Module 7 - Global Footprints: Stories from and for the Developing World

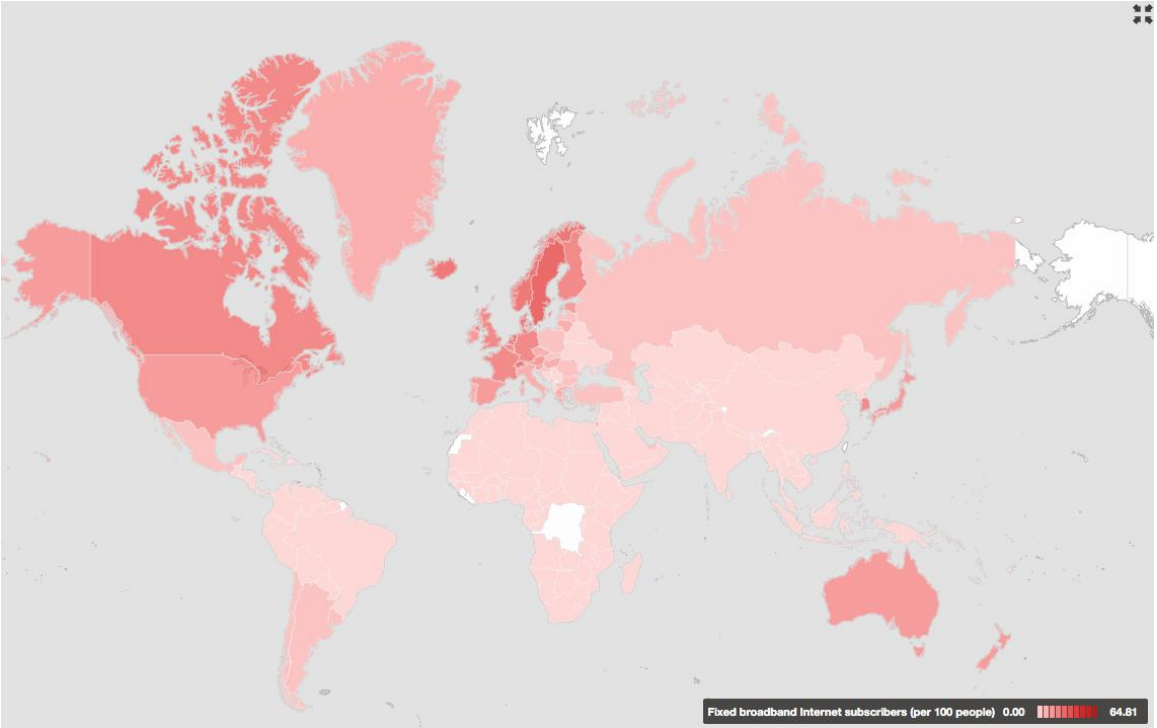
Tables

Figures

Boxes

Developing nations face a number of broadband demand and supply side barriers compared to developed countries. These include a shortage of fixed infrastructure, constrained inter- and intra-modal competition, low income, and awareness. As a result, they typically lag developed countries in broadband penetration (Figure 1), although there are exceptions such as some nations in the Caribbean or the Gulf States.

Figure 1. Fixed broadband subscribers per 100 inhabitants



Source: World Bank (http://data.worldbank.org/indicator/IT.NET.BBND.P2/countries?display=map).

A number of studies show that broadband increases economic growth (See Chapter 1). Broadband is also a platform for innovation, an enabler of Small and Medium Enterprise (SME) growth and a facilitator of new firm foundation. This is particularly relevant for countries facing the challenge of development and looking to raise the standard of living of their citizens. In that regard, it is useful to look at international objectives for promoting development and examine how broadband fits in.

1 Broadband and global goals for developing countries

Broadband has taken on increased relevance within the development community because of its potential to reduce poverty and better enable countries to participate in the global information society. International agreements on development and ICTs provide a context for the significance of broadband in developing countries.

In September 2000, governments adopted the Millennium Declaration, committing their nations to reducing poverty monitored through measurable targets (Figure 2). The targets have a 2015 deadline and are known as the *Millennium Development Goals* (MDGs).[1] Several reports have illustrated how ICTs can help to achieve the MDGs.[2] Broadband can specifically help to achieve the MDGs in numerous ways. For example, one of the barriers to achieving Goal 2 on universal primary education is the lack of primary school teachers. Broadband can facilitate fast track teacher training through distance education and e-learning. Three of the MDGs are related to health; high-speed networks can have an impact through applications such as telemedicine.

Figure 2. The 8 Millennium Development Goals (MDGs)

Source: United Nations MDG Monitor.

The *World Summit on the Information Society* (WSIS) was held in two phases, in 2003 in Geneva and in 2005 in Tunis.[3] The *Declaration of Principles* identifies ICTs as an "essential foundation for the information society" noting that "[a] well-developed information and communication network infrastructure and applications, adapted to regional, national and local conditions, easily-accessible and affordable, and making greater use of broadband and other innovative technologies where possible, can accelerate the social and economic progress of countries, and the well-being of all individuals, communities and peoples." WSIS adopted ten targets addressing connectivity across different sectors (Figure 3). The International Telecommunication

[1] http://www.un.org/millenniumgoals/

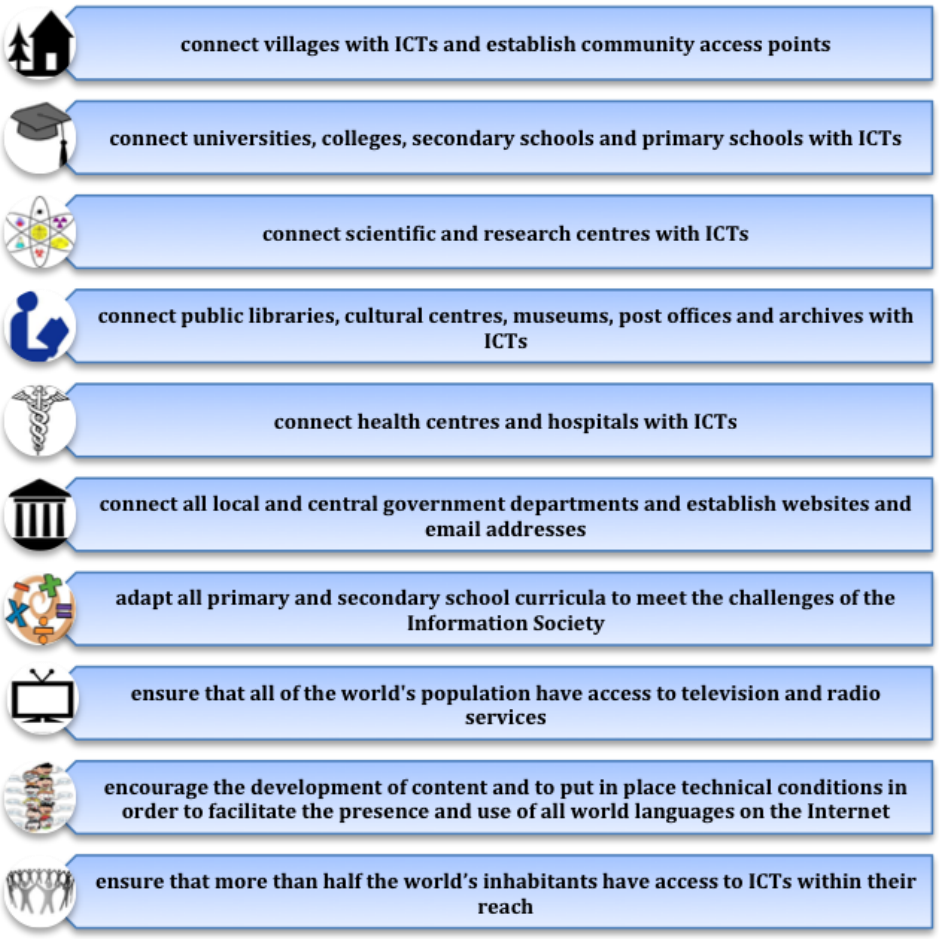
[2] For example see: ITU. 2003. "ICTs and the Millennium Development Goals." In *World Telecommunication Development Report 2003* and Broadband Commission. 2010. "Broadband and the Interlinked and Interdependent MDG Agenda". In *The Future Built on Broadband*.

[3] http://www.itu.int/wsis/index.html

Union (ITU) has reviewed progress towards the WSIS targets and emphasized that most should be considered as having a broadband component:

> "It is widely recognized that ICTs are increasingly important for economic and social development. Indeed, today the Internet is considered as a general-purpose technology and access to broadband is regarded as a basic infrastructure, in the same way as electricity or roads. … Such developments need to be taken into consideration when reviewing the WSIS targets and their achievement, and appropriate adjustments to the targets need to be made, especially to include broadband Internet."[4]

Figure 3. The 10 WSIS targets



Source: WSIS Plan of Action (http://www.itu.int/wsis/docs/geneva/official/poa.html).

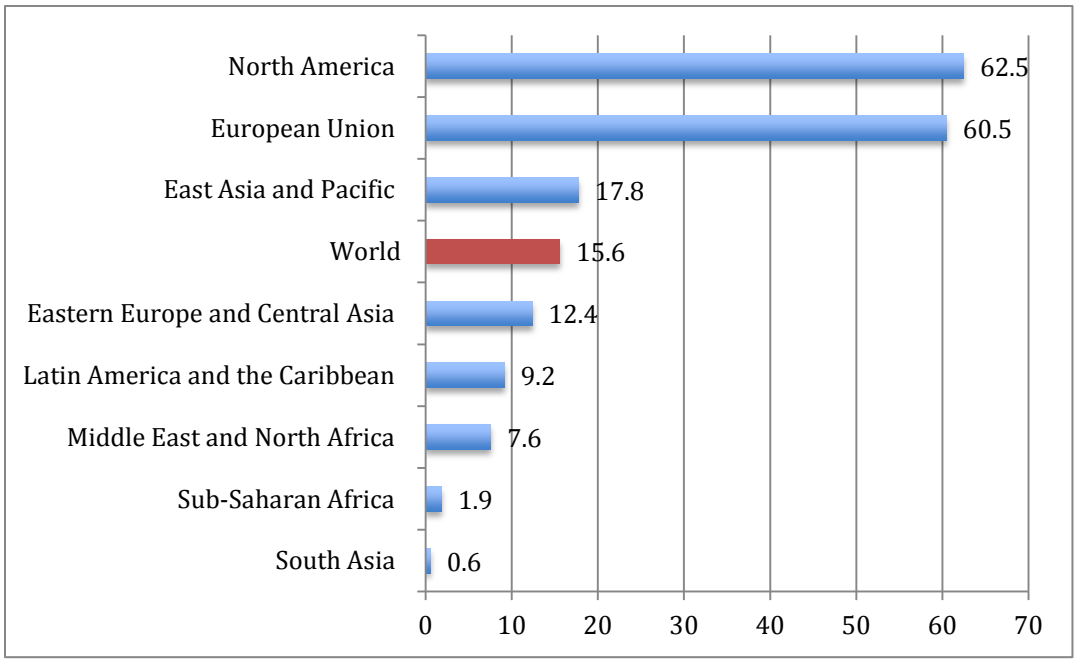
Taken together, the MDGs and WSIS targets provide a global roadmap for developing country policymakers. Broadband can help achieve the MDGs and thus place high-speed networks within the context of overall national development goals while the WSIS targets monitor broadband deployment across different sectors.

[4] ITU. 2010. *World Telecommunication Development Report: Monitoring the WSIS Targets*.

2 Broadband bottlenecks in developing regions

There is a wide broadband gap around the world. Three out of every five people in the European Union and North America have a broadband subscription compared to less than one in a hundred in South Asia (Figure 4).

Figure 4. Global Broadband Subscriptions, Fixed and Wireless, September 2009

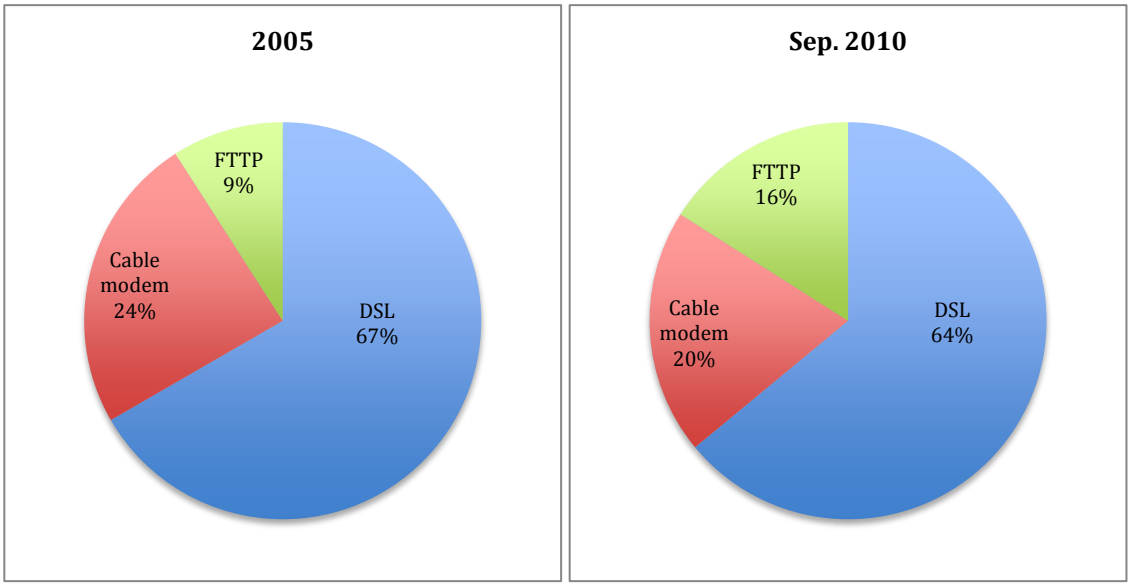


Source: World Bank analysis based on data from TeleGeography's GlobalComms database and from the Wireless Intelligence database.

Note: Table covers subscribers using fiber-optic, DSL (digital subscriber line), cable television, CDMA2000 (Code Division Multiple Access 2000) 1xEV-DO (Evolution Data Optimized), CDMA2000 1xEV-DO Rev. A, W-CDMA (Wideband Code Division Multiple Access), W-CDMA HSPA (high-speed packet access), WiMAX (worldwide interoperability for microwave access), and TD-SCDMA (Time Division–Synchronous Code Division Multiple Access) networks.

Improving access to broadband networks requires addressing supply and demand side bottlenecks. On the supply side, there are two broadband routes with different characteristics and market developments: fixed and wireless. The three main fixed broadband technologies in use are Digital Subscriber Line (DSL), cable modem and fiber to the premise (FTTP) (Figure 5). DSL is the predominant technology accounting for almost two thirds of fixed broadband subscriptions in September 2010. Broadband access over cable television networks was used by one in five subscriptions around the world. FTTP accounted for just 16% of global fixed broadband in September 2010 but its share has grown since 2005 while DSL and cable modem have dropped.

Figure 5. Distribution of fixed broadband subscriptions, world, 2005 and Sep. 2010



Source: Point-Topic.

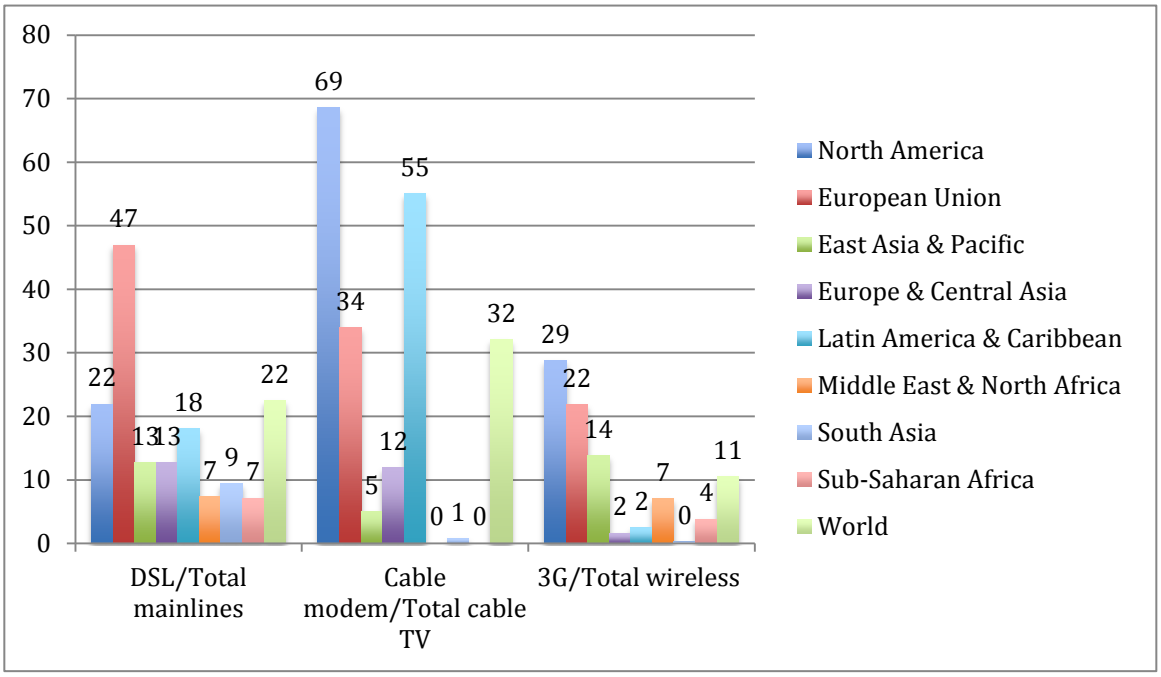
Fixed broadband requires an underlying wired infrastructure. In the case of DSL, these are the copper lines used to connect subscribers to the telephone network. In the case of cable modem, the supporting transport media is the coaxial cable used to provide television access to subscribers. Fiber optic broadband uses fiber optic cables running directly to the home or building. Fixed telephone and cable television infrastructures are expensive to create from scratch and thus hard to replicate if a country is not already endowed with them. In the case of fiber optic, significant investment is required to install the cables.

Given the above-mentioned constraints, the wireless broadband route appears more promising for developing nations. There is a larger base of mobile subscriptions compared to fixed telephone or cable television throughout the world. However, converting mobile networks to broadband readiness requires investment for spectrum and equipment by operators and the purchase of new devices by users. Although the deployment costs of mobile broadband are less than fixed, they are still significant. Other wireless options include fixed wireless such as WiMAX and satellite. Like mobile broadband, fixed wireless also requires investment in spectrum and equipment and it may not be able to leverage the existing infrastructure of mobile subscriptions in terms of towers and backbone networks. Satellite broadband is an option, particularly for remote locations but is more costly than other solutions for mass deployment.

Conditions vary across the developing world, and each country is endowed with differing levels of communication networks. Some, such as Costa Rica or Croatia, have a relatively well-developed fixed telephone network that could support broadband deployment, while others, such as China and Romania, have widely spread cable TV networks that are able to provide a measure of facilities-based competition. The challenge is to create incentives so that existing networks can be used to offer broadband services. In other countries, the challenge is to rollout broadband-capable networks from scratch. Diversity in broadband infrastructure creates a higher degree of inter-modal competition. Therefore, countries should consider how they could leverage existing infrastructures to create greater competition in the broadband market. In 2009, the world was only using a little over one fifth of telephone lines for DSL, around a third of

cable television connections for cable broadband, and just over ten percent of mobile subscriptions were broadband (Figure 6).

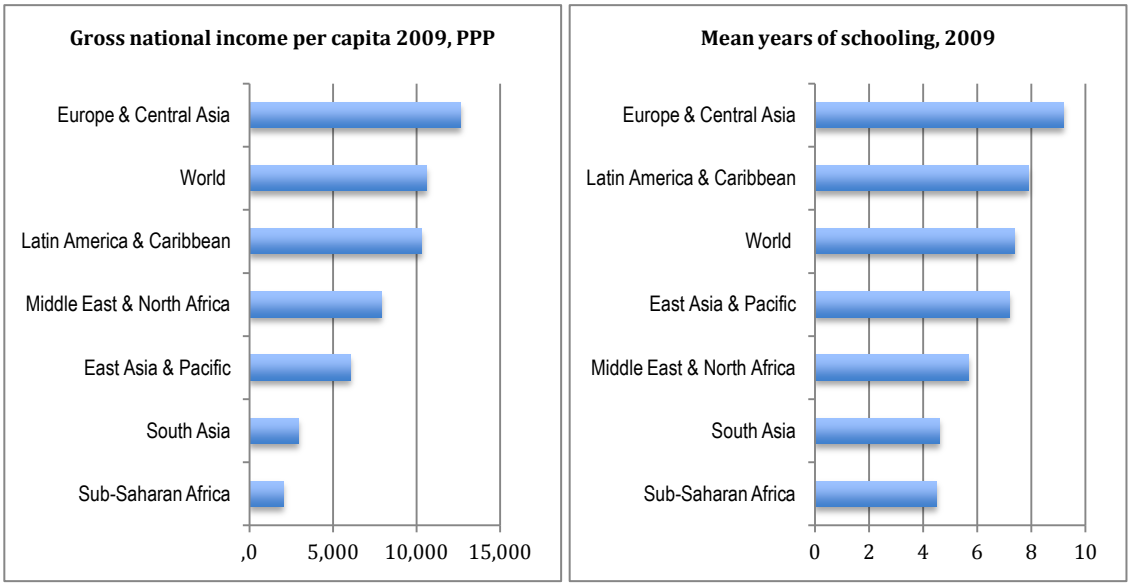
Figure 6. Broadband connections relative to underlying infrastructure



Source: Data for DSL from TeleGeography's GlobalComms database (2008), data for 3G from Wireless Intelligence (2008) and data for cable broadband from ictDATA.org (2009).

Broadband is also dependent on demand side aspects such as accessibility to broadband services, being able to afford broadband and awareness of its benefits. If these demand side issues are not tackled, a country risks creating a mismatch between supply and demand and will not be able to fulfill its broadband potential. A country's level of income impacts the ability to pay for broadband services while education levels affect awareness. Figure 7 illustrates demand side indicators for different developing regions in terms of per capita income and years of schooling.

Figure 7. Demand side indicators



Source: World Bank (GNI per capita), UNDP (years of schooling).

The next section summarizes the broadband status of developing regions and regional and national policies for boosting broadband penetration. Section 4 identifies groups of countries that face specific income, geographic or other limiting conditions. Section 5 provides case studies of broadband in selected countries and Section 6 outlines best practice principles.

3 Regional developments

This section highlights broadband status in different developing regions.[5]

3.1 East Asia and the Pacific

The region is home to world broadband leaders such as the Republic of Korea, Hong Kong, China and Japan where super high-speed access is increasingly becoming the norm. However, a huge broadband divide distinguishes "the mostly high-income countries that are broadband leaders from the mostly middle- and low-income countries that are broadband challenged." [6]

A number of developing countries in the region have deployed telephone and cable television network infrastructure but often they are not adequately upgraded for fixed broadband access. For example, the region's developed economies such as Japan, the Republic of Korea and Singapore have been successful in developing broadband access through cable television network infrastructure. This is not the case in the region's developing nations. Despite large cable television markets in some countries such as China, the Philippines and Thailand, broadband competition from cable television providers is generally low. One reason is that many networks in developing economies have not been upgraded to support broadband access

[5] This chapter classifies developing economies into geographic groups according to the World Bank regional classifications at: http://data.worldbank.org/about/country-classifications/country-and-lending-groups.

[6] ESCAP. 2010. *Broadband development in Asia and the Pacific*. August 13. http://www.unescap.org/idd/events/cict-2010/CICT2_INF5.pdf.

via cable modem. Take China; despite having the world's largest cable television market with almost 175 million subscribers in 2009, it has relatively few cable modem subscriptions and only about a quarter of its subscriptions are digital. This is likely to change with China's new "Triple Network Project" announced in 2010.[7] The project aims to enhance convergence among telecommunications, Internet and broadcast networks by reducing barriers so that each market segment can provide any broadband service.

Mobile broadband is beginning to make inroads. Most of the East Asian nations have awarded mobile broadband spectrum and in a number of the region's developing nations, mobile broadband subscriptions exceed fixed. Take Indonesia where in September 2010 there were 6.7 million mobile broadband subscriptions using data cards compared to only 1.9 million fixed broadband subscriptions.[8] Mobile broadband coverage needs to be extended throughout the region from mainly urban areas to rural zones.

Malaysia is a regional example of a country that has set broadband goals.[9] It developed its Information, Communications, and Multimedia Services (MICMS) 886 strategy in 2006, setting a number of goals for broadband services. One was to increase broadband penetration to 25 percent of households by the end of 2006 and 75 percent by the end of 2010. But despite impressive growth, the target for 2006 has not been met. The government is now focusing on WiMAX, 3G, and FTTH platforms to boost broadband adoption. To that end, the government is funding a fiber optic network that will connect about 2.2 million urban households by 2012. The network will be rolled out by Telekom Malaysia under a public private partnership. Under the partnership, the government will invest MYR 2.4 billion (US$ 700 million) in the project over 10 years, with Telekom Malaysia covering the remaining costs. The total cost of the project is expected to be MYR 11.3 billion (US$ 3.28 billion).

Connecting the Pacific region with broadband is a major challenge. But it is critical that Pacific economies gain access to adequate bandwidth essential for supporting broadband development. Many of the island nations are widely dispersed and backbone networks are limited. Most countries rely on high-cost, limited capacity satellites and only a few economies have access to fiber optic submarine cables. The sub-region has been slow to develop mobile broadband, a consequence of previously limited competition in mobile markets. However, a number of countries now have competitive mobile markets that should spur deployment of high-speed wireless networks.[10]

Vietnam has made impressive strides in boosting international high-speed connectivity and broadband use. The case of Vietnam is highlighted in a case study (see Section 5.7).

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[7] "Triple network project launched." *People's Daily Online*, July 2, 2010. http://english.peopledaily.com.cn/90001/90778/90860/7050112.html.

[8] Telkom Indonesia. n.d. *Info Memo - Third Quarter 2010 Results (Unaudited)*. http://www.telkom.co.id/investor-relation/reports/info-memo/.

[9] Kim, Yongsoo, Tim Kelly, and Siddhartha Raja. 2010. *Building Broadband: Strategies and Policies for the Developing World*. Washington D.C.: World Bank. http://www.infodev.org/en/Publication.756.html.

[10] Howes, Stephen, and Matt Morris. 2008. *Pacific Economic Survey 2008: Connecting the Region*. Canberra: Australian Agency for International Development. http://www.ausaid.gov.au/publications/pdf/pacific_economic_survey08.pdf.

3.2 Europe and Central Asia

The region is relatively well endowed with characteristics to encourage broadband take-up: significant fixed and cable television networks and relatively high incomes and levels of education compared to other developing regions. However, it is highly diverse in terms of broadband potential. This diversity is reflected in the United Nations Economic Commission for Europe (UNECE) four-stage classification of European and Central Asian members' ICT development[11] (Table 1). The UNECE describes strategies as ranging from accelerating and deepening usage in the more advanced economies of the region to raising awareness and establishing community access in those countries in the lowest level.

Table 1. UNECE classification of regional ICT development

ICT Level	Countries	Main Focus
Advanced	Western European and Northern European countries mainly	To accelerate effective usage of ICT and the Internet by businesses and consumers and deepen the Internet
Upper medium	Some Baltic, Central and Southern European countries	Extending the Internet outreach horizontally and vertically by means of e-governance, e-education and targeted e-Inclusion program
Lower medium	Some Central, Eastern, Southern European and Balkan countries, including Kazakhstan, Ukraine, Belarus and the Russian Federation	Horizontal extension of the ICT and Internet physical infrastructure, furthering and improving the institutional regime, digitization of public agencies and services, and investing in ICT education and research facilities
Lowest level	Most of the Central Asian countries	Raising awareness of ICT and the Internet, establishing an enabling institutional environment, and widening the access to the Internet by means of Public Internet Access Points

Source: UNECE.

Despite having deployed fixed infrastructure relatively well, wired broadband growth has been hampered because consumers are content with using Internet dial-up. One reason is that telephone charges have historically been low in the region and not all Internet subscribers see the benefits of switching to more expensive higher speed connections. Mobile broadband has been launched in most countries in the region although the timing has differed. Most Eastern and Southern European countries launched mobile broadband before the Central European and Central Asian nations. This provided Eastern and Southern European countries with a head start in both deployment and migration to higher speeds. For example, Romania launched 3G in 2006 and had over 2.5 million active mobile broadband subscribers at the end of 2009 accounting for almost half of all broadband subscriptions; mobile broadband speeds up to 21.6Mb/s are available in the Romanian market.

[11] Kapitsa, Larissa. 2008. "Towards a Knowledge-based Economy – Europe and Central Asia: Internet Development and Governance." *UNECE Discussion Papers*. UNECE. http://www.unece.org/oes/disc_papers/disc_papers.htm.

A number of the medium and upper medium countries in the region adopted broadband strategies within the framework of national ICT plans. Most of the country's plans were launched in the early to mid-2000s and coincided with significant increases in broadband penetration. For example Moldova adopted its information society strategy in 2005 that incorporated a number of tracking indicators to monitor the impact of policies and programs for improving broadband access.[12] Broadband penetration in Moldovan households rose from less than one percent in 2003 to 17 percent by 2009.[13] International bandwidth rose significantly in the landlocked country following an optical fiber connection to Romania (Box 1).

Box 1. Impact of improved access to international connectivity: The case of Moldova

Until April 2010, Moldova's international connectivity market was entirely controlled by state-owned incumbent Moldtelecom. Due to this and because it is a landlocked country, Moldova's private firms did not have direct access to the Internet. At that time, the Government reformed policy and procedures to open the market to competition. By July 2010, three companies, mobile telephony provider Orange and Internet service providers Starnet and Norma, successfully applied to construct and operate cross border fiber optic cables and gain direct access to carriers via Romania.

The benefit of liberalization on availability, prices, and quality was immediate. International Internet bandwidth available in Moldova went from 13 Gbps in December 2009 to over 50 Gbps in July 2010. In response, Moldtelecom dropped the prices for wholesale connectivity by a third over that same time, with some of this drop coming in anticipation of the liberalization in late 2009. And retail subscribers in some parts of the country have already seen their available bandwidth double while subscription rates have remained the same.

As a country looking to establish its position as an ICT hub in Eurasia, this move marks the first step towards connecting Moldova's fledging IT based services to global markets. Improved connectivity will allow SMEs to connect with new markets at lower prices and enhance their competitiveness.

Source: World Bank analysis, TeleGeography Global Bandwidth Research Service data for 2009[14]

Some of the countries in the region have translated broadband deployment into high bandwidth and rank among the top countries in the world in average download speeds. This includes Moldova, a landlocked country. On the other hand, landlocked countries in Central Asia face the challenge of ensuring that regional broadband backbones keep up with the region's growing ICT needs. Within that context, the Economic and Social Commission for Asia and the Pacific (ESCAP) undertook a feasibility study in four countries: Kazakhstan, Kyrgyzstan, Tajikistan, and

[12] Government of Moldova. 2005. *National Strategy on Building Information Society –"e-Moldova"*. http://en.e-moldova.md/Sites/emoldova_en/Uploads/strat_ENG.36370AF841D74D74B3969D0FA3FBE6D2.pdf

[13] ANRCETI. 2010. *Report on Activity and Evolution of Electronic Communications Markets in 2009*. http://en.anrceti.md/news20042010_2

[14] *Broadband competitiveness in Eastern Europe and Central Asia*. August 25, 2010. www.infodev.org/en/Document.960.pdf.

Uzbekistan.[15] The study recommended closer regional cooperation to spur development of backbone networks.

Turkey's government recognizes the importance of a vibrant telecommunications market and is keen to promote the spread of broadband. For instance, many educational institutions now have broadband access. The Information Society Strategy for 2006–2010 aims to develop regulation for effective competition and to expand broadband access. Targets include extending broadband coverage to 95 percent of the population by 2010 and reducing tariffs to 2 percent of per capita income. The regulator has also looked at issuing licenses for the operation of broadband fixed wireless access (BFWA) networks in the 2.4GHz and 3.5GHz bands. In June 2009, Turkey had penetration rates of 9 percent for fixed broadband and 4 percent for mobile broadband. The case of Turkey is highlighted in a case study (see Section 5.6).

3.3 Latin America & the Caribbean

In November 2010, ministers at the Third Ministerial Conference on the Information Society of Latin America and the Caribbean (LAC) adopted eLAC2015, a regional roadmap for the information society. eLAC2015 considers broadband pivotal noting:

> "For the countries of Latin America and the Caribbean, the universalization of broadband access in the twenty-first century is as important for growth and equality as were electric power and road infrastructures in the twentieth century. Broadband is an essential service for the economic and social development of the countries of the region, and it is indispensable for progress, equality and democracy. That is why the strategic goal is for broadband Internet access to be available to all of the citizens of Latin America and the Caribbean."[16]

Six goals were highlighted for universal broadband access in the region:

Table 2. eLAC2015 universal broadband access goals

Goal 1:	Increase direct investment in broadband connectivity to make it available in all public establishments.
Goal 2:	Advance towards universal availability of affordably priced broadband connectivity in homes, enterprises and public access centres to ensure that, by 2015, at least 50% of the Latin American and Caribbean population have access to multiple convergent interactive and interoperable services.
Goal 3:	Coordinate efforts to bring down the costs of international links by means of a larger and more efficient regional and subregional broadband infrastructure, the inclusion of (at least) the necessary ducts for fibre-optic cables in regional infrastructure projects; the creation of Internet exchange points; the promotion of innovation and local content production; and the attraction of contents suppliers

[15] ESCAP. 2009. *Broadband for Central Asia and the road ahead*. http://www.unescap.org/idd/working%20papers/IDD_TP_09_05_of_WP_7_2_909.pdf.

[16] *Plan of Action for the Information and Knowledge Society in Latin America and the Caribbean (eLAC2015)*. ECLAC, November 2010. http://www.eclac.cl/cgi-bin/getProd.asp?xml=/socinfo/noticias/documentosdetrabajo/5/41775/P41775.xml&xsl=/socinfo/tpl-i/p38f.xsl&base=/socinfo/tpl/top-bottom.xsl.

	and distributors.
Goal 4:	Collaborate and coordinate with all regional stakeholders including academia and business, the technical community and organizations working in the field, such as the Latin American and Caribbean Internet Addresses Registry (LACNIC) and the Internet Society (ISOC), to ensure that Internet Protocol version 6 (IPv6) is broadly deployed in the region by 2015; and implement, as soon as possible, national plans to make government public services portals in Latin America and the Caribbean accessible over IPv6 and to make public sector networks native IPv6 capable.
Goal 5:	Harmonize indicators which provide an overview of the situation of broadband in the region, in terms of both penetration and uses of applications, in accordance with international standards.
Goal 6:	Promote ICT access and use by persons with disabilities, with emphasis on the development of applications that take into account standards and criteria on inclusion and accessibility. In this connection, promote compliance by all government web portals with the web accessibility standards established by the World Wide Web Consortium (W3C).

Source: eLAC2015.

LAC has a relatively high number of fixed telephone lines and cable television subscribers compared to other regions. Cable broadband has been particularly successful with over half of the subscribers enjoying a broadband subscription. The number of telephone lines being used for broadband using DSL is relatively low, a consequence of the high costs of entering the fixed telephone market and the lack of effective local loop unbundling policies in the region.

Mobile broadband development has lagged compared to other regions. One factor has been delays in the award of spectrum used specifically for 3G services. However, this has been mitigated somewhat by widespread policies throughout the region allowing operators to use their existing 850/900 MHz spectrum, originally allocated for voice, for high-speed mobile data services. These frequencies also support wider coverage with fewer base stations so that investment costs are lower and a larger number of people can gain access.[17]

On the demand side, LAC fares favorably compared to other developing regions. Education levels are relatively high and the existence of common languages throughout many countries—Spanish in Latin America and English in much of the Caribbean—results in a high level of content, spurring demand. Despite relatively high per capita income for a developing region, incomes are highly skewed in the region and affordability remains an issue. For example over half of Mexican households reported that they did not have Internet access in 2009 because they could not afford it.[18]

Chile was the first Latin American country to announce a national broadband strategy. The strategy identified ICT as a priority for economic development. Chile has also planned and

[17] Roetter, Martyn. 2009. *Mobile Broadband, Competition and Spectrum Caps*. http://www.gsmworld.com/documents/Spectrum_Caps_Report_Jan09.pdf.

[18] Instituto Nacional de Estadística y Geografía. 2009. *Disponibilidad y Uso de las Tecnologías de la Información en los Hogares*. http://www.inegi.org.mx/prod_serv/contenidos/espanol/bvinegi/productos/encuestas/especiales/endutih/ENDUTIH_2009.pdf.

implemented ICT policies from both the supply and demand sides. The demand-side strategy has included programs for e-literacy, e-government, and ICT diffusion. For example, almost all taxes are filed electronically, and government e-procurement more than doubled the volume of transactions processed between 2005 and 2008. The government has also promoted broadband use by municipalities. By 2008, almost all municipalities had Internet access, and 80 percent had websites. In June 2009, Chile's fixed broadband penetration was 10 percent, while mobile broadband penetration was 2 percent. In order to reach the objectives of a digital Chile, the government's broadband goal is to double broadband connections and complete nationwide coverage by 2012.

Brazil is one of the few countries in the region with a specific broadband plan. St. Kitts and Nevis has the highest broadband penetration in the region. The cases of Brazil and St. Kitts and Nevis are highlighted in case studies (see Sections 5.1 and 5.4).

3.4 Middle East and North Africa

The region is relatively well endowed with fixed line telephony for a developing region and most fixed broadband is primarily via ADSL. Nonetheless, prospects for fixed broadband are constrained. Few alternative operators have deployed copper line infrastructure, local loop unbundling, for the most part, is not available across the region, the development of inter-modal competition through cable television is inhibited by the popularity of satellite television, and most new entrants have adopted wireless strategies.

Mobile broadband, on the other hand, has had greater success. Many but not all of the countries have awarded spectrum for mobile broadband services. Morocco was one of the first countries to award 3G spectrum in the region. It did so through a beauty contest, which lowered spectrum costs for operators. Some of the spectrum was awarded to a new operator, shaking up the existing duopoly and triggering intense competition in the mobile broadband market (Box 2). As a result, mobile broadband subscriptions in Morocco have surpassed fixed connections. The country has adopted the *Maroc Numerique 2013* strategy with targets providing broadband to all schools and one third of households by 2013.[19] Morocco is highlighted in a case study (see Section 5.3).

A report analyzing the main factors affecting broadband demand in many of the countries in the region identified challenges hindering broadband deployment and suggested recommendations to overcome them (Table 3).[20] The report's overarching conclusion was the requirement for convergence—through bundled offers and transition to IP-based networks—would trigger mass broadband adoption.

Table 3. Challenges hindering broadband deployment in MENA and suggested recommendations to overcome them

Challenge	Recommendation

[19] Government of Morocco. N.d. *Maroc Numerique*. http://www.egov.ma/Documents/Maroc%20Numeric%202013.pdf

[20] ESCWA. 2007. *Broadband for Development in the ESCWA Region*. http://www.alcatel-lucent.com/wps/portal/!ut/p/kcxml/04_Sj9SPykssy0xPLMnMz0vM0Y_QjzKLd4w3MfQFSYGYRq6m-pEoYgbxjgiRIH1vfV-P_NxU_QD9gtzQiHJHR0UAAD_zXg!!/delta/base64xml/L0lJayEvUUd3QndJQSEvNElVRkNBISEvNl9BXzRDUi9lbl93dw!!?LMSG_CABINET=Docs_and_Resource_Ctr&LMSG_CONTENT_FILE=News_Releases_2007/News_Article_000148.

Challenge	Recommendation
1. High prices and low market maturity	**Bundled services**, whereby broadband is provided with other services like telephony and TV content, constitute a key enabler for price reduction and economies of scale for service providers.
2. Regional and international connectivity to the Internet is both complex (no regional backbones) and costly in many countries.	The **improvement of regional connectivity and peering**, as well as the **emergence of powerful regional service providers** capable of negotiating better interconnection prices with the main Internet backbones, would drastically reduce underlying costs.
3. Lack of a service culture and insufficient quality of telephony copper (especially for DSL deployment) are factors hindering the mass deployment of broadband.	The promotion of a service culture and transparency as regards copper quality are needed. Wireless local loop technologies constitute an alternative to copper lines, provided that the availability of the frequency spectrum required is ensured by governments and regulatory bodies.
4. Mass broadband adoption is the result of the **availability of content and applications** that are relevant to users in their native language, and contributes in turn to the promotion of improved productivity in the economy as a result of this mass adoption. Both factors are lacking in the region.	The development of **digital Arabic content** and the **lifting of restrictions on Internet access** allow the Internet to become the main medium for the exchange of knowledge between people in the envisaged knowledge society.
5. The region is characterized by a "relatively–low" to "fair" penetration of PCs.	**Low–cost PCs and community centers**– for collective access when individual purchase of PCs is not economically feasible– would substantially increase access to the benefits of broadband.
6. In the region, the scope of Universal Access is confined to basic, conventional ICT services, and Universal Access to broadband remains an unstated priority in national policies.	**An extended scope for Universal Access, which includes broadband, should be clearly articulated in national ICT policies,** with an increase in investments for upgrading operators' access networks. Associated regulatory mechanisms are needed to ensure effective competition while bridging the digital divide between urban and rural areas.
7. The development of a competitive and dynamic broadband market is definitely lagging in the region.	World-wide, **local loop unbundling** of the fixed telephony infrastructure is becoming an essential pre–requisite for such a market; hence regulators should enforce it and avoid restrictions on the provision of other services.

Challenge	Recommendation
	In the long term, incumbent operators will benefit from such competitive markets by becoming multi–service operators themselves.

Source: Broadband for Development in the ESCWA Region.

Most countries in the region share a common language facilitating collaboration on developing digital Arab content to improve demand for broadband.[21] The Jordanian Minister of Information and Communications Technology has outlined the importance of the content industry as a main driver of Internet penetration, especially as it relates to local and Arabic content. The digital content industry in Jordan received a boost in 2009, when chipmaker Intel announced an investment in two digital content companies: Jeeran and ShooFeeTV.[22] The funding will be used to help both companies pursue regional growth as well as extend their product offerings. Jeeran (http://www.jeeran.com/) is the largest user-generated content site in the Arab world, reaching one million members and seven million unique visitors per month. ShooFeeTV (http://www.shoofeetv.com) provides online information for more than 120 Arab satellite channel including listings, programming information, celebrity news, pictures and video clips.

3.5 South Asia

South Asia faces severe supply and demand side constraints in promoting broadband access. Fixed infrastructure is limited. Nonetheless in absolute terms there is a significant base of fixed telephone lines and cable subscribers. But the number of telephone lines and cable television connections for broadband services is relatively low. Some countries have yet to award mobile broadband spectrum that would trigger inter-modal mobile broadband competition. On the demand side, the region is the second poorest developing region after Sub-Saharan Africa and levels of education are relatively low.

India was the first country in the region to adopt a broadband policy in 2004.[23] However, it has not achieved the goals set. The country published a consultative document[24] on a new broadband policy and in December 2010, the Telecommunications Regulatory Authority of India issued broadband recommendations.[25] A key strategy is to develop an open access national fiber optic backbone network connecting all localities with more than 500 inhabitants by 2013.

Pakistan published a broadband policy in 2004.[26] But broadband deployment has not lived up to expectations — the number of broadband subscribers in 2007 was only half of the level targeted

[21] See: "Final Meeting of the Project on 'Promotion of the Digital Arabic Content Industry through Incubation'" at http://www.escwa.un.org/divisions/projects/dac/index.asp

[22] "Intel Capital to invest in two digital content companies in Jordan." *Press Release*, May 17, 2009. http://www.intel.com/capital/news/releases/090519.htm.

[23] Government of India. *Broadband Policy 2004*. http://www.dot.gov.in/ntp/broadbandpolicy2004.htm.

[24] Telecom Regulatory Authority of India. 2010. *Consultation Paper on National Broadband Plan*. http://www.trai.gov.in

[25] "TRAI issues Recommendations on 'National Broadband Plan'." *Press Release*. December 8, 2010. http://www.trai.gov.in

[26] See: Government of Pakistan. 2004. *Broadband Policy*. http://www.pta.gov.pk/media/bbp.pdf and Ministry of IT. N.d. *Broadband Penetration in Pakistan*. http://202.83.164.27/wps/portal/Moit/!ut/p/c0/04_SB8K8xLLM9MSSzPy8xBz9CP0os3h_Nx9_SzcPIwN3d3MDAyNzf0t

for that year and well short of the half million target for 2010. In an effort to accelerate broadband take-up, the Universal Service Fund is being used to subsidize the deployment of broadband throughout the country.[27]

Other South Asian nations have also adopted or are developing broadband plans.[28] But programs that would address demand side affordability issues are limited (Table 4).

Table 4. Broadband plans and policies in selected South Asian nations

Country	National broadband plan?	Universal service includes broadband?	Are there other financing mechanisms for broadband?	Are there social tariffs for broadband subscribers?
Afghanistan	Under development	No	TDF Fund	No
Bangladesh	Yes	No, but foreseen in the National Broadband Policy	No	No
Bhutan	Yes	No	No	No
Maldives	No	No	No	Yes for education
Nepal	Under development	Yes in rural areas. USO imposed on the incumbent fixed line operator, and financed through USF Fund and interconnection charges	Tax exemption for telecom equipment imported for rural services	No

Source: ITU. 2010. *Stimulating Universal Access to Broadband in Afghanistan, Bangladesh, Bhutan, Maldives and Nepal.*

Sri Lanka, which was one of the first countries in South Asia to award 3G spectrum has the second highest penetration, the lowest tariffs and fastest mobile broadband speeds in the region. Sri Lanka's broadband experience is highlighted in a case study (see Section 5.5).

Ld3cXA4sgY_2CbEdFAED6W7U!/?WCM_GLOBAL_CONTEXT=/wps/wcm/connect/MoittCL/ministry/highlights/study+undertaken+by+moit+regarding+broadband+penetration+in+pakistan

[27] See "Broadband Programme" on the Universal Service Fund web site at: http://www.usf.org.pk/Broadband-Programme.aspx.

[28] ITU. 2010. *Stimulating Universal Access to Broadband in Afghanistan, Bangladesh, Bhutan, Maldives and Nepal*. http://www.itu.int/pub/D-HDB-UNIVERSA;-2010.

3.6 Sub-Saharan Africa

The Sub-Saharan Africa region faces tremendous barriers in broadening broadband. It starts from a very low base, with limited fixed telephone networks and practically no cable television networks on the supply side, coupled with demand side bottlenecks with the lowest per capita income and years of schooling of all developing regions.

Over the past decade, a large amount of private investment, driven by sector liberalization and competition and major advances in cellular technology, has brought mobile services within the reach of the majority of Africa's population. Increasing competition is making services more affordable and putting pressure on operating margins. Operators are responding by expanding their networks beyond towns and cities into rural areas, and tailoring services to the needs of the lower-income tiers of the population.

Sub-Saharan Africa, however, has been largely left behind in the shift to broadband. Increasing the availability and affordability of broadband services is thus high on the agenda for policy makers. Conducive policy environments, investment in network infrastructure, access to radio spectrum, and availability of affordable international bandwidth will all play key roles in the delivery of low-cost broadband to the region.

The region's focus, thus far, on mobile networks to address an immediate service need has left backbone networks underdeveloped. This has created a major bottleneck in the rollout of high-bandwidth services and in the upgrading of cellular networks to provide value-added services.[29] Overcoming this infrastructure hurdle is an important element in shaping the structure and policy framework of the telecommunications services sector. Without it, broadband will remain expensive and limited to businesses and high-income customers.

The backbone deficit has been acutely felt in international bandwidth. Due to limited content and a shortage of national Internet exchanges, a significant amount of Internet traffic is routed abroad from Sub-Saharan Africa. A lack of international high-speed fiber optic capacity has meant that even where countries have been able to deploy broadband last mile infrastructure, performance is affected by slow international connectivity. Where connectivity exists, cable theft continues to be a major problem for reliability.

Until 2009, SAT3/SAFE was the only major regional submarine optic cable serving the content. Other countries had to use more costly and slower satellite links. This has changed dramatically since the arrival of several new undersea cable systems (i.e., TEAMS, SEACOM, EASSy) including the first serving the region's east coast (i.e., TEAMS). Total capacity rose by a factor of 8.5 in 2009 and additional planned cables are expected to increase undersea capacity to over 20 Tb/s by 2012.[30]

International connectivity is just part of the supply chain. Countries in the African region also need to ensure that the bandwidth gets disbursed throughout the country and, in the case of the region's landlocked countries that national backbones are in place to connect to neighboring countries. This will require public private partnerships to generate the investment needed and to ensure an effective and open access operating arrangement. The Kenyan government has supported open access to backbone infrastructure in various ways. It encouraged operators to

[29] Parts of this section adapted from: Williams, Mark. 2009. *Broadband for Africa policy for promoting the development of backbone networks*. Washington DC: World Bank. http://www.infodev.org/en/Publication.526.html.

[30] See "African Undersea Cables" at: http://manypossibilities.net/african-undersea-cables/

participate in the TEAMS undersea cable and has also pursued public private partnerships for national backbone construction. It is now contemplating the same for the construction of broadband wireless networks using LTE technology. See the Kenya case study in Section 5.2.

At the local access level, mobile broadband holds great promise. However outside of a few countries, the region has yet to exploit this on a significant scale. Around two dozen Sub-Saharan African countries had commercially deployed 3G networks at the end of 2010 with around nine million subscriptions.

Few African countries have elaborated a specific broadband policy. If mentioned at all, broadband is touched upon in overall sector strategies. One exception is South Africa. The *Broadband Policy for South Africa* prepared by the Department of Communications was published on 13 July 2010.[31] Defining broadband as speeds of at least 256 kbps, the government has identified two targets for 2019: all inhabitants to be within two kilometers of a public broadband access point and a household broadband penetration of 15%.

Box 2. The Third Man: Encouraging disruption in broadband markets

Growth in some of the more successful developed economy broadband markets has been triggered by the entry of brand new disruptive operators. These new service providers tend to be the third player entering the market, shaking up duopolies of DSL and cable broadband operators or a dominant incumbent and a major wireless operator. This is the case in the developed East Asian economies of the Republic of Korea, Japan and Hong Kong, China where new operators entered the broadband market with innovative business plans and models, unsettling the market and triggering a beneficial stimulus to broadband growth.

- Hanaro entered the market in 1999 as a facilities-based telephone operator in competition with the incumbent Korea Telecom. Soon after entry, Hanaro began offering broadband ADSL services resulting in intensive competition, a major factor in the Republic of Korea's rise as a top ranked broadband country. Hanaro had captured almost a quarter of the broadband market at the end of 2009.

- SOFTBANK entered the Japanese broadband market in 2001 by leasing unbundled local loop lines from the incumbent telephone operators and in 2004, it obtained a facilities license and began deploying its own infrastructure. It acquired Japan's third largest mobile operator in 2006 allowing SOFTBANK to enter the mobile broadband market. Marketing its service as Yahoo!BB, SOFTBANK had a 14 percent share of the broadband market in 2009 and over a third of its subscribers were getting speeds of 50 Mbps. According to the company: "It is not an exaggeration to say that the fixed-line broadband service in Japan was created by the SOFTBANK Group."[32]

- Hong Kong Broadband Network (HKBN) entered the market in 2000 after it was awarded a fixed wireless license. The city's compact high-rise building environment shaped HKBN's technological strategy of installing in-building wiring; communications between buildings and HKBN's routers and switches were carried out using wireless transmission through rooftop antennas. HKBN was able to penetrate the market quickly

[31] Department of Communications. 2010. *Broadband Policy for South Africa*. http://www.info.gov.za/view/DownloadFileAction?id=127922

[32] Softbank. 2007. *Annual Report 2007*. http://www.softbank.co.jp/en/irinfo/library/annual_reports/

and shook up the quasi-duopoly between the incumbent fixed line operator and cable television company for broadband provision. HKBN later acquired a fixed line license and once again is shaking up the market by deploying fiber optic to the home. It had a 20 percent share of the fixed broadband market by 2009.

The process of disruption has also occurred in some European markets where alternative operators initially entered using the infrastructure of incumbent operators and then having established a foothold, began investing in their own infrastructure. This is the case in France and Italy:

- Free started as dial-up operator in France in 1999 and began providing broadband services in 2002 using ADSL over France Telecom's Unbundled Local Loop (ULL). In 2006, it began rolling out its own FTTH network and intends to cover four million homes by 2012, representing an investment of about €1 billion. Free has been providing triple play services since December 2003. Its IPTV service offers over 300 channels and Free's broadband speeds range between 22-28 Mbps. In 2009, it was awarded the country's fourth 3G license. Free had 23% of the French fixed broadband market in 2009.

- In Italy, FASTWEB started by deploying a fiber optic network in Milan. In 2001 it began providing triple-play services using DSL over Telecom Italia's infrastructure. The company has partnered with other operators in a "Fiber for Italy" project where they will pool resources to provide FTTH in Italy's 15 largest cities, an investment expected to cost €2.5 billion. Meanwhile, FASTWEB has also been building its own FTTH network that passes nearly two million homes, offering speeds of up to 100 Mbps. FASTWEB had 13% of the fixed broadband market at the end of 2009.

Market disruptive operators are spreading to emerging and developing economies:

- Starnet entered the Moldovan market in 2003 providing ADSL over the incumbent's telephone network. In 2006, Starnet began providing voice over broadband and also started the construction of its fiber optic network. In 2009, IPTV was added to its portfolio and by end of the year Starnet had captured 16% of the fixed broadband market.

- In Morocco, Wana was awarded wireless broadband spectrum in 2006. A company owned by national investors, it launched services in 2007 using high-speed EV-DO technology. This resulted in intense competition with the existing mobile operators and led to rapid adoption of 3G services that soon passed fixed broadband subscriptions. By the end of 2010, there were 1.4 million 3G subscribers in Morocco, almost three times the number of fixed broadband connections. Wana had 41% of the mobile broadband market.

The lesson for developing countries is that while it is critical to open broadband markets to competition, it is just as important to introduce brand new operators. Setting aside spectrum for a new operator and lowering other market entry barriers, particularly those relating to the ability to provide convergent services, can encourage this.

Sources: ITU. 2008. *Asia-Pacific Telecommunication Indicators - Broadband in Asia-Pacific: Too much, too little?*, operating reports of companies discussed and regulatory authorities for broadband market shares.

4 Countries in special circumstances

In addition to regional groups, countries are also classified by particular economic, geographic and political situations. This section identifies several groupings relevant to the international development community and how the specific characteristics of that group can affect broadband development.

4.1 Least Developed Countries (LDCs)

The UN created the Least Developed Countries (LDCs) category in 1971 to recognize the existence of a group of countries with severe poverty and weak economic, institutional and human resources.[33] This group consists of 49 countries with a combined population of 815 million in 2008 (Figure 8). Most are in Africa, almost a third are in Asia and the Pacific and one is in Latin America. Around half are either small islands states or landlocked.

The LDCs face tremendous supply and demand side challenges in deploying broadband networks. The existing level of fixed infrastructure is low as are demand side indicators such as incomes and educational levels. The capacity for developing effective broadband strategies and policies is also limited due to institutional weaknesses and insufficient human resources in ministries and regulators.

Figure 8. LDCs

Source: UN-OHRLLS.

New technologies such as broadband can help LDCs overcome development challenges and can move LDC economies away from their dependence on primary commodities and low-skill manufacturing.[34] There is some urgency to deploy broadband networks in order to mitigate LDCs falling further behind technologically and becoming even more marginalized in the world economy.[35] The development of international and national backbones is a main priority that will

[33] LDCs are identified through three criteria: income per capita, human capital and economic vulnerability. For the methodology see: http://www.unohrlls.org/en/ldc/related/59/. For the list of LDCs see: http://www.unohrlls.org/en/ldc/related/62/

[34] UNCTAD. 2010. *The Least Developed Countries Report 2010*. New York: United Nations. http://www.unctad.org/templates/webflyer.asp?docid=14129&intItemID=5737&lang=1&mode=downloads

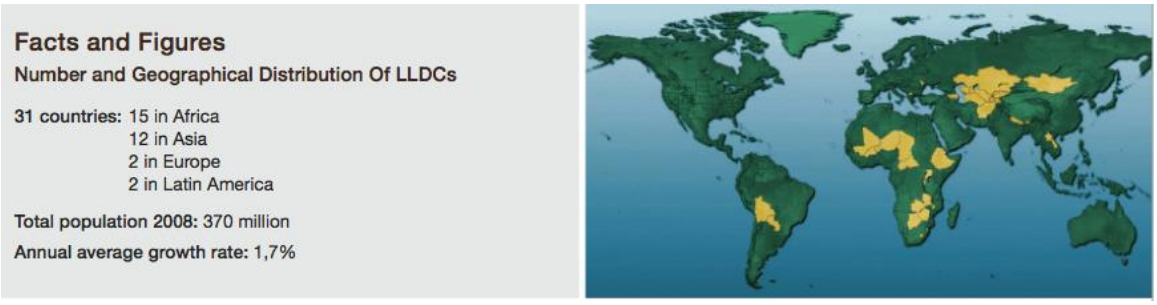
[35] UNCTAD. 2007. *The Least Developed Countries Report 2007*. New York: United Nations. http://www.unctad.org/en/docs/ldc2007_en.pdf

require innovative public private partnerships. Wireless broadband holds great promise given the significant increase in mobile networks in the LDCs and the lower costs of deploying mobile broadband. In order to achieve this, LDCs will need to introduce greater competition and allocate spectrum for wireless broadband services.

4.2 Landlocked developing countries (LLDCs)

Landlocked developing countries (LLDCs),[36] predominantly located in Sub-Saharan Africa and Asia, "face severe challenges to growth and development due to a wide range of factors, including: a poor physical infrastructure, weak institutional and productive capacities, small domestic markets, remoteness from world markets, and a high vulnerability to external shocks."[37] There are 31 LLDCs with a total population of 370 million in 2008 (Figure 9).

Figure 9. LLDCs



Source: UN-OHRLLS.

One of the main barriers LLDCs face is distance from key ports causing high transaction costs and reducing international competitiveness. Broadband can help to overcome these limitations, since it is not distance sensitive. However, geographical conditions pose a supply side challenge for LLDCs in terms of global connectivity through high-speed fiber networks.

"Virtual coastlines" can be created for LLDCs through the connection of national backbones to countries directly linked to undersea cables. This connectivity can then be brought to "virtual landing stations" in the LLDC where all ISPs gain cost-based access to international bandwidth. Rwanda has created a virtual landing station where optic fiber cables from undersea landing stations in Kenya and Tanzania (Rwanda's "virtual coastline") are terminated.[38]

Access to high-speed international bandwidth will require regional cooperation and public private partnerships to spur investment in national backbones and ensure their onward connectivity to neighboring countries with undersea fiber optic cable. According to an ESCAP study on Central Asia countries must cooperate to expedite and ensure effective regional connectivity.[39] A broadband backbone infrastructure transcending borders requires

[36] For a list of LLDCs see: http://www.unohrlls.org/en/lldc/39/

[37] See "UN recognition of the problems of land-locked developing countries" on the UNCTAD web site at http://www.unctad.org/Templates/Page.asp?intItemID=3619&lang=1

[38] David Kanamugire. n.d. "The Role of Governmental Institutions in fostering ICT research capacity." http://euroafrica-ict.org.sigma-orionis.com/downloads/rwanda/Kanamugire.pdf

[39] ESCAP. 2009. *Broadband for Central Asia and the road ahead.* http://www.unescap.org/idd/working%20papers/IDD_TP_09_05_of_WP_7_2_909.pdf.

interconnection and along with management and maintenance, this affects all the countries benefiting from the network.

4.3 Small Island Developing States (SIDS)

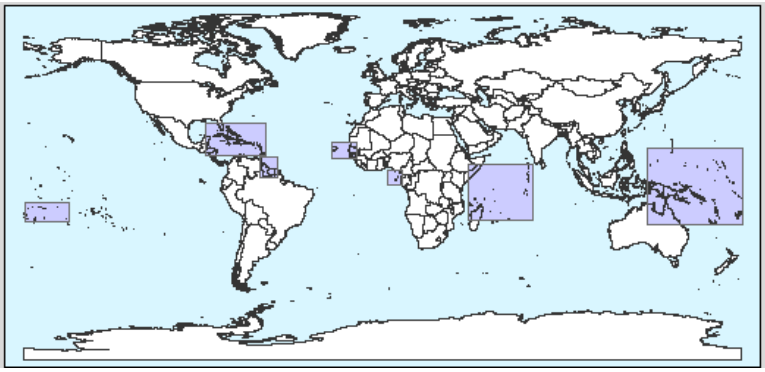
The United Nations has recognized the particular problems of Small Island Developing States (SIDS) since 1994.[40] According to UNCTAD, SIDS face "… a greater risk of marginalization from the global economy than many other developing countries…" due to their small size, remoteness and vulnerability to external shocks.[41] They are also susceptible to natural disasters such as tsunamis and damaging environmental changes such as sea level rise. There are 38 UN Members classified as SIDS with a population of 55 million in 2008 (Figure 10). Over one quarter are also LDCs.

Figure 10. SIDS

Facts and Figures

38 UN Members:
16 in Caribbean
16 in Asia & Pacific
6 in Africa

Total Population 2008:
55 million



Source: Adapted from UN-OHRLLS, FAO, IMF.

Broadband connectivity can help overcome these challenges in several ways such as economic diversification through establishment of IT-enabled industries, creating a virtual closeness to the rest of the world and real-time weather modeling and monitoring.

The SIDS are geographically diverse with different broadband supply and demand challenges. On the demand side, many SIDS have relatively small populations that may deter investment. However, the small size makes it easier and cheaper to quickly deploy networks with a high degree of coverage and a growing number of SIDS are achieving universal mobile service.[42] On the supply side, most of the Caribbean SIDS are located in a condensed area, crisscrossed by a number undersea fiber optic cable networks. Pacific SIDS tend to be more spread out. Since there are far fewer options for access to undersea fiber optic cables, most Pacific SIDS are dependent on more expensive satellite solutions. Some Pacific SIDS such as Fiji are served by undersea cables and therefore are in a position of being a potential fiber hub to neighbors.[43]

Most of the Caribbean SIDS introduced competition in telecommunications networks a number of years ago whereas the Pacific ones have done so only recently. Mobile broadband has yet to

[40] For a list of SIDS see: http://www.unohrlls.org/en/sids/44/

[41] See: "UN recognition of the problems of small island developing States" at: http://www.unctad.org/Templates/Page.asp?intItemID=3620&lang=1

[42] See "Samoa Mobilized" at: http://www.ictdata.org/2010/09/samoa-mobilized.html

[43] World Bank. 2009. *Regional telecoms backbone network assessment and implementation options study*. http://www.itu.int/ITU-D/asp/CMS/Events/2009/PacMinForum/doc/POLY_WB_GeneralReport_v3%5B1%5D.0.pdf.

have a significant impact in most SIDS to date due to a lack of spectrum allocation and uncertain demand.

The Eastern Caribbean Telecommunications Authority (ECTEL) was established as a regional regulator for countries in that sub-region. ECTEL overcomes human resource limitations of each country staffing their own full-fledged regulatory institution and harmonizes sub-regional policies. ECTEL recently moved to make high-speed Internet more accessible by designating the 700 MHz Band for broadband wireless services such as WiMAX.[44]

Saint Kitts and Nevis, a Caribbean SIDS, is profiled in a broadband country case study (see Section 5.4).

4.4 Post-conflict countries

Post-conflict countries refer to nations where war and civil strife leads to the destruction of institutions and economic facilities. There is no official definition of a post-conflict economy. They are often locations where civil conflicts have necessitated the intervention of peacekeeping troops.[45] ICTs can play in beneficial role in helping to reconstruct these countries by attracting foreign investment, generating employment, enhancing education prospects and creating linkages to the global economy.[46] Given the often poor or destroyed telecommunication infrastructure, post-conflict countries can leapfrog to state-of-the-art next generation networks. However, this will require a liberalized telecommunication regime that encourages convergence and investment in Internet Protocol networks.

In Afghanistan years of civil strife destroyed much of the economy, shutting down most government institutions including schools. A NATO sponsored project has installed broadband access in universities using satellite technology.[47] This has overcome shortages of learning materials and teachers since professors and students can download teaching information and use on-line learning tools. In East Timor, the Australian government has been assisting with the development of the new country's media sector by providing journalists with the ability to upload and research news through the establishment of broadband centers.[48]

The case of Sri Lanka, a country emerging from a decades long civil conflict, is highlighted in a broadband study (see Section 5.5).

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[44] ECTEL. 2009. *Policy on the Allocation and Assignment of Frequencies in the 700 MHz Band*. http://www.ectel.int/pdf/consultations/2010/700%20Mhz%20Band%20Plan%20and%20Policy.pdf

[45] There is no official definition of a post-conflict economy. They are often locations where civil conflicts have necessitated the intervention of peacekeeping troops. For a list of locations where UN peacekeeping troops are stationed, see: http://www.un.org/en/peacekeeping/

[46] The World Bank financed e-Sri Lanka project argues that "ICT can promote peace efforts by providing connectivity and electronic delivery of much needed information and public services, bridging space, time and promoting understanding between the North and East and the rest of the country." See: *Sri Lanka - E-Lanka Development Project*. December 1, 2003. http://go.worldbank.org/567ZZUWMD0.

[47] "Broadband for Afghanistan." *The NATO Chronicles*. Episode 2. March 2010. http://www.natochronicles.org/#/en/episode2

[48] See "Governance Activities: East Timor" on the AusAID web site at: http://www.ausaid.gov.au/country/east-timor/governance.cfm.

5 Broadband country case studies

This section *summarizes* the results of broadband case studies commissioned for the toolkit. The countries studied cover a range of regions and development status.

5.1 Brazil

5.2 Kenya: Build it and they will come

The study considers the case of broadband in Kenya and the manner in which the country has tackled its capacity challenges. Kenya has a natural geographic advantage being strategically positioned on the East Coast of Africa. Its government-led "build it and they will come" approach to broadband development has leveraged the country's geographic location and played a major role in dramatically increasing fiber optic backbone capacity. Many of Kenya's milestones have been realized in less than five years. Connections were made to three fiber optic submarine cables by the end of 2010 changing the face of the broadband market. The country has gone from relying on satellite for international capacity, to having access to almost four terabits over fiber.

Although the landing of the cables is merely a first step, it has already resulted in an 80 percent decrease in wholesale bandwidth costs (although reliability is sometimes a problem). Lower prices and greater availability are expected to increase access to the Internet as well as to promote the continued spread of sophisticated mobile applications and services and consequently improve opportunities for the creation of and access to information and knowledge. Affordable broadband is expected to increase Kenya's competitiveness, particularly in the Business Process Outsourcing (BPO) industry, and to encourage entrepreneurship and innovation.

With an estimated fixed and mobile broadband penetration rate of 2 subscriptions per 100 people in 2010, Kenya still has significant progress to make with respect to broadband uptake. Stimulating demand and usage by citizens and the public and private sector remains a challenge. Kenya, largely through the government, has taken an innovative and pro-active approach to putting the user at the center and addressing the other elements of the broadband ecosystem, such as education, literacy, applications and content. This has been done through progressive regulation, the promotion of polices relating to ICT in education, the subsidization of relevant content and application projects, and facilitating creative Public Private Partnerships (PPPs).

Much of Kenya's success seems attributed to four important factors: (1) A clear national approach of how broadband fits into its *Vision 2030* development goals; (2) Strong leadership and direction; (3) A credible regulatory, policy and institutional framework, and (4) Leveraging the strength of the public and private sectors through PPPs.

The initiatives discussed in the study possess elements of these traits across all aspects of the broadband ecosystem. The Kenyan experience is inspiring, although there have been a few hiccups in terms of the pace of implementation and overlaps in the policy and institutional framework. These are discussed in the study to provide a proper context for the Kenyan broadband story and to enable countries to learn from its experiences.

5.3 Morocco

5.4 Saint Kitts and Nevis: Strength in Depth

The study focuses on the broadband Internet sector in St. Kitts and Nevis, specifically the approach the island has taken in developing the sector, to the extent that at the end of 2010 fixed broadband subscription rates stood at almost 30 percent, the highest rate among all independent countries of the Latin America and Caribbean region. This achievement in broadband can be attributed in part to the small physical size of St. Kitts and Nevis that has enabled faster rollout of the physical infrastructure, facilitated more effective marketing, and promoted maximum impact for Government-led information and communication technology policy initiatives. Among the Caribbean islands, however, 'smallness' is certainly not unique. The study therefore explores other factors that may have contributed to this achievement.

The phrase "strength in depth" is borrowed from the world of soccer, the most popular sport on the island. The phrase is used to underscore the point that the strength of the island's achievement in the broadband sector, lies in its deep commitment to nurturing the foundational components of the broadband ecosystem. Promotion of basic education and digital literacy, building technology awareness, facilitating access to basic technologies, and encouragement of a healthy competitive telecommunications environment are but a few examples of where the country has developed its core strengths.

Key strengths of the St. Kitts and Nevis broadband ecosystem identified in the study can be grouped under one of the following areas:

(a) *Competitive environment* – through efficient legislation and regulation;

(b) *Regional coordination* – particularly for design of effective policy frameworks;

(c) *Government as facilitator* – strong leadership in the ICT sector;

(d) *Government as leader* – promoting service demand through content provision;

(e) Universal *service* – for broadening access to technologies; and

(f) *Public private partnerships* - to catalyze and strengthen broadband initiatives.

The implementation of a second submarine fiber network in 2006 offering up to 1.3 terabits, has introduced competition in the international backbone capacity that should further serve to enhance the broadband sector. However, as in any ecosystem, sustainability and growth can be threatened by internal weaknesses. Some of these weaknesses have served as lessons learnt and adjusted to at the national level; others continue to pose a challenge to the islands. Cost prohibitive services, an unstable power supply, quality of service issues, and deficiencies in the availability of local content and applications that create network value for citizens, are some of the challenges for future growth of the broadband sector in St. Kitts and Nevis.

In general, the two islands have been successful in promoting uptake of broadband Internet through a number of measured approaches; approaches that can be of relevance to discussions on broadband strategies pertaining to developing countries, based upon identified strengths and weaknesses within this study.

5.5 Sri Lanka: Glass half full or half empty?

Sri Lanka, an island nation located in the Indian Ocean just south of India, has lately experienced an explosion in the availability and use of mobile broadband services.

Key trends in the Sri Lankan ecosystem include:

Innovative business models for making services accessible to all: The increase in mobile broadband rides on the wave of extremely high mobile voice growth. Intense competition forced operators to innovate in such a way as to be able to profitably serve even the poorest consumers. Network costs were reduced drastically by sharing passive and active infrastructure and outsourcing key parts of the operation. Distribution costs were minimized through e-reloads, eliminating the need to print and distribute top-up cards for pre-paid users. Small top-up values attracted consumers with low and variable incomes to the market. This "budget telecom model" enabled operators to make positive margins even though ARPU was low. This model is now being applied to mobile broadband in Sri Lanka. By enabling pre-paid, very low value re-charge and promotional discounts for students, the youth have been brought into the mobile broadband market. These early adopters have spread interest in mobile broadband.

3G spectrum availability: 3G frequency was made available as far back as 2003 for testing and in 2005 commercial 3G services were launched. Early access to spectrum enabled operators to gain experience and constantly innovate to stay competitive. As a result, Sri Lanka has fastest mobile broadband technologies in the region.

Government's e-development agenda motivating investment: *e-Sri Lanka* is a cross-sector ICT-enabled development program for the whole country. A series of comprehensive supply and demand side projects (for example, setting up a network of nearly 500 rural telecenters, plans for a least-cost subsidy scheme to build and operate a fiber backbone in rural areas and a comprehensive e-government program) helped create awareness about broadband in the country. Operators were motivated to invest in the network infrastructure in light of upcoming demand.

The ethnic conflict and impact on demand for broadband: Since the early 1980s, Sri Lanka was plagued by a violent ethnic conflict. One of the negative results was that it forced a large portion of the minority Tamil population to leave Sri Lanka and seek refuge in other countries. This large migrant population generated high demand for Internet services in order to communicate with relatives remaining in Sri Lanka. Demand for Internet telephony was unusually high in conflict zones with Internet cafes catering to this demand for VoIP.

International connectivity hampering quality: The downside of budget telecommunications models is that price is sometimes sacrificed for quality. Compared with the developed world, Sri Lankan consumers get less broadband value for the money they spend. Part of the reason is advertising broadband speeds that are theoretically possible, but not in reality. Another bottleneck is international connectivity. A significant portion of Internet traffic is routed outside of the country and wholesale international connectivity prices are relatively high making Internet capacity a sought after resource.

5.6 Turkey

5.7 Vietnam

6 Crafting a broadband development strategy for a particular country environment[49]

6.1 Broadband as an ecosystem

Across the developing world, countries are looking to increase access to and use of broadband. It is useful to conceptualize **broadband as an ecosystem** consisting of infrastructure networks, the services that the networks carry, the applications and content delivered over the networks, and the users that utilize applications and content (Figure 11):

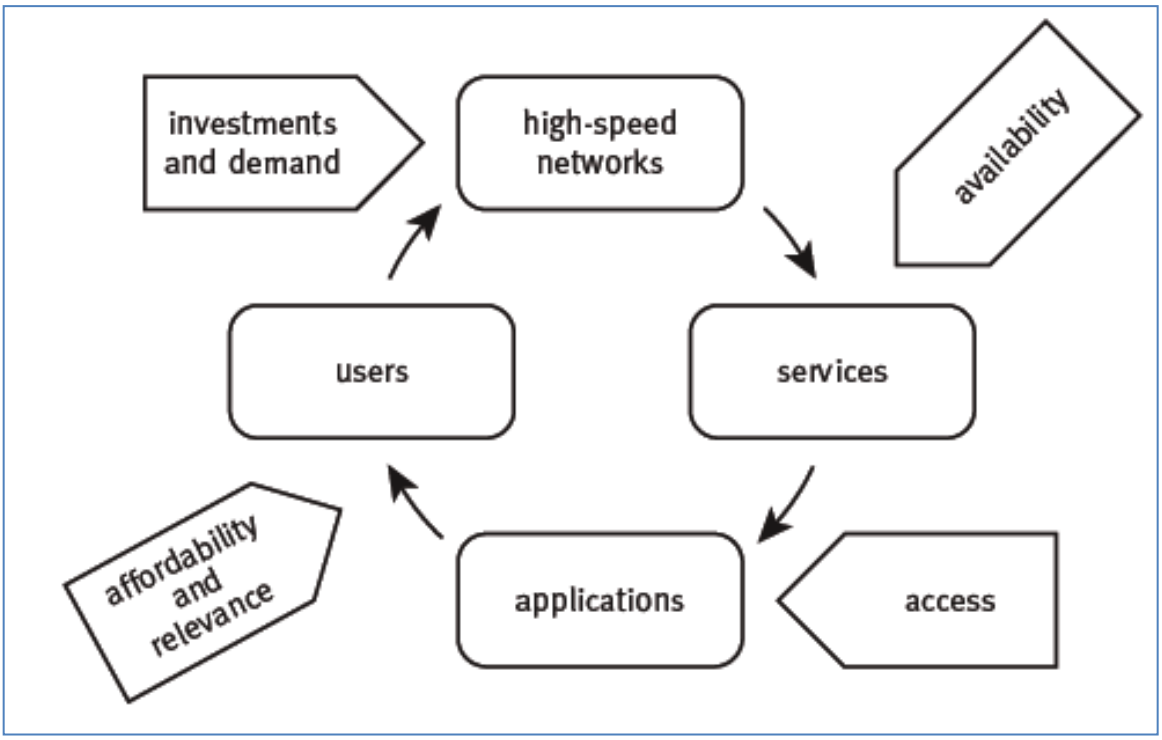
- Infrastructure-Refers to the networks that support high-speed data communication (e.g., telephone networks, broadcast networks, computer networks using copper wires, coaxial cable, fiber optic cable and other transmission media)
- Services-Refers to the services these networks provide (e.g., broadband access to the Internet)
- Applications and Content-Refers to the programs and information provided by services (e.g., Voice over Broadband (e.g., Skype), social media (e.g., Facebook), video (e.g., YouTube), search engines (e.g., Google), etc.)
- Users-Refers to citizens and businesses who respond to the affordability of the services and relevance of the applications and content.

The broadband ecosystem is a virtuous circle with each component leveraging on another. Investments and user demand expand the reach of high-speed networks. These networks increase the availability of high-quality services to both users and application providers. Users then grow in number and sophistication, demanding and driving greater investments in networks.

Viewing broadband as an ecosystem helps define the likely roles that governments will need to play in using broadband as a tool in ICT for development (ICT4D). Broadband is more than the supply of access to networks and services, and thus represents a significant shift away from the models used with telephones. To foster broadband markets, governments will have to move beyond their traditional “push” role focused on supply-side growth in ICT infrastructure and development of the ICT sector. They also need to stimulate demand for broadband.

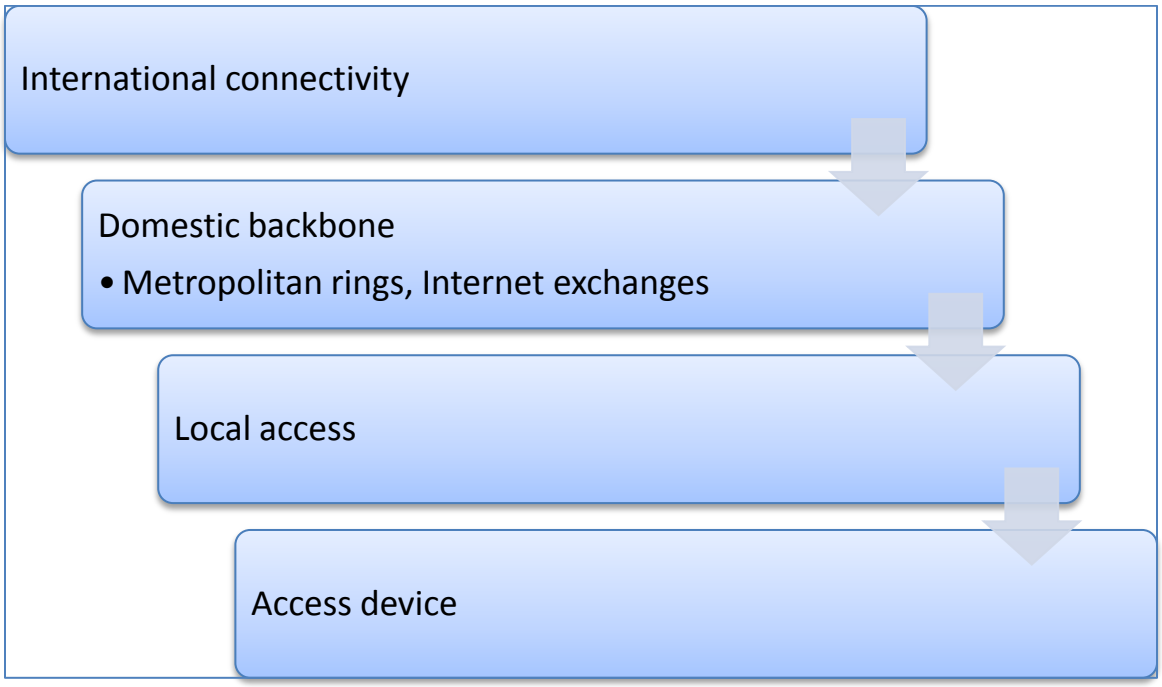
[49] Parts of this section are adapted from: Kim, Yongsoo, Tim Kelly, and Siddhartha Raja. 2010. *Building Broadband: Strategies and Policies for the Developing World*. Washington D.C.: World Bank. http://www.infodev.org/en/Publication.756.html.

Figure 11. The Broadband Ecosystem



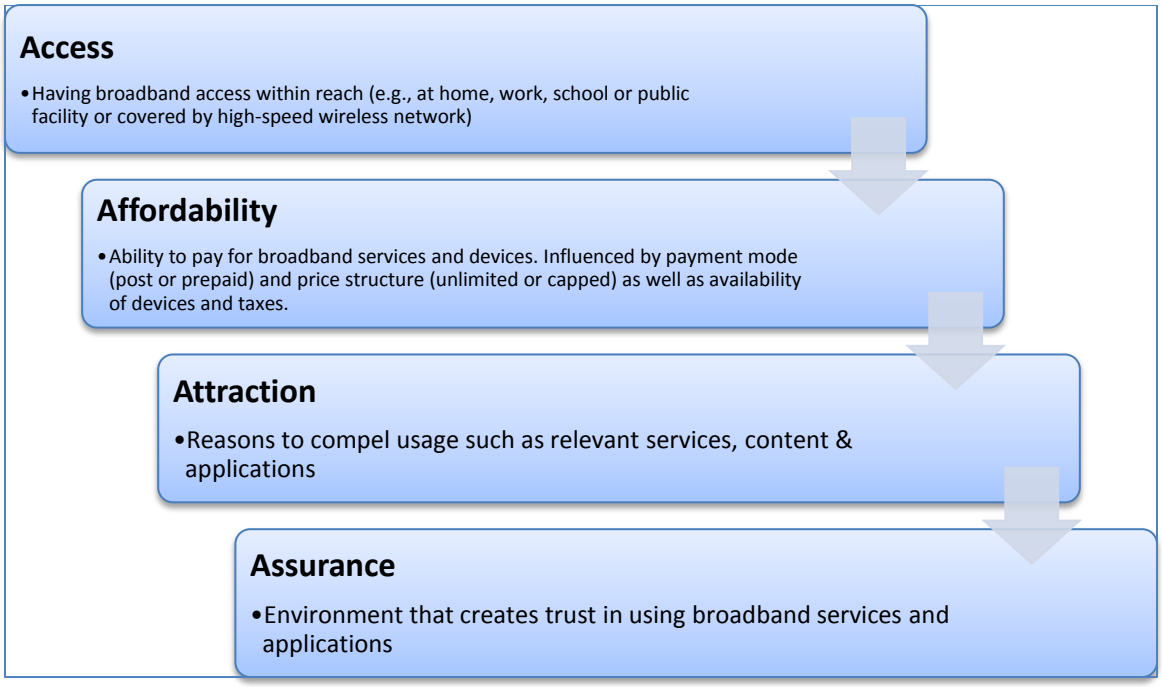
Defining broadband to include both the supply and demand sides of the market leads to a rethinking of approaches to spur broadband access and use. It is critical to create an enabling environment for supply-side growth in terms of access to networks and services—but is also important to facilitate demand for and adoption of broadband. There are two kinds of blockage that inhibit the natural development of broadband deployment and use. On the supply side, these relate to blockages at the various levels of infrastructure that are necessary for a broadband network (Figure 12).

Figure 12. Broadband supply factors



On the demand side, barriers that affect usage of broadband are access, attraction, affordability and assurance (Figure 13).

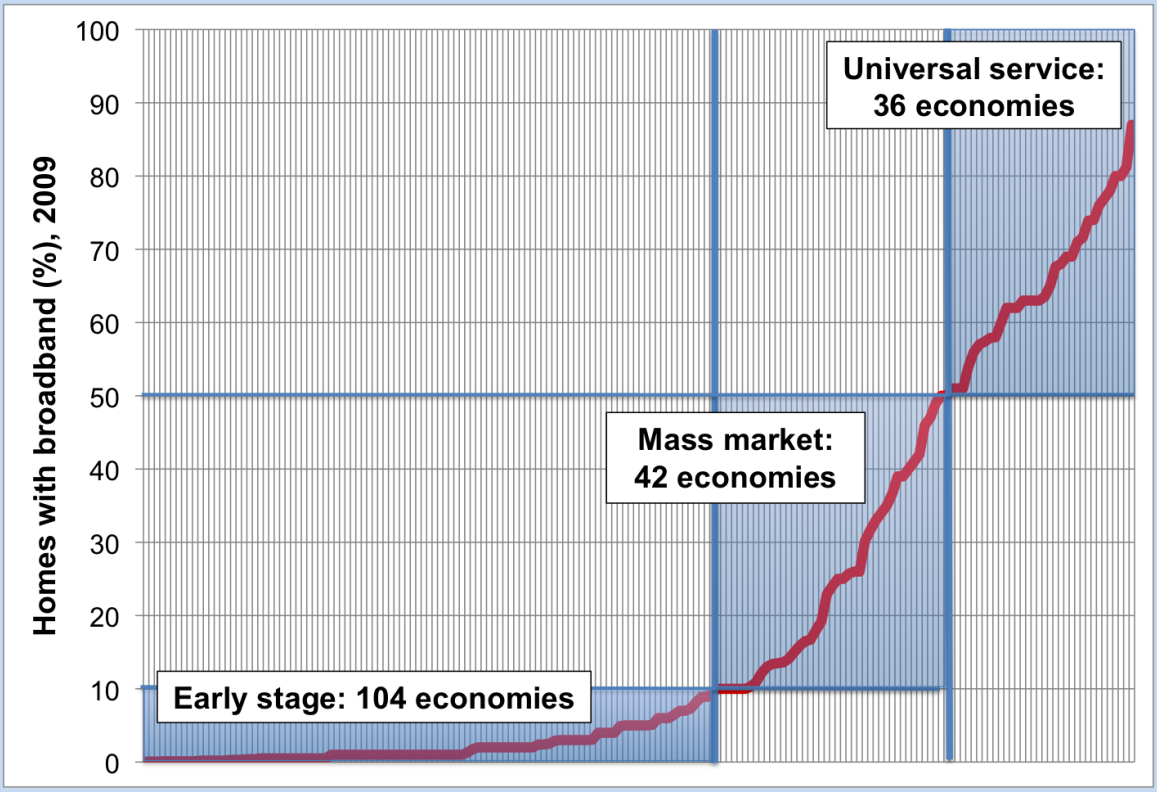
Figure 13. Broadband demand factors



Box 3. Broadband gap: Stages of broadband development

Broadband markets pass through three stages—promotion when the market is incipient, oversight as competition begins to drive growth, and universalization as the market matures. Most countries are in the early stage (household broadband penetration less than 10%, Figure 4). Around 40 economies are in the mass-market stage (penetration ≥ 10% and less than 50%) and three dozen are in the universalization stage (penetration > 50%).

Figure Box 3 . Stages of broadband development



Source: TMG Analysis based on data from regulators.

Broadband development strategies are implemented using policies, regulations, and programs. The policies and regulatory tools support the operation of a competitive, efficient market and seek to expand access to all. They also include demand-side policies and programs. Many of these measures would have little or no implications for government budgets. Some could be funded through contributions from the broadband industry, and others would be self-sustaining from service fees (as with e-government programs) or cost savings (as with infrastructure sharing).

Descriptions and examples of the policies and programs are provided in Table 5. This is next related to a country's geographic placement with reference to examples from different regions (Table 6).

Table 5. Policies and programs for promoting broadband in developing countries

	INFRASTRUCTURE
Policy / Program:	**Promote investment and market entry**
Supply & Demand impacts:	Supply: All levels; Demand: Access, affordability
Description:	The first step of broadband policy implementation is to foster competition with minimal market entry barriers. Lowering or removing entry barriers into broadband markets drives competition. A key consideration is technological neutrality. The rapid development and diffusion of broadband is largely due to competition between technologies such as DSL, cable modem, fiber optics, and wireless. To enjoy the full benefits of such competition, governments should not influence the technological choices of providers without good reason.
Example:	The Thai government considers that international connectivity could be a bottleneck and for that reason issues automatic licenses for international gateway services.[50]
Policy / Program:	**International coordination**
Supply & Demand impacts:	Supply: All levels
Description:	Coordination among countries can impact all levels of the broadband supply chain by lowering costs through common technical standards and facilitating the development of international, regional and national backbones. There already exists a high-level of global and regional cooperation in areas such as equipment standards and frequency coordination. Regional harmonization in broadband regulatory approaches can help to reduce uncertainty and attract investment.
Example:	The Eastern Caribbean Telecommunications Authority (ECTEL) is a regulatory body for its five member states. It coordinates policy in a number of areas including aspects related to broadband such as frequencies for broadband wireless access, wholesale access to networks and quality of service.[51]
Policy / Program:	**Reduce administrative burdens and provide incentives for R&D, pilots, and network rollout**
Supply & Demand impacts:	Supply: All levels; Demand: Access, Affordability
Description:	High license fees, taxes and burdensome administrative processes can discourage investment in the broadband sector, especially when the market is nascent and the returns uncertain. Measures such as providing investors

[50] National Telecommunications Commission, Thailand. *Enabling Open Networks*. 2010 Global Symposium for Regulators. Dakar, 10 to 12 November 2010. http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR10/consultation/contributions/Thailand.pdf

[51] See the ECTEL web site at: http://www.ectel.int

	with tax benefits and low-interest, long-term loans can promote investment in network development. Likewise allowing operators to use broadband spectrum for pilots prior to formal allocation provides an opportunity to test feasibility of different frequencies and gain valuable experience.
Example:	In order to encourage broadband connectivity India removed licensing requirements for use of Wi-Fi and WiMAX in the 2.4 GHz-2.4835 GHz band. [52]
Policy / Program:	**Allocate and assign spectrum**
Supply & Demand impacts:	Supply: Domestic backbone, local access; Demand: Access
Description:	Allocating the appropriate spectrum can significantly alter the business case and usefulness of wireless broadband. Furthermore, governments should manage their radio spectrum appropriately to reduce entry barriers, promote competition, and enable the introduction of innovative technologies. An important consideration for spectrum policy is which frequencies should be allocated for broadband services and how. The critical choice is whether countries want to maximize their up-front earnings through spectrum sales but reduce potential new market entrants. The move toward digital television is providing an opportunity to use the parts of the spectrum freed by the move for wireless broadband services. Given the rapid development of wireless broadband technologies, governments should allow providers to obtain new frequencies by expanding available frequency bands. They should implement management policies that are based on market principles, encourage efficient use, and shift spectrum from low-value uses to services such as broadband. Spectrum managers should also keep in mind the effect of their spectrum allocations on business economics: higher bands make mobile communication more difficult and more expensive. In addition, spectrum managers should look toward newer management models—such as the spectrum-as commons approach that has been a key factor in the success of Wi-Fi networking—to encourage spectrum sharing and innovation. Spectrum should be assigned on a technology- and service-neutral basis. This approach is critical to enabling all the different types of applications of broadband services: voice, video, and data can all be provided by wireless broadband technologies. If spectrum authorizations limit what applications can be provided, they will diminish the utility of the broadband service and undermine the business case for the service provider. Finally operators should be allowed to use their existing spectrum for mobile broadband services.
Example:	Widespread policies throughout Latin America allow operators to use their existing 850/900 MHz spectrum, originally allocated for voice, to be used for high-speed mobile data services. These frequencies also support

[52] See “Indian Telecom Sector” on the DOT web site at: http://www.dot.gov.in/osp/Brochure/Brochure.htm

	wider coverage with fewer base stations so that investment costs are lower and a larger number of people can gain access.[53]
Policy / Program:	**Infrastructure sharing**
Supply & Demand impacts:	Supply: International connectivity, domestic backbone, local access; Demand: Access, Affordability
Description:	Civil works (for example, trenches, ducts, and cables) are the biggest fixed and sunk cost in broadband network construction in both the access and the backbone segments of fiber-optic networks. They also play a major role in increasing the cost of network deployment for new service providers as well as incumbents. The costs of backbone network construction can be cut by establishing legal grounds for open access to the passive infrastructure (conduits, ducts, and poles) of other services (roads, railways, and power supply facilities). This approach can significantly lower the cost of rolling out telecommunications networks, because adding communications equipment (such as cables) to other infrastructure projects is relatively cheap. Similarly, when contractors construct other types of new infrastructure, the government can require them to build passive infrastructure that communications service providers can access on a nondiscriminatory basis. Another option is to require the installation of basic infrastructure, such as ducts, when homes and offices are constructed or renovated. Facilities should be granted on an impartial basis to all providers. Finally, governments can permit or facilitate joint construction of backbone and subscriber networks among providers.
Example:	In Thailand, operators signed a Memorandum of Understanding on infrastructure and network sharing in November 2010 in support of the country's National Broadband Policy.[54] According to the government, the MoU will lead to more efficient use of networks.
Policy / Program:	**Internet exchange**
Supply & Demand impacts:	Supply: International connectivity; Demand: Affordability
Description:	There are many advantages to local routing of Internet traffic via a common exchange point: • Substantial cost-savings are made by eliminating the need to put all traffic through the more expensive long-distance links to the rest of the world. • More bandwidth becomes available for local users because of the lower costs of local capacity. • Local links are often up to 10 times faster because of the reduced latency in traffic, which makes fewer hops to get to its destination.

[53] Roetter, Martyn. 2009. *Mobile Broadband, Competition and Spectrum Caps*. http://www.gsmworld.com/documents/Spectrum_Caps_Report_Jan09.pdf.

[54] Prasert Aphiphunya. 2010. *Broadband Development in Thailand*. http://www.unescap.org/idd/events/cict-2010/Mr-Prasert-NTC.pdf

	• New local content providers and services, which rely on high-speed low-cost connections, become available, further benefiting from the broader user-base available via the IXP. • More choices for Internet providers become available on which to send upstream traffic to the rest of the Internet—contributing to a smoother and more competitive wholesale transit market.
Example:	The case of Mongolia demonstrates that a combination of ISP cooperation and tacit support from governmental authorities can lead to the rapid and successful establishment of an IXP in a developing country. In January 2001, a group of leading Mongolian network operators met in Ulaanbaatar to explore the creation of a national IXP. At the time, all Mongolian ISPs were interconnected via providers in the United States or Hong Kong. Satellite latencies amounted to a minimum of 650 milliseconds (over half a second) for each packet of data in each direction. Costs were high and very few Mongolian Internet business services were hosted within Mongolia. Mongolia's three leading Internet providers completed planning for an independent exchange within three months. By March 2002, MIX had six ISP members and steadily increasing traffic between them. Today, local latency is less than 10 milliseconds per transaction and an average of 377 gigabytes of data are transferred domestically each day among MIX's members. Moreover, each domestically exchanged transaction frees up an equal amount of international bandwidth, thereby improving connection speeds and reducing latency over Mongolia's international links. [55]
Policy / Program:	**Public/private partnerships (PPPs) for deployment of open access broadband networks**
Supply & Demand impacts:	Supply: International connectivity / Domestic backbone
Description:	Network construction is the highest entry barrier in the communications industry, requiring significant financial resources. Construction of domestic and international backbone networks is essential to ensure that high-quality, low-cost connectivity is available. Businesses might initially avoid investing in backbone networks because they are unsure of the returns on their investments. Governments can partner with the private sector to provide up-front support in order to reduce risks or act as an anchor tenant to induce investment.
Example:	The Kenyan government has been aggressively promoting the development of broadband backbones through public-private partnerships (PPPs). It took an active role in The East African Marine System (TEAMS), an undersea fiber optic cable linking Mombasa, Kenya and Fujairah in the United Arab Emirates (UAE). The government encouraged operators in Kenya to join it in taking an 85% stake in the cable, which was launched in 2009. More than ten operators have an ownership interest in TEAMS guaranteeing them access at wholesale

[55] Mike Jensen. 2009. "Promoting the Use of Internet Exchange Points: A Guide to Policy, Management, and Technical Issues." *Internet Society Reports*. http://www.isoc.org/internet/issues/docs/promote-ixp-guide.pdf

	rates. Kenya also encouraged PPPs for building the national fiber backbone and is considering the same for LTE networks. [56]
Policy / Program:	**Coordinate access to rights of way**
Supply & Demand impacts:	Supply: Domestic backbone, Local access; Demand: Affordability
Description:	Obtaining the rights of way necessary to deploy broadband infrastructure can be a complex process adding to costs and delaying deployment.
Example:	Canada's Telecommunications Act includes provisions to facilitate operators' access to public property.[57]
Policy / Program:	**Facilitate open access to critical infrastructure**
Supply & Demand impacts:	Supply: International connectivity, Domestic backbone, Local access; Demand: Affordability
Description:	Critical infrastructure is essential network elements or services that are typically owned by a single or small number of suppliers. These include facilities such as international and national fiber optic backbones and fixed local access networks that cannot easily be replicated. Facilitating open access to these facilities through options such as an obligation for providers to provide wholesale access offers or structural separation of wholesale and retail activities can stimulate competition and lower retail broadband prices.
Example:	The European Commission's requires incumbent operators to offer unbundled access to their fixed telephone networks.[58]
	SERVICES
Policy / Program:	**Connect schools to broadband networks**
Supply & Demand impacts:	Supply: Domestic backbone, local access; Demand: Access, Affordability, Awareness, Assurance
Description:	School connectivity provides many benefits including access to an ever-growing volume of educational information, opportunities for collaboration and the use of on-line applications. It provides students and teachers hands-on experience for developing ICT skills. Schools can also be leveraged to provide connectivity in off-hours to the rest of the community.
Example:	In Chile, the Center for Education and Technology within the Ministry of Education administers *Enlaces*, the country's initiative to improve education in subsidized state schools using ICTs.[59] Enlaces provides access to the

[56] World Bank. 2011. *Kenya Broadband Case Study* (forthcoming).

[57] See "Sharing rights of way" on the ICT Regulation Toolkit at: http://www.ictregulationtoolkit.org/en/PracticeNote.aspx?id=3245

[58] "REGULATION (EC) No 2887/2000 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2000 on unbundled access to the local loop." *Official Journal of the European Communities*. December 30, 2000. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2000:336:0004:0004:EN:PDF

	Internet to approximately 75 per cent of students in schools that are enrolled in the project, 67 per cent of which have a broadband connection.
Policy / Program:	**Government as an anchor tenant**
Supply & Demand impacts:	Supply: Domestic backbone, Local access; Demand: Access
Description:	One of biggest expenses in providing broadband connectivity in rural areas is the "middle mile," or the portion connecting a town to the Internet backbone. Once the backbone connection is established to government institutions, it can be leveraged to provide retail broadband services to local residences and businesses. Broadband connected government institutions thus become "anchor points" from which broadband connectivity can be shared with the surrounding community.
Example:	The United States has recommended that broadband connectivity in federal offices located around the country should be used to extend broadband access to unserved and underserved communities.[60]
Policy / Program:	**Monitor service quality**
Supply & Demand impacts:	Demand: Assurance
Description:	Broadband service providers often advertise broadband speeds that are higher than the bandwidths actually experienced by the user. Differences between advertised and actual speed can impact users' confidence in the quality of broadband services. This can be overcome through regular reporting of service quality levels.
Example:	The Telecommunications Regulatory Authority of Bahrain publishes quarterly results of its broadband quality of service monitoring.[61] It carries out a predefined set of tests around the clock. The results are stored in a centralized database. Actual versus advertized speeds for different ISPs are tested based on access to local and international web sites. The measurements supplement information already available to consumers in respect to prices and advertized speeds.
Policy / Program:	**Create an enabling environment for intermodal competition**
Supply & Demand impacts:	Supply: Local access; Demand: Attraction
Description:	Convergence allows for the provision of voice, data and broadcast services over telephone, broadcast, mobile and Internet networks. Governments should allow any type of network to offer any type of broadband service in order to intensify competition. This includes the legalization of voice over broadband and television over

[59] See the "Connect a School, Connect a Community" web site at: http://connectaschool.org/en/schools/connectivity/regulation/Section_6.1_Chile_case_study

[60] See "Government Performance" at: http://www.broadband.gov/plan/14-government-performance/#r14-1

[61] Telecommunications Regulatory Authority. January 2011. *Broadband Quality of Service Report*. http://www.tra.org.bh/en/marketQuality.asp

	Internet Protocol services.
Example:	Chile allows telecom and television operators to provide voice, data and video services. Cable television operators account for almost half of broadband lines and around one fifth of voice subscriptions.[62]
Policy / Program:	**Ensure nondiscriminatory access for service, application, and content providers**
Supply & Demand impacts:	Demand: Attraction
Description:	It is critical to ensure that all broadband providers of services, applications and content have fair access to broadband networks. "Network neutrality" helps to achieve this by preventing broadband operators from blocking or degrading access to specific content except when requested by user.
Example:	Chile's *Internet and Network Neutrality Law* prohibits operators from blocking applications or content unless requested by the user. Intensive users would be required to subscribe to a broadband plan that reflects the cost of their usage.[63]
Policy / Program:	**Consider expanding universal service obligation to include broadband**
Supply & Demand impacts:	Supply: Local Access; Demand: Access, Affordability
Description:	In a number of countries, the type and quality of telecommunication services that must be made available to subscribers is defined in laws. The inclusion of broadband in such definitions would require operators to make broadband available on demand.
Example:	In July 2010, the Communications Market Act in Finland was revised to include a reasonably priced Internet connection in the definition of universal service. According to the Ministry of Transport and Communications: "Telecom operators defined as universal service providers must be able to provide every permanent residence and business office with access to a reasonably priced and high-quality connection with a downstream rate of at least 1 Mbit/s."[64] The industry regulator will carry out monitoring of the provision as well as reviewing price and quality (including delivery time). The connection can be either fixed or wireless.
	APPLICATIONS & CONTENT
Policy / Program:	**Undertake government-led demand aggregation, with government agencies as early adopters and innovators**

[62] See: "Información Estadística" on SUBTEL's web site at: http://www.subtel.cl/prontus_subtel/site/artic/20070212/pags/20070212182348.html

[63] SUBTEL. "REGLAMENTO DE NEUTRALIDAD RECOGE TODOS LOS BENEFICIOS Y DERECHOS DE LOS USUARIOS CONSAGRADOS EN LA LEY DE INTERNET." *Press Release*. January 20, 2011. http://www.subtel.cl/prontus_subtel/site/artic/20110117/pags/20110117093211.html

[64] Ministry of Transport and Communications. "1 Mbit Internet access a universal service in Finland from the beginning of July." *Press Release*. June 29, 2010. http://www.mintc.fi/web/en/pressreleases/view/1169259

Supply & Demand impacts:	Supply: Domestic backbone, Local access; Demand: Access
Description:	In many countries there exists pockets of broadband demand that are too small to obtain adequate broadband service at favorable prices. By pooling that demand together, a larger market can be created providing incentives for broadband operators to supply the market.
Example:	In Italy an agency of the Ministry of Treasury has aggregated government demand for broadband leading to a sharp reduction in the prices paid.[65]
Policy / Program:	**Provide e-government applications**
Supply & Demand impacts:	Demand: Attraction
Description:	Computerizing public information and providing e-government services through broadband networks are essential. E-government encourages citizens to subscribe to broadband services.
Example:	In Colombia, all municipalities have a web site, the first Latin American country to accomplish this. The Colombian e-government portal is linked to some 3,000 web sites, with information about around 3,000 administrative processes of which 541 could be accomplished completely online in December 2009. Citizen use of e-government services doubled in 2009 to over half a million visits per month.[66]
Policy / Program:	**Promote adoption by industry**
Supply & Demand impacts:	Supply: International connectivity, Local access; Demand: Affordability, Awareness
Description:	Support for broadband-related industries increases demand for supply side components enhancing infrastructure investment and helps to create long-term sustainable demand for broadband services. Providing training and incentives for Small and Medium Sized enterprises can help them get broadband connected to improve their productivity and widen their market opportunities
Example:	In Vietnam the government supports software parks through development of basic infrastructure and incubation and securing domestic and foreign investment for tenants.[67]
Policy / Program:	**Promote creation of digital content**
Supply & Demand impacts:	Demand: Attraction

[65] Daniela Battisti. "Demand aggregation to encourage infrastructure rollout to under-served regions." *WPIE/OECD Public Sector Broadband Procurement Workshop*. Paris, 4 December 2002. http://www.oecd.org/dataoecd/41/60/2491219.pdf

[66] Ministry of ICT. "Así marcha el Programa." *Noticias*. May 10, 2010. http://programa.gobiernoenlinea.gov.co/noticias.shtml?apc=e1c1--&x=2480

[67] See: "LEADERS OF HIGH-TECH PARKS FROM THE ASIAN SCIENCE PARK ASSOCIATION (ASPA) GATHERED IN HA NOI" at: http://www.hhtp.gov.vn/69d40b41_c573_4726_b03c_4f86b90969e1_cms_204.hhtp

Description:	Support for content creation relevant to local needs and in national languages can help attract people to use broadband.
Example:	The Jordanian government has facilitated foreign investment in the digital creation industry. In 2009, chipmaker Intel announced an investment in two Jordanian digital content companies: Jeeran and ShooFeeTV.[68] The funding will be used to help both companies pursue regional growth as well as extend their product offerings.
Policy / Program:	**Support secure e-transactions**
Supply & Demand impacts:	Demand: Assurance
Description:	Online transactions are an important part of the broadband environment. Transactions must be secure and legal to encourage the development of two-way interactive e-commerce, e-government and telemedicine applications. This means that legal systems need to recognize electronic signatures and transactions. Information security such as encryption technologies and anti-hacking software, are also critical for a stable and safe broadband atmosphere.
Example:	The Association of South East Asian Nations (ASEAN) published a reference framework for e-commerce back in 2001 and has since guided the creation and harmonization of e-commerce laws in the region. By April 2008, eight of its ten members had enacted e-commerce legislation enabling the legal recognition of online transactions to support applications such as online retailing and Internet banking.[69] ASEAN is the first developing region in the world to implement a harmonized e-commerce legal framework throughout member countries.
Policy / Program:	**Implement reasonable intellectual property protections**
Supply & Demand impacts:	Demand: Assurance
Description:	One enabler of content and media development is the creation of an intellectual property rights (IPR) regime that protects creators' interests while enabling others to use and improve those creations. Such rights need to balance the interests of creators with the larger goals of enabling knowledge sharing, fair use, and adaptation. This is particularly relevant for the development of e-learning and distance education applications.
Example:	Creative Commons licenses allow creators to specify which rights they wish to reserve, thereby allowing a range of possibilities between full copyright and the public domain. [70]
	USERS

[68] "Intel Capital to invest in two digital content companies in Jordan." *Press Release*. May 17, 2009. http://www.intel.com/capital/news/releases/090519.htm

[69] Galexia. "Harmonisation of E-Commerce Legal Infrastructure in ASEAN" April 2008. http://www.galexia.com/public/research/articles/research_articles-art53.html

[70] See the Creative Commons web site at: http://creativecommons.org/

Policy / Program:	**Provide low-cost user devices in education**
Supply & Demand impacts:	Supply: Access device; Demand: Affordability, awareness
Description:	The spread low-cost computers in schools typically include an ecosystem for operating and maintaining the devices, which often involves providing broadband access in schools in order to download software and support the Wi-Fi capability of the devices. The provision of low-cost educational computers also develops ICT skills at an early age helping to grow demand for broadband.
Example:	Uruguay has supplied Wi-Fi enabled laptops to all primary school children. [71] One of the goals of the Uruguayan plan was to boost overall household computer ownership by leveraging the students taking the laptops home after school. This has resulted in 220,000 new homes with computers including 110,000 in the lowest income families.
Policy / Program:	**Develop digital literacy programs for citizens**
Supply & Demand impacts:	Demand: Awareness
Description:	To raise public awareness of the benefits of broadband services and promote their use, governments should provide training on how to use computers and the Internet. This training can contribute to the rapid and widespread penetration of broadband. In the short run, such training generates demand. It can also be a step toward universal service when the program targets underserved groups. ICT training for children and students can change their learning behavior and interests and, by extension, alter their parents' views of ICT and broadband.
Example:	In Colombia, the Compartel program within the Ministry of ICT devoted around $153 billion pesos in 2009 for teaching free computer literacy courses at some 1,670 Internet centers around the country. The courses were provided to around 200,000 people where they learn about basic computer tools, Internet navigation, email, search engines, chat and ICT applications. In addition, teachers use virtual training and video conferencing at the centers to offer courses in other subjects. The centers are often located in educational institutions with access provided to the local community for training during non-school hours.[72]
Policy / Program:	**Address content and security concerns**
Supply & Demand impacts:	Demand: Assurance

[71] Miguel Brechner. "Plan Ceibal: One Laptop per Child and per Teacher." Presented at *Reinventing the Classroom*, Inter-American Development Bank, Washington D.C. September 15, 2009. http://events.iadb.org/calendar/eventDetail.aspx?lang=en&id=1444&

[72] See "Más de 200 mil alfabetizados digitalmente en los "Nuevos Telecentros Compartel"" on the Compartel web site at: http://archivo.mintic.gov.co/mincom/faces/index.jsp?id=19037

Description:	Many users are leery of broadband Internet access because of objectionable content and security concerns. This concern can be alleviated through programs that educate users about perceived risks, child online protection and how to use the Internet safely.
Example:	The regulator in Qatar has created a site for children, teenagers, teachers and parents providing tips for safe online surfing.[73]
Policy / Program:	**Expand access to underserved communities with USF support**
Supply & Demand impacts:	Supply: National backbone, local access; Demand: Access
Description:	Universal Service Funds (USF)—typically financed by contributions from telecom operators—were initially created to facilitate the development of telephone infrastructure in rural and other underserved localities. Given that broadband connectivity can provide many beneficial services in addition to voice telephony countries should consider the scope of USF to cover broadband deployment in underserved areas.
Example:	Pakistan's USF is funded by a 1.5% levy on telecom operator revenues. Broadband projects are eligible for funding and include the connection of schools through broadband computer labs and extending domestic fiber optic backbones to rural areas.[74]
Policy / Program:	**Construct community access centers**
Supply & Demand impacts:	Supply: Local access; Demand: Affordability, Awareness, Access, Assurance
Description:	Citizens in underserved communities do not use broadband because they have no access, cannot afford it or are not aware of its benefits. Creating facilities for public broadband use can alleviate these barriers by establishing a place of access, offering free or low cost tariffs and including training.
Example:	In Malaysia, the Government established Community Broadband Centers (CBC) to provide collective high-speed Internet to underserved areas identified under the Universal Service Provision (USP) program.[75] The CBC is outfitted with computers connected to broadband. Training is also provided at each CBC.
Policy / Program:	**Facilitate affordability of broadband devices**
Supply & Demand impacts:	Supply: Devices; Demand: Affordability
Description:	Computers, mobile phones and data cards for broadband use are expensive for many citizens of developing

[73] See ictQATAR's "Stay Safe Online at: http://www.safespace.qa/csk/en/home.aspx.

[74] See "Company Profile" on the Pakistan Universal Service Fund web site at: http://www.usf.org.pk/Company.aspx

[75] See "COMMUNITY BROADBAND CENTRES" on the Malaysian Communications and Multimedia Commission web site at: http://www.skmm.gov.my/index.php?c=public&v=art_view&art_id=34

	countries. Countries could consider developing policies and programs that make user devices more affordable for people who want to buy them but lack the means to do so. This includes reducing or eliminating taxes on broadband-enabled devices and subsidizing or offering low or zero interest loans for their purchase.
Example:	In March 2009, China announced that it had selected 14 PC vendors to offer low-priced PCs in rural areas. All the PCs in the winning bid are priced from $290 to $510. This approach is part of the National Home Appliance Subsidy Program for rural areas. About 57 percent of the rural population—about 200 million households—will be eligible for a 13 percent subsidy if they purchase one of those PCs.[76]

[76] He, Eileen, and Simon Ye. 2009. "Rural China PC Program Will Increase PC Shipments in 2009." Gartner, Stamford, CT. http://www.gartner.com/DisplayDocument?id=909330 .

Table 6. Regional examples of policies and programs for broadband development

Component	East Asia & the Pacific (Vietnam) Lower-middle-income economy	Europe & Central Asia (Turkey) Upper-middle-income economy	Latin America & the Caribbean (St. Kitts) Upper-middle-income economy	Middle East & North Africa (Morocco) Lower-middle-income economy	South Asia (Sri Lanka) Lower-middle-income economy	Sub-Saharan Africa (Kenya) Low-income economy
Infrastructure	A number of fixed and mobile broadband operators have been licensed	Requires incumbent to provide wholesale broadband access to its fixed telephone network	Licensed cable TV & fixed wireless operators to provide broadband services in competition with incumbent	Granted license to new operator Wana who is now the 2nd largest broadband operator	Sri Lanka was among the first in the region to award mobile broadband spectrum and has lowest prices and highest speeds	Kenyan government encouraged local operators to participate in undersea TEAMS cable through PPP
Services	Installation of a broadband network connecting over 1,000 educational institutions in Ho Chi Minh City	Broadcast firms allowed to provide broadband and incumbent allowed to provide IPTV	VoIP services such as Vonage, MagicJack, and Skype extensively used by residential consumers	The Genie program is installing broadband multimedia computer labs in all schools impacting 6 million students.	The regulator compiles broadband quality of service showing difference between advertized and actual speeds	VoIP legal since 2006 with liberal licensing for ISPs
Applications	Several plans and programs for promoting software and digital content industries	Share of government services provided online to total public services reached to 66% in 2010	Government encourages local portals developed by entrepreneurs; SKNVibes gets 2 million hits a month	The Idarati (e-government) program led to 97% of administrative units having a web site with some 200 services on-line	The *e-Sri Lanka* program has resulted in 112 on-line services and some 4 million people conducting transactions with government online	Judiciary Telepresence project connects judges and courts
Users	Support procurement of digital information devices for households with financial difficulties through USF & spectrum auction proceeds	1,850 Public Internet Access Points (PIAP) to provide ICT access and ICT competency to citizens, have been provided by the government	Students in the final grade of high school provided with laptops. Operators bid on providing Internet access to these students on a pay-as-you-go basis	Subsidizes laptops for engineering students and teachers	The *Easy Seva* project used PPPs to install over 50 public Internet facilities in rural areas connected with mobile broadband	The Kenya ICT Board establishes and funds *Pasha Digital Villages* with broadband access for communities

Source: Adapted from World Bank Broadband Country Case Studies.