP addresses had been assigned to the domain name. See: ITU (2010a), p. 160, and Kitsing, M., & Philip N. H. (2009). Turning Dirt Roads into Information Highways: The Conceptual Misformation of Internet Diffusion. *World Information Access Project Working Paper #2009.2.* Seattle: University of Washington.

8   ITU. (2010b). Measuring the Information Society 2010, p.15. Geneva: ITU.

Chapter 4

1   UNOHRLLS. (2010). *LDC's: Facts and Figures*. Retrieved February 21, 2011 from www.unohrlls.org/UserFiles/File/Elle Wang Uploads/UN_LDC_Factsheet_061610.pdf.

2   See UNCTAD (2003). Trade preferences for least developed countries: An early assessment of benefits and possible improvements. (UNCTAD/ITCD/TSB/2003/8).

3   Current WTO members include Angola, Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Dem. Rep. of the Congo, Djibouti, Gambia, Guinea, Guinea Bissau, Haiti, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Senegal, Sierra Leone, Solomon Islands, Togo, Uganda, Tanzania and Zambia. Meanwhile, Afghanistan, Bhutan, Comoros, Equatorial Guinea, Ethiopia, Lao P.D.R., Liberia, Sao Tomé and Principe, Samoa, Sudan, Vanuatu and Yemen are in the process for accession.

4   UNOHRLLS. (2010). *LDC's: Facts and Figures*. Retrieved February 21, 2011 from www.unohrlls.org/UserFiles/File/Elle Wang Uploads/UN_LDC_Factsheet_061610.pdf.

5   See Karl, K. (2001). Foreign direct investment in the LDCs: How it could help and what is preventing it? *The Courier ACP-EU*, July/August.

6   LDCs that are also considered SIDS include Comoros, Guinea-Bissau, Haiti, Kiribati, Maldives, Samoa, Sao Tome & Principe, Solomon Islands, Timor-Leste, Tuvalu and Vanuatu.

7   IPCC. (2007). p. 104.

8   Nazrul, A. (2008). *LDCs in the post-Kyoto negotiations.* Retrieved on March 17, 2011 from www.wamis.org/agm/meetings/rsama08/Bari501-Nazrul_Kyoto-Protocol.pdf.

9   *Idem*, p. 3.

10   *Ibidem*, p. 2.

11   For a review of the evolution in the number of independent telecommunication regulatory agencies in LDCs from 1990 to 2005 see: ITU (2006). *ICT and Telecommunications in Least Developed Countries: Mid-Term review for the decade 2001-2010.* Geneva, Switzerland: ITU, p. 23.

12   Bauer, J. (2005). Regulation and State Ownership: Conflicts and Complementarities in EU Telecommunications. *Annals of Public and Cooperative Economics*, 76(2), 151-177; Edwards, G., &

Waverman, L. (2006). The Effects of Public Ownership and Independence on Regulatory Outcomes. *Journal of Regulatory Economics*, 29(1), 23-67.

[13] Naish, A. (2009, October 19). Government to sell shares from Dhiraagu. *Dhivegi Observer*. Retrieved on February 26, 2011 from http://doreview.blogspot.com/2009/10/government-to-sell-shares-from-dhiraagu.html.

[14] See Bauer (2010). Regulation, Public Policy, and Investment in Communications Infrastructure. *Telecommunications Policy, 34*(1-2), 65-79.

[15] See, for example, Falch, M., & Henten, A. (2010). Public-private Partnerships as a Tool for Stimulating Investments in Broadband. *Telecommunications Policy, 34*(9), 496-504.

[16] Countries with partial competition in mobile voice services (in most cases competition limited to certain regions) as of 2009 are Afghanistan, Eritrea, Guinea-Bissau, Haiti, Kiribati, Lao PDR, Liberia, Maldives, Mali, Rwanda, Samoa, Senegal, Sierra Leone, and Sudan.

[17] According to the ITU Regulatory Database, in 2009, the following countries permitted VoIP: Bhutan, Cambodia, D.R. Congo, Gambia, Guinea, Kiribati, Liberia, Madagascar, Malawi, Maldives, Myanmar, Nepal, Rwanda, S. Tome & Principe, Samoa, Senegal, Sudan, and Togo.

[18] See: www.unohrlls.org/UserFiles/File/Elle Wang Uploads/UN_LDC_Factsheet_061610.pdf.

[19] Samarajiva, R. (2010). Leveraging the budget telecom network business model to bring broadband to the people. *Information Technology and International Development*, 6, special issue: 93-97. http://itidjournal.org/itid/article/view/630/270; and Samarajiva, R. (2009). How the developing world may participate in the global Internet economy: Innovation driven by competition. In OECD, *ICTs for development: Improving policy coherence* (pp. 75-118). Paris: OECD. www.oecd.org/dataoecd/39/15/44003919.pdf.

[20] For example, Ribeiro, J. (2010, May 18) Vodafone takes a hit in India. *PC World*. Retrieved from www.pcworld.com/article/196533/vodafone_takes_a_hit_in_india.html.

[21] Teletimes International (2010, September 21). *Pakistan Telecommunications Industry – Growth and Challenges*. Retrieved from http://teletimesinternational.com/research/411/pakistan-telecommunications-industry-growth-and-challenges

[22] Huawei. *Defining success for operators*. Retrieved from www.huawei.com/communication_extension/white_paper/success.do.

[23] Eisenberg, A. (2010, July 17). Bye-bye batteries: Radio waves as a low-power source. *New York Times*. Retrieved from www.nytimes.com/2010/07/18/business/18novel.html?_r=1&th&emc=th.

[24] InStat. (2011). Over 1/3 of New Base Stations Deployed from 2011 to 2014 Will Be in China, India, or the US. *InStat Market Alerts*.

[25] Ibrahim, M. (2010). Country paper. Presented at the International conference on good governance for national development, Seoul, June 17-18. Retrieved from http://unpan1.un.org/intradoc/groups/public/documents/un/unpan039629.pdf.

[26] Video of Soledad Alvis, at http://lirneasia.net/projects/2008-2010/bop-teleuse-3/teleuse3videos/.

1   An in depth review of the activities implemented by the ITU during the 2001-2005 period is presented it: ITU (2006). *ICT and Telecommunications in Least Developed Countries: Mid-term review for the decade 2001-2010.* Geneva: ITU. This report is available online at www.itu.int/ITU-D/ldc/pdf/ictand_telinldc-e.pdf.

2   In 2010, the ITU LDC Programme adopted the target of increasing the average telephone density in LDCs to 15 main lines (ML) per 100 inhabitants and the number of Internet connections to 15 users per 100 inhabitants by 2015. See: ITU-D (2010). *Hyderabad Plan of Action*, World Telecommunication Development Conference, Final Report, Annex C, p. 66.

3   See: Resolution 19 (Malaga-Torremolinos, 1973) of the ITU Plenipotentiary Conference.

4   A different set of countries is selected for the following two years.

5   In the past, assistance for disaster risk reduction through emergency telecommunications had been provided on an ad hoc basis, in response to various ITU resolutions and recommendations, e.g. Resolution 34 (Istanbul, 2002) and Recommendation 12 (Istanbul, 2002) of the World Telecommunication Development Conference, and Resolution 36 (Rev.Marrakesh, 2002) of the Plenipotentiary Conference. In January 2005, the United Nations held the World Conference on Disaster Reduction in Hyogo, Kobe and adopted the Hyogo Declaration for the decade 2005-2015. The Hyogo Declaration recognizes that disasters remain a major threat to the survival, dignity, livelihood and security of peoples and communities, in particular the poor such as those in LDCs and SIDS.

6   ITU. (2002). Programme 6: Special programme for least developed countries. *World Telecommunication Development Conference (WTDC-02) – Final report*, pp. 46-48.

7   Concentrated assistance for 2011 is planned for Cape Verde, Comoros, Ethiopia, Guinea, Madagascar, Mali, Mauritania, Niger, Somalia and Zambia in the African region, Haiti in the Americas and Bangladesh, Kiribati, Nepal, Timor Leste and Tuvalu in the Asia Pacific region.

8   The ITU-D ICT Applications and Cybersecurity Division is dedicated to promoting the adoption of ICT networks, services and applications in the areas of commerce, agriculture, government and health, among other, as well as to the promotion of cybersecurity (see: www.itu.int/ITU-D/cyb/); meanwhile ITU-D's Partnership Division is dedicated to advancing the creation of public-private partnerships to fund diverse ITU initiatives (see: www.itu.int/ITU-D/partners/index.html).

9   UN-OHRLLS. (2005). Programme of Action for the Least Developed Countries for the Decade 2001-2010: Framework for Partnership. New York: UNOHRLLS, p. 3.

10 The project was co-funded by the Asia-Pacific Telecommunity, the Government of Australia, ITU, the Pacific Islands Forum Secretariat, the Pacific Islands Telecommunications Association, and the United Nations Development Programme.

11 See: ITU-D. (2009). *ITU-D Operational Plan 2009, Performance Report as of 19.1.09*, available at www.itu.int/ITU-D/pdf/op/Performance2009_19_1_09.pdf.

12 See: Sections 2 (d) and 2(g) under Commitment 2 in UN-OHRLLS. (2005). Programme of Action for the Least Developed Countries for the Decade 2001-2010: Framework for Partnership. New York: UNOHRLLS, pp. 4-5.

13 See: www.itu.int/wtpf/.

14 See: www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR10/consultation/index.html.

15 See Sections A. (d), B. (a) and C. (c) under Commitment 3 in UN-OHRLLS. (2005). *Programme of Action for the Least Developed Countries for the Decade 2001-2010: Framework for Partnership.* New York: UNOHRLLS, pp.

16 See the ITU website page on SMS4DC at: www.itu.int/ITU-D/tech/spectrum_management/SMS4DC.html.

17 See: http://go.worldbank.org/3B3IIW2IW0.

18 InfoDev – World Bank. (2007, May 24). *A global capacity building initiative for regulators.* Highlight. Retrieved on March 22, 2011 from www.infodev.org/en/Article.111.html.

19 The common portal for the ITU Academy is available at http://academy.itu.int.

20 See: www.itu.int/pub/T-TUT-EHT-2006-RTM.

21 See Target 25 and section 4.B (d) under Commitment 4, in UN-OHRLLS. (2005). Programme of Action for the Least Developed Countries for the Decade 2001-2010: Framework for Partnership. New York: UNOHRLLS.

22 Information on the current status of the Nepal Wireless Networking Project, beyond the support delivered by ITU, can be a found in the project's site: www.nepalwireless.net/.

23 ITU. (2007). eHealth in Nepal. ITU Final Report: Assessment and recommendations on National eHealth Planning, Nepal. Internal document.

24 The project benefited from a South-South transfer of expertise, know-how and technology from India.

25 This project is a joint effort of ITU, the Tanzania Commission for Science and Technology (COSTECH), World Space Corporation, UNESCO, UNHCR and Volunteers in Technical Assistance (VITA).

26 See section 5 (c) under Commitment 5, in UN-OHRLLS. (2005). Programme of Action for the Least Developed Countries for the Decade 2001-2010: Framework for Partnership. New York: UNOHRLLS.

27 For further information on activities conducted under this action line see: www.itu.int/osg/csd/cybersecurity/WSIS/index.phtml.

28 Developments on PKI are part of the work of ITU-T Study Group 17, Question 11 - "Directory services, Directory systems, and public-key/attribute certificates."

29 The Nepali e-Haat Bazaar website is available at www.b2b.com.np/new/index.php.

30 See: Child Online Global Initiative at www.itu.int/osg/csd/cybersecurity/gca/cop/.

31 See section 6. (b) under Commitment 6, in UN-OHRLLS. (2005). Programme of Action for the Least Developed Countries for the Decade 2001-2010: Framework for Partnership. New York: UNOHRLLS.

32 ITU. (2008). *Annual report on the activities of the Union - Council 2008*. Document C08-35-E. Geneva, Switzerland: ITU, p. 38.

33 ITU. (2006, March). Mission report: ITU Workshop on Emergency Communications for Disaster Management in Bangladesh. Internal report.

34 See: www.itu.int/ITU-D/emergencytelecoms/events.html.

35 See: www.itu.int/ITU-D/emergencytelecoms/events/global_forum/index.html.

36 See: www.amcdrrmalaysia.com.my/pages.php.

37 ITU. (2007). *Annual report on the activities of the Union - Council 2007*. Document C07-35-E. Geneva, Switzerland: ITU, p. 36.

38 ITU. (2009). *Annual report on the activities of the Union - Council 2009*. Document C09-35-E. Geneva, Switzerland: ITU, p. 25.

39 ITU-D. (2009). ITU-D Operational Plan 2009, p.3.

40 See: www.itu.int/pub/D-STG-SG02.22-2010/en.

41 See: www.itu.int/ITU-D/cyb/app/e-env.html.

42 The latest version of the report can be found at http://itu.int/ITU-T/emergencytelecoms/plan-tdrew.html.

43 ITU. (2010). *Preliminary draft WSIS+5 report*. Unpublished manuscript. p. 9.

44 See sections 7 (i) and 7.D. (c) under Commitment 7, in UN-OHRLLS. (2005). Programme of Action for the Least Developed Countries for the Decade 2001-2010: Framework for Partnership. New York: UNOHRLLS.

45 ITU. (2007). Annual report on the activities of the Union - Council 2007. p. 36.

46 See: www.itu.int/ITU-D/connect/index.html.

47 The GSMA is the Association that unites nearly 800 of the world's mobile operators, as well as more than 200 companies in the broader mobile ecosystem, including handset makers, software companies, equipment providers and Internet companies.

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

49 See: www.itu.int/ITU-D/connect/flagship_initiatives/wireless_broadband/index.html.

50 See: www.itu.int/ITU-D/connect/flagship_initiatives/wireless_broadband/index.html.

51 See Resolution 16 in ITU. (2010). *World Telecommunication Development Conference (WTDC-10).* Geneva: ITU, p. 133.

Chapter 6

1 The ICT Market Harmonization for ECOWAS/UEMOA project resulted in the adoption of a harmonized ICT legal framework currently being transposed into national law by 15 West African States. For more details see: www.itu.int/ITU-D/treg/projects/itu-ec/index.html.

2 The beneficiary LDCs are listed under each of the three sub-projects of the policy harmonization initiative.

3 The initiative's original time frame (January 2008 – December 2011) was extended for a period of 9 months per decision of the ITU-ACP-EC Steering Committee.

4 HIPSSA beneficiary countries include: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Côte d'Ivoire, D.R. Congo, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Equatorial, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia, and Zimbabwe.

5 The LDCs not included under HIPSSA are Comoros, Djibouti, Mauritania, Somalia and Sudan.

6 This report provides a comparative study of the existing regional policy, legal and regulatory frameworks in Sub- Saharan Africa, resulting in a comparison between the regional harmonization initiatives in the various sub-regions to determine their commonalities and divergences. The report identifies the key

challenges and opportunities related to achieving a harmonized regulatory approach and present the results under a SWOT analysis for each regional organization.

7   The documents were presented at the SADC Technical meeting held in Johannesburg, South Africa, in March 2010; the SADC Telecommunications, Postal and ICT Ministerial meeting in Luanda, Angola, in May 2010; and a validation workshop in Maputo, Mozambique, July 2010.

8   Beneficiary countries under HIPCAR include Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname and Trinidad and Tobago.

9   These countries are Barbados, Dominican Republic, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname and Trinidad and Tobago.

10 ITU-D. (2009), p. 9.

11 Beneficiary countries include Cook Islands, East Timor, Fiji, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.

12 Statement by H.E. M. Masoom Stanekzai, Minister of Communication of the Transitional Islamic State of Afghanistan, World Summit for the Information Society, Geneva, Switzerland, December 11, 2003. Retrieved on March 25, 2011 from www.itu.int/wsis/geneva/coverage/statements/afghanistan/af.doc.

13 The project, implemented with the collaboration of the United Nations Development Programme, was funded with an ITU contribution of over half a million dollars from its Telecom Surplus fund. See: www.itu.int/newsarchive/press_releases/2002/35.html.

14 Speech of Hassam Baryalai, Afghanistan's Deputy Minister of Communications and Information Technology, WSIS Forum 2009. Retrieved on March 27, 2011 from www.itu.int/itunews/manager/display.asp?lang=en&year=2009&issue=05&ipage=26&ext=html.

15 ITU & UPU. (2008, July). E-Services through post offices in Afghanistan: A development cooperation project of Government of Islamic Republic of Afghanistan, Government of India, International Telecommunication Union and Universal Postal Union. p. 1. Retrieved March 12, 2011 from www.itu.int/ITU-D/tech/rural_telecom/Rural_Projects/UPU_Afghanistan.pdf.

16 See: www.itu.int/ITU-D/emergencytelecoms/events/global_forum/itu-ifce.pdf.

17 ITU. (2010, March). ITU responds to earthquake-torn Haiti. *ITU News*, retrieved on March 12, 2011 from www.itu.int/net/itunews/issues/2010/02/16.aspx.

18 See: www.itu.int/ITU-D/emergencytelecoms/events.html.

Chapter 7

1   *An Industry on the Line: Telecommunications in Afghanistan*. *India Knowledge@Wharton*. Retrieved on March 30, 2011 from http://knowledge.wharton.upenn.edu/india/article.cfm?articleid=4361.

2   The Development Bank of South Africa and AfDB provided USD 410,000 to fund the study, which was completed in July 2009.

3   Originally published in ITU. (2009). *Information Society Statistical Profiles 2009: Africa*. ITU: Geneva, Switzerland.

4   Sri Lanka Telecom. (n.d.). *Investor relations*, available at www.slt.lk/data/investor/041investing.htm.

5   ITU. (2002). *International Internet bandwidth in Asia-Pacific.* Retrieved on March 29, 2011 from www.itu.int/itunews/issue/2002/10/indicators.html.

6   World Bank. (2010, September). Information and Communication Technologies for Development. *Issue Brief.* Washington D.C.: The World Bank.

7   Broadband Commission for Digital Development. *Terms of reference*. Retrieved on 10 January, 2011, from www.broadbandcommission.org/terms.html.

8   Foster, V., Butterfield, W., Chen, Ch. & Pushak, N. (2009). Building bridges: China's growing role as infrastructure financier for Sub-Saharan Africa. p. xi.

9   During the 2001-2007 period, China has directed funds to finance ICT projects in Angola, Benin, Burundi, Central African Rep., D.R. Congo, Eritrea, Ethiopia, Gambia, Lesotho, Mali, Niger, Senegal, Sierra Leone, Sudan, Togo and Zambia.

10   Foster, V. *et al.* (2009). pp. 100-105.

11   *Idem*.

12   *Idem*, p. 24.

13   Yemen is the only Asian LDC that is not also a developing member country of de ADB.

14   This figure is not the amount invested for the ICT component but for the whole project.

15   This figure is based on the number of initiatives, not individual projects. For example, an initiative on public administration reform supported by several piggybacked loans and TAs/grants is counted as one project.

16   The World Bank Business Warehouse database.

17   Walsham, G., & Sahay, S. (2006). Research on Information Systems in Developing Countries: Current Landscape and Future Prospects. *Information Technology for Development, 12*(1).

18   See, for example: Jensen, R. (2007). The Digital Provide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector. *Quarterly Journal of Economics*, 122(3), pp. 879-924; Aker, J. C. (2008). Does Digital Divide or Provide? The Impact of Cell Phones on Grain Markets in Niger. *BREAD Working Paper*, 154*;* Aker, J. C. (2010). Information from Markets Near and Far: Mobile Phones and Agricultural Markets in Niger. *American Economic Journal: Applied Economics*, 2(3), pp. 46-59; and Klonner, S. & Nolen, P. (2008). *Does ICT Benefit the Poor? Evidence from South Africa.* Unpublished mimeo.

19   *Idem*.

20   Bhatnagar, S. (2004). eGovernment, from Vision to Implementation, A practical Guide with Case Studies (8th ed.); Curtin, G., Sommer, M., & Vis-Sommer, V. (Eds.). (2003). The World of E-Government.

21   Price Waterhouse Coopers/GSMA. (2006). *Regulation and the Digital Divide*. GSMA.

22   ITU. (2010). Preliminary report WSIS+5, p. 27.