# Module 2.  Policy Approaches to Promoting Broadband Development

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## 2.1  Introduction

The development of broadband networks and services over the last decade or so has been largely focused in developed countries.  In that time, private sector investment, coupled with enabling polices put in place through liberalization and regulatory reform, has driven the building of broadband networks and the adoption of broadband services throughout the developed world.  But as more economic and social activity has moved onto broadband networks in recent years, developing countries are implementing their own broadband plans and initiatives to realize the benefits that broadband can bring to a country and its citizens.

As they consider how best to promote broadband, policymakers and analysts have come to realize that broadband must be viewed as an ecosystem with supply and demand considerations (the ecosystem is described in Module 1).  On the supply side, the building of networks to carry broadband services is the first priority.  But simply having a network available does not guarantee that broadband services will automatically be used.  It will also be necessary for government policy and private sector investment to focus on driving demand for broadband services—whether by putting more services online or educating users on the benefits of broadband and the skills needed to effectively use the new services.  Those countries with the best success in broadband development have focused on developing holistic policies to support both sides of the broadband supply and demand equation.

This module identifies the issues policymakers must address as they seek to create an enabling environment for broadband and examines what policies and regulatory approaches may be effective in encouraging broadband development.  It is designed to provide an overall introduction to the issues, policies and strategies that are discussed in more detail in subsequent modules and provides hyperlinks to the modules where these issues are addressed in detail.  These topics are also covered in the Broadband Strategies Handbook, which is a condensed, but comprehensive, version of the Toolkit that the World Bank has also made available.  The cross-referenced modules and the Handbook analyze the issues extensively, and provide many examples of how different countries have approached broadband development.  They deal respectively with the technologies that make broadband possible, how broadband networks and services can be universalized, how demand for broadband can be stimulated and what changes to policies, laws and regulations can help broadband reach its greatest potential.

## 2.2  The Public Policy Context for Broadband

As discussed in Module 1, broadband is a general purpose technology that significantly affects how people live and work.  It is a key driver of economic growth and national competitiveness,[1] as well as social and cultural development.  Broadband-enabled cities can attract more services firms and so create more jobs than their narrowband counterparts.[2] Communities also benefit from faster Internet access: their residents have enhanced real and virtual opportunities to communicate with each other and to access government services and public officials. Conversely, countries, communities, corporations, and individuals that lack easy access to broadband may miss economic and social opportunities.

Recognizing the widening broadband divide and the risk that some groups may be missing out on the economic and social benefits of broadband access and use, policymakers in a growing number of countries are looking to encourage greater broadband development.  Even some countries with well-developed telecommunications markets and good broadband penetration are looking to universalize broadband, sometimes as part of larger macroeconomic stimulus and development programs.

The development of strategies and policies to promote broadband, however, is not an easy task. Policymakers are quickly realizing that promoting broadband may be harder to achieve compared to other types of services, such as mobile telephony.  The usefulness of a mobile telephone is typically obvious to consumers regardless of income or education level, and, coupled with relatively low prices, such intuitive services have grown rapidly.  But the same cannot necessarily be said of broadband—especially if the opportunity to try it is undermined by high prices.  Using broadband services requires access to a computer or smartphone, and some way to pay for using the network—either through a subscription (and often some form of term contract), a pay-as-you-go approach or through prepaid services.  In the absence of access through the workplace, school or community centers, this can make ownership relatively costly (even with falling prices for hardware and subscriptions) for individual users.  In addition, understanding the benefits of broadband, and having the skills to make use of the available services, requires some level of digital literacy, as well as basic literacy (i.e., the ability to read and write).  This section addresses the public policy context within which broadband development strategies are made and identifies the challenges that policymakers and other interested parties may face in trying to facilitate greater broadband availability and use.

## 2.2.1   The Public Sector's Evolving Role in Broadband

The past decade has seen significant debate on the appropriate role for government in expanding broadband diffusion.  The public sector has played two general roles in promoting the growth of information and communication technologies (ICT): 1) making markets more competitive, efficient and accountable/transparent; and 2) ensuring equitable access for all.  This has enabled the private sector to lead the roll-out and investment in ICT.  This same approach should be pursued with broadband development.  The role of government should be to enable, facilitate and complement market development, rather than to substitute government decisions for market forces and public sector investment for private investment.

Due to broadband's importance, however, there have been calls to view broadband as a public good in order to ensure affordable universal access and spread the benefits across the full range of economic sectors.[3]  Based at least partially on a public goods analysis, some countries have taken more direct action to promote broadband development, establishing initiatives and strategies where the government intervenes more directly to promote, oversee and universalize their broadband markets. This was particularly the case as a result of the economic crisis of 2008, as many governments came to see broadband networks and services as a way to preserve and enhance their economies.  In 2009, for example, countries with different economic philosophies included broadband in their economic stimulus plans (e.g., Australia), indicating that they were no longer averse to making strategic investments.  By 2011, however, such policies were being increasingly called into question as government debt levels rose, in some cases dramatically, forcing austerity programs and corresponding cuts in government spending on a wide range of priorities, including broadband.

## 2.2.2   Technological Change and Convergence

### New Technologies and Services Provide Opportunities and Challenges[4]

As policymakers and regulators consider ways to expand broadband infrastructure and stimulate demand for broadband services, it is also important to remember that technologies, applications and services will continue to evolve and present new challenges to the legal and regulatory underpinnings for broadband development.  Increased broadband access and use over the next decade will lead to an even greater breadth of applications and services -- many of which are not yet commercially available,

or even conceived.  This is likely to require policymakers and regulators to find ways to embrace these new applications, while balancing competitive and regulatory goals.

More importantly, this change is likely to come quickly.  For example, little more than five years ago, YouTube was just beginning to become popular; it recently surpassed the four billion views a day milestone on a global basis (as of March 2012), nearly double the combined primetime audience of all three major free over-the-air television networks in the United States.[5]  Similarly, in its relatively short history, Skype has become the equivalent of the largest "carrier" in the world based on registered users, contributing 12 percent of world-wide international long distance traffic (see Figure 2.1).[6]

**Figure 2.1:  Top five mobile carriers by subscribers compared to Skype registered users (1Q 2010)**
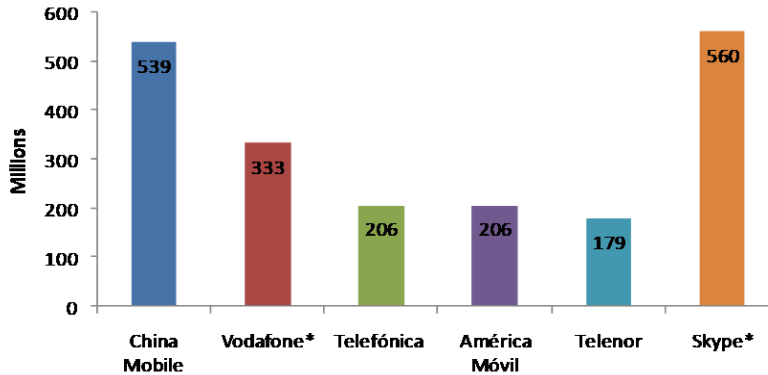


*Note: * Figures refer to 4Q 2009*
*Source: Company reports, TeleGeography, Morgan Stanley*

The development of such new services and applications may provide policymakers with lessons on how to draw people to the Internet and broadband.  A good example is the rapid rise of so-called "social networking sites," such as Facebook or Twitter.  Such services have exploded in popularity among broadband users and are becoming more and more popular in both developed and developing countries.  In fact, of the top 30 countries ranked by the number of Facebook users, fully half are developing countries (see Figure 2.2.).  In addition, as it has grown and evolved, Facebook has begun to offer a wider range of services—from transferring personal messages and "status updates" to exchanging photos to gaming–all of which gives users a wide range of things to use and do just within Facebook itself.  The popularity of such sites, and the many services they offer, can be used as a way to show non-users the benefits of broadband use.  However, it is also true that some of these new services also raise new regulatory issues (e.g., relating to data protection and privacy) that may subject such sites to increased regulatory scrutiny as governments seek to further define the rules for personal information, etc.

**Figure 2.2:  Top 30 countries by number of Facebook users**
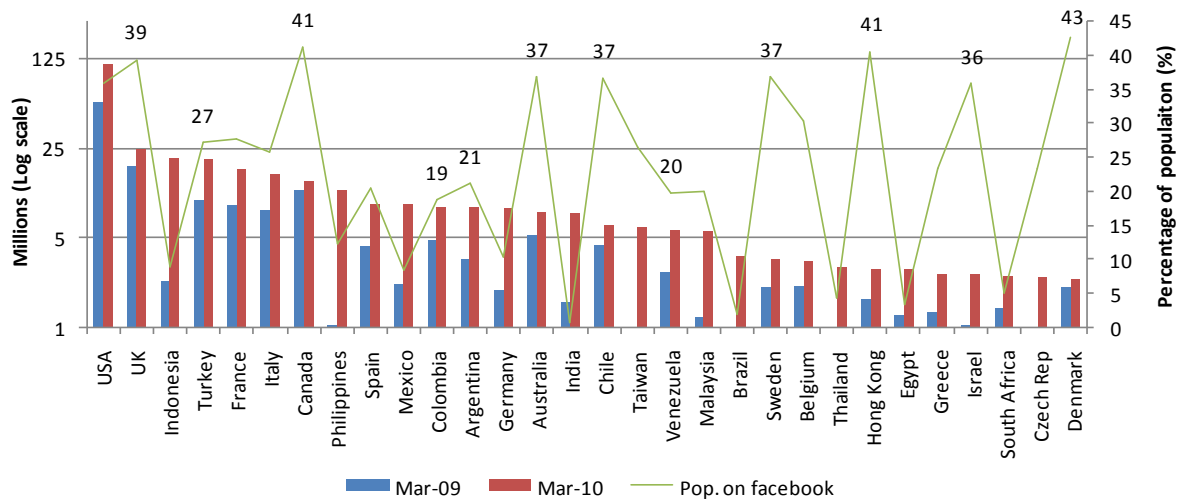


*Source: Telecommunications Management Group, Inc. based on Nick Burcher,  Facebook usage statistics - March 2010; Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision, http://www.nickburcher.com/2010/03/facebook-usage-statistics-march-2010.html.*

## Convergence Continues

As broadband technologies and services grow, so will the ability of users to create and share all types of digital content. And as their drive to control costs and grow revenues gets stronger, providers will look to new technologies and services to help them.  Countries with policy and regulatory frameworks that allow converging technologies to develop and markets to function well will benefit the most.  With the pace of convergence likely to increase, many countries are adjusting their policy and regulatory frameworks to facilitate convergence.

Three main forms of convergence can be identified:

- Service convergence, or "multiple play," allows a firm to use a single network to provide several ICT services that traditionally required separate networks. Conversely, any individual service can be provided over many different networks.

- Network convergence exists where a common standard allows several types of networks to connect with each other. Consequently, a communication service can travel over any combination of networks.

- Corporate convergence results from mergers, acquisitions, or collaborations among firms. New business entities are created to offer multiple services (old and new) and address different markets.

Convergence has a significant impact because it alters market structure and dynamics.  On one hand, users are able to access a wider range of services, choose among more service providers, and produce and distribute content.  On the other hand, convergence allows service providers to adopt new business models, offer new services, and enter new markets.

Policy frameworks that restrict competition or prevent convergence from playing out in a market lead to suboptimal outcomes that may reduce the development impact of broadband.  In the long term,

countries that resist change are likely to miss the benefits of improved technologies and services. Countries that take a "wait and watch" approach might benefit if the frameworks in place do not pose major immediate problems, but risks remain because converged networks and services typically do not fit easily into traditional policy frameworks and both technologies and markets are likely to continue changing quickly. Evidence suggests that the greatest benefits are derived in markets that seek to facilitate convergence.

Expanding access to broadband, the demand for multimedia and user-created content, the availability of inexpensive multimedia devices, and the drive to cut costs while increasing value from broadband services are coming together to speed up the pace of convergence.  All these trends are challenging policymakers and regulators on several levels.  First, there is the issue of how to treat similar services provided by operators that had been traditionally separate and governed by different sets of rules.  In addition, there are numerous issues involved in market and competition law/regulation that depend on specific market definitions and analyses that are coming under increasing scrutiny.  Finally, as more and more content and services move online, governments must also address what their role is in promoting the demand for such services as part of an overall strategy to promote broadband development.

## 2.2.3   Defining the Challenges:  Barriers to Broadband Growth

As policymakers and regulators consider approaches to stimulate and promote broadband development, it is important to recognize the full scope of the challenges that must be addressed. These challenges tend to be multi-layered and involve stimulating the supply of broadband infrastructure and encouraging demand for broadband applications and services, as discussed in Module 1.  On the supply side, the problem is not as simple as just building more networks; as operators develop their broadband business plans, issues of cost, service quality (bandwidth/data speeds), and technology choice will also play important roles in deciding how best to bring access to a nation's citizens.  Even then, just building more networks or providing access to all is not a guarantee of success—governments may need to support broadband development by encouraging demand for broadband in those limited instances where the private sector does not generate useful and relevant applications, services and content.  As discussed in Module 1, governments must think of broadband as an ecosystem, with supply and demand components, to maximize their chances for broadband development success.  Such a holistic approach, however, may prove challenging for some governments where organizational barriers may exist to greater cooperation and joint policy development and execution between departments that historically have not had to work together.

### Supply:  reaching unserved and underserved users

In considering policies and strategies to promote broadband development, one important goal is to ensure that access is available to the widest possible user base.  This means that networks need to be built out to reach as many people as possible.  But facilitating broadband supply presents at least two significant issues.  First, there are areas in virtually every country that have no meaningful access to broadband services at all.  This problem is most pronounced in developing countries, which have seen less investment in the construction of networks outside metropolitan areas.  This situation has improved in recent years with the spread of wireless networks, but there are still areas without any type of network coverage.  Second, some areas have networks in place, but these networks are not capable of supporting broadband speeds and services.   These areas will need to be upgraded to provide broadband, either through the construction of high-speed wireline networks and/or through advanced wireless networks (3G or 4G services).  In many developing countries, where wireless penetration can far exceed wireline penetration, upgraded wireless networks capable of providing true broadband

speeds are expected to be the main supplier of broadband services.  Box 2.1 describes some of the barriers to bringing higher speed services to the countries of Sub-Saharan Africa.

**Box 2.1. Constraints on Backbone Capacity in Africa**

Current backbone network infrastructure in Sub-Saharan Africa is characterized by widespread, low-capacity networks generally owned and operated by vertically integrated operators focusing on voice services.  Incumbent network operators have much less extensive networks than in other regions and, in many cases, do not play a major role as providers of backbone network services.  In other regions of the world, by comparison, large-scale investment in backbone networks has resulted in intensive competition and vertical disaggregation of networks, encouraging entry into the downstream market and stimulating the rollout of broadband services.  The underlying causes of this pattern of network and market development in Sub-Saharan Africa are the high cost of network construction and operation, regulatory restrictions, and the historical evolution of networks and the market.

Most of the terrestrial backbone infrastructure in Sub-Saharan Africa is wireless.  In fact, only 12 percent of the total terrestrial infrastructure in the region is fiber-optic cable, while the remainder is microwave. If satellite-based backbone network infrastructure is also taken into account, the significance of fiber in the total backbone network infrastructure of Africa is even smaller.  This mix of wireline and wireless infrastructure varies considerably among various types of network operators. Approximately 99 percent of the backbone network length of mobile operators in Sub-Saharan Africa is made up of microwave technology, while only 1 percent is fiber.  Fixed operators in the region have much more fiber in their networks, with approximately 40 percent of the length of their backbone networks built from fiber technologies.

The capacity of a backbone network is determined by the technology on which it is based and the capacity of the transmission equipment installed on the network.  Though there are technical limits on the maximum capacity of wireless networks, in practice, the choice of whether to use wireless or fiber-optic cables in the backbone network is usually determined by cost structure rather than technical capacity limitations.  For low-traffic volumes such as those generated by mobile voice networks, wireless backbone networks are the most cost-effective technology.  For higher volumes of traffic, fiber networks are typically the optimal solution due to their very high data-carrying capacity. Detailed technical information on the capacity of backbone networks in the Sub-Saharan Africa region is not available, since it is usually commercially confidential.  However, the predominance of microwave and satellite backbone technologies in the networks provides a clear indication of network capacity limitations.  These wireless networks are not capable of handling the volumes of traffic generated by broadband services, particularly for a large customer base.

Differences in the cost structure of wireless and fiber-optic backbone networks help to explain why operators have preferred to utilize wireless technologies.  In wireless backbone networks, only a small proportion of the total costs are fixed with respect to the capacity of the network, so total costs are primarily driven by the volume of traffic carried. The costs of fiber-optic cable networks, by contrast, are largely fixed.  A recent study by the Organisation for Economic Co-operation and Development (OECD) concluded that 68 percent of the costs in the first year of rolling out a fiber network to the premises are in the civil works.  These costs are completely unrelated to the volume of traffic that the network will carry. This is consistent with other studies, which have put the percentage of total costs of fiber networks that are fixed at 60-80 percent.[7]

Going forward, expanding these backbone networks, and improving the capacity of the wireless-dominated backbone networks will be a challenge.  African policymakers and regulators will need to creatively address the following issues to help operators make the transition:

**Regulatory Environment.**  In many Sub-Saharan African countries, mobile operators are allowed to build their own backbone networks for the provision of services to their own retail customers but have been prevented from selling backbone services to other operators on a wholesale basis, effectively constraining the development of a market in backbone network services.  The restriction also limits opportunities for taking advantage of economies of scale in network infrastructure and reduces incentives to invest in high-capacity backbone networks.  As a result, mobile operators have built their own networks that operate parallel to each other and there is very little consolidation of traffic onto core backbone networks.

**Stage of market development.** The second reason for the lack of aggregation of traffic onto backbone networks in Sub-Saharan Africa lies in the stage of market development in most countries. Operators face a tradeoff when deciding whether to allow competing operators to use their backbone networks. On one hand, by doing so, they increase their revenues and utilize spare capacity on their networks. On the other, they may lose some competitive advantage by allowing other operators to effectively increase their network coverage faster than they would if they were required to build their own networks.  The result of this tradeoff is that direct competitors in growing markets typically cannot reach agreement on the use of each others' backbone networks, a difficulty that is often exacerbated by a failure of the regulatory authority to facilitate commercial negotiations or to impose regulatory interconnection obligations on operators.

**Network economics.** The current predominance of wireless backbone networks in the region has implications for the way in which the backbone market is developing. Wireless backbone networks are scalable, meaning that operators develop them incrementally to meet internal capacity requirements. Operators are therefore less likely to have excess backbone network capacity than might have been the case if they had invested in fiber networks.[8] This has implications for the market in backbone services because the marginal cost of capacity on a network in which there is a large margin of spare capacity is much lower than on a network that is scalable. Operators with spare capacity have a strong commercial incentive to sell spare capacity and, since their marginal cost is low, any competition among operators could be expected to reduce prices. An operator with a predominantly microwave backbone network, on the other hand, is likely to install the amount of capacity it requires to meet its own traffic needs. If it were to decide to sell backbone capacity on a wholesale basis, additional capacity would have to be installed. An operator with a wireless backbone network thus has less of an incentive to enter into this market than an operator with a fiber-optic cable network.

*Source:  Mark D. Williams, the International Bank for Reconstruction and Development/The World Bank, Broadband for Africa:  Developing Backbone Communications Networks at 3, 2010.*

## Demand:  Barriers to adoption

Improving the availability of broadband networks only addresses one impediment linked to broadband development.  Even with networks in place and accessible, there are likely to be barriers due to lack of demand*.*  This problem involves people who have access to broadband network(s), but are unable or unwilling to obtain service.  Addressing lack of demand is important because low adoption rates will leave networks underutilized.  This has at least two implications.  First, from a network externalities standpoint, fewer users reduce the economic and social utility of the networks.  Where relatively few people can communicate online, the network externalities will be reduced since there is a smaller number of potential customers for businesses to serve.  This further means that there may be fewer local businesses and consumers to offer broadband-enabled services and applications, such as video streaming services (e.g., Hulu+), voice and video communications (e.g., Skype) and download services for a variety of applications like software, e-books, etc.

Second, low adoption and use will undermine the business case of any network—even those built with public funds.  Fewer users means that networks are correspondingly higher-cost, or their costs are spread over a smaller user base, making them relatively more expensive to build and maintain/operate.  Thus, it is important for governments to focus their attention on developing policies that not only facilitate and encourage the building of broadband networks, but ensure that as many people as possible can and do use them.

In studies that have been conducted to identify barriers to Internet and broadband adoption, the findings are roughly consistent across countries.  In the United States, for example, the Pew Internet and American Life Project found many reasons why people do not use the Internet and/or broadband services.[9]  The reasons can be grouped into four main categories:

- Broadband is not relevant to me                50 percent
- Equipment or service too expensive           19 percent
- Service not available                               17 percent
- Lack of training or use issues                    13 percent

These four groups are generally consistent with the data collected in Europe by Eurostat.[10]  Importantly, even in high-adoption countries, relevance or need is still the most common reason for non-adoption.  In the United Kingdom, for example, 42 percent of those without Internet service said that the main reason was "there's no need," or "I'm not bothered" by the lack of access.[11]  Of that group, 43 percent said they would not get Internet service even if it (and the computer to access it) were free.  Demand issues also tend to cluster according to particular demographic groups.  In summing up the barriers to adoption for the European Commission's Supporting Digital Literacy program, the Danish Technological Institute found that the greatest numbers of non-computer and non-Internet users are found among:[12]

- The elderly (from 55 years of age and older – especially those between 65 and 74 years of age);
- Women compared to men;
- Persons with low education levels;
- Persons with few economic resources;
- Persons in low-density population areas;
- Persons in manual jobs, the unemployed, and especially the retired or inactive.

This is not to say that demand inhibitors are exactly the same in all countries.  The factors seen as impediments to adoption in some countries may be less of a factor in other countries, due to different social and cultural histories and experiences, as well as different socio-economic conditions.[13]  Figure 2.3, which reflect survey data collected from non-adopters of Internet services in Brazil and the United States, shows how some factors are more important than others.[14]  Respondents in the United States, for example, see digital literacy as a much bigger problem than respondents from Brazil who consider high cost to be a larger issue.  Therefore, each country must analyze and address the demand-reducing factors on a case-by-case basis and tailor solutions to their individual circumstance.

**Figure 2.3.  Reasons for Non-Adoption of Internet in Brazil and Broadband in the United States**
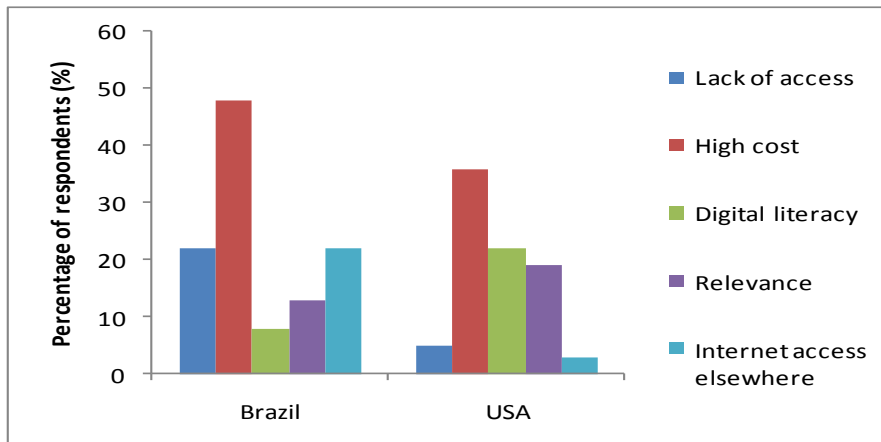


*Sources: NIC Brasil, Análise dos Resultados da TIC Domicílios and FCC, Broadband Adoption and Use in America.*

## Institutional Barriers

Holistic broadband strategies addressing both supply and demand issues should define the institutional framework within which the various programs and policies will be implemented.  Some of these institutions might be obvious, such as ICT industry regulators, but there are also other agencies that could have a role in implementing the strategy.  For instance, competition regulators, trade ministries, and finance departments might support broadband development by ensuring a level playing field, easing equipment import restrictions, or providing tax breaks.  Line ministries such as those overseeing health, agriculture, education, and public administration may also play a role in broadband development by supporting content development, bringing their services online, implementing specific programs or using broadband to streamline their functioning.

A range of institutional structures has been tried across countries. Some successful broadband markets have one agency that spearheads policy development and implementation.  Japan and Korea offer one model, where a single organization took the entire responsibility for implementing policy, thus ensuring consistent and efficient promotion of broadband.  Establishing legal systems to support the broadband vision and policies can also contribute to consistent policy implementation.  Japan and Korea enacted laws on their broadband visions and policies and used them to secure stability in policy deployment and secure cooperation from the ministries involved.

But political circumstances often hold back governments from reforming organizational structures.  Many countries have legacy administrative systems.  In such cases, some mechanism for collaboration should be in place to coordinate policies and implementation among government bodies.  For instance, the United States and some European countries have regulators that take full responsibility for regulatory policies, while promotional and universalization policies are handled by ministries dealing with economic affairs.  Despite such separated management of policies, these organizations have maintained efficiency through their capacity for policy coordination.

## 2.2.4  Development of Country-Specific Solutions

There is no "one-size-fits-all" approach that will guarantee greater broadband deployment and adoption in every country.  Political and economic conditions vary, and each country is endowed with different technological resources.  Some countries have a relatively well-developed wireline telephone network that could support broadband deployment, while others have widely deployed cable TV networks that might be able to provide a measure of facilities-based competition from the start.  In yet other

countries, there may be various regulatory, political, economic or other barriers to entry that prevent potential providers from offering broadband services or building broadband networks.

This variety makes it unwise to propose a uniform solution to promote broadband development. In some cases, the challenge will be to create incentives so that widespread networks can be used to offer broadband services. In other countries, the main challenge may be to find ways to educate potential users about the benefits of broadband and train them to use broadband applications and services. As a result, each country will face its own unique circumstances that will drive policy and investment decisions. However, the key objective for governments is to pursue policies that will create an enabling environment that will foster broadband development.

Important lessons can be learned from those countries that have pursued broadband development policies.[15] First, the focus in these countries has been on improving the incentives and climate for private investment—a policy that even highly resource-constrained countries might be able to follow (and many have successfully attained with mobile telephony). Many of the policies and programs that have been developed support private sector investments and call for specific, limited and well-justified public funding interventions only in exceptional circumstances. In particular, where governments are trying to promote the growth of underdeveloped markets, policies and regulations that may reduce private sector investment should be avoided.

Government funding or policy should not have the effect of "crowding out" private sector investment. For example, governments can encourage private investments in many cases without direct subsidies, such as by opening passive infrastructure—ducting, towers, cable conduits, and providing access to rights of way—which can significantly cut costs and create minimal market distortions.[16] Public investments should be considered only when no or insufficient private investments are expected for a significant period. Furthermore, to maintain a level playing field for competition even with public investments, governments should seek to avoid favoring one company (or type of company, e.g., telephony vs. cable) over another. For example, if and when governments intervene to increase network availability, it may be necessary to ensure that subsidized networks are open access—meaning that network operators offer capacity or access to all market participants in a nondiscriminatory way.[17] Nonetheless, it is recognized that there may be cases where a dominant provider may need to be appropriately regulated to avoid market concentration or other adverse impacts on overall market competition. Box 2.2 summarizes the actions that governments can take to promote greater broadband development.

**Box 2.2. Public Sector's Role in Fostering Broadband Development—Key Lessons**

- Government should focus on maximizing competition, including removal of entry barriers and improving the incentives and climate for private investment.

- Government should provide specific, limited, and well-justified public funding interventions only in exceptional circumstances (e.g., where governments are trying to promote growth of underdeveloped markets).

- Government funding should not compete with or displace private sector investment.

- Government should maintain a level playing field for competition, including government-owned providers, by avoiding favoring one company (or type of company, e.g., telephony vs. cable) over another.

- Subsidized networks should be open access (i.e., offering capacity or access to all market participants in a nondiscriminatory way).

> - Government may need to regulate dominant providers to avoid market concentration or other adverse impacts on overall market competition.
>
> *Government should eliminate barriers to content creation and refrain from blocking access to content, including social networking sites, or restricting local content creation.*

*Source:  Telecommunications Management Group, Inc.*

Developing countries in particular will also need to identify ways to leverage limited resources to maximize impact, prioritizing programs based on demand and market evolution, rather than shying away from policy reform altogether.  For most developing countries, the most effective approach to promoting broadband development is likely to involve a mix of approaches and policies that seek to boost private sector investment, coupled with regulatory reform that will promote efficient and competitive markets (which will also increase private sector investment).   Direct government intervention should be limited to those cases where markets may not function efficiently (e.g., providing service to high-cost areas) or where larger social goals are clearly identified (e.g., digital literacy training).  The basic principle remains the same: governments should only intervene based on sound economic principles, where the benefits of intervention outweigh the costs.  For example, particularly at the initial stage of broadband market development, there may be a need for aggressive government policies to generate demand, expand networks, and reach underserved areas and communities.

## 2.3  How to Do It:  Implementing Policies and Strategies to Enhance Broadband Development

Governments have a number of ways to promote the development of broadband networks and services in their countries.  In most cases, the most effective government strategies are those that seek to harness the power of private sector investment to spur broadband growth.  For purposes of this Toolkit, there are four broad categories of government action in this regard that will be examined:  (i) legal and regulatory policies and reform; (ii) universal access policies; (iii) support for private sector broadband network build-out; and (iv) policies that seek to grow demand and spur adoption.  These approaches are illustrated in Figure 2.4.

**Figure 2.4. Government Support for Broadband Development**
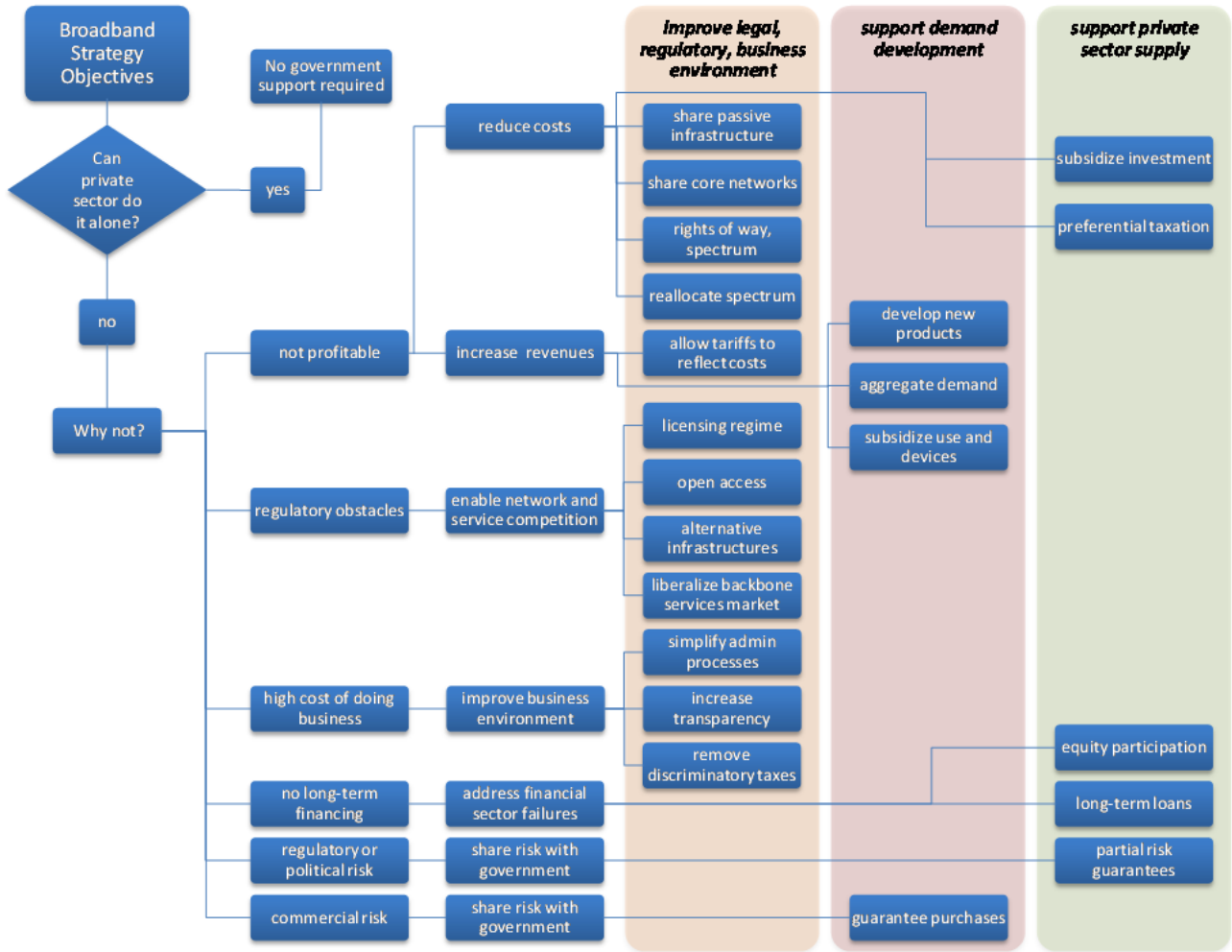


*Source: Telecommunications Management Group, Inc.*

## 2.3.1  General Approaches to Promote Broadband

As policymakers seek ways to promote the development of broadband in their countries, certain general lessons can be learned from those countries with more developed broadband networks and services. This section describes the general elements that governments should be aware of as policies and strategies are created.

### Establish Specific Plans and Policies

Based on an evaluation of the supply and demand challenges that exist in a country (see section 2.2.3), the next step is developing the specific policies and strategies to address those challenges. This will entail setting concrete, measurable objectives for improving the supply of broadband through infrastructure build-out as well as promoting demand for broadband services and applications. Setting specific plans or policies will provide a clear sense of direction that will encourage investment, as well as provide a blueprint for long-term action. Many countries have already developed such plans, as shown in Practice Note 2.1.

**Practice Note 2.1. Broadband Plans around the World**

WB BBTK Broadband
Plans and Strategies.

A good plan should aim to promote efficiency and equity, facilitate demand and help to support the social and economic goals of the country.  The most successful plans will start with a clear vision of what broadband development should be and contain well-articulated goals that can be used to develop specific strategies to achieve success. Such frameworks can launch or revise ambitious national broadband visions, including definitions of broadband, service goals (including national and rural coverage), transmission capacity, service quality, and demand-side issues such as education and skills development.   The government of the Republic of Korea, for example, was one of the early broadband leaders.  It has developed six plans since the mid-1980s that have helped shape broadband policy in the country.  As the Korea example shows, policy approaches can effectively move beyond network rollout and include research, manufacturing promotion, user awareness and digital literacy.  It also highlights the possibilities for sector growth to be based on long-term interventions focused predominantly on opportunity generation rather than direct public investment.

For many countries, the development of an extensive national broadband plan or strategy is an important step towards elaborating more specific broadband development policies.  The countries highlighted in Table 2.1 have national broadband strategies containing specific broadband development goals.

**Table 2.1.  Publicly Stated Policy Goals for Broadband Service Delivery and Adoption**

| Country | Goal for Broadband Service Delivery, Access and Adoption |
|---|---|
| Brazil | By 2014, to have 30 million fixed broadband connections, including homes, businesses and co-operatives, plus 100 000 telecenters. |
| Finland | Legal right of all citizens to one Megabit per second (Mbit/s) access at affordable levels by 2010.  By year end 2015, 99 percent of all permanent residences should have access, within two kilometers (km), to an optical fiber or cable network delivering 100 Mbit/s service. |
| France | By 2012, ubiquitous access to 512 kilobits per second (kbit/s) service at monthly rates at or below EUR 35. |
| Germany | 75 percent of households should have high speed broadband access with transmission rates of at least 50 Mbit/sec by 2014. |
| Malaysia | By end of 2011, it is expected that the penetration rate for total household broadband connections will reach 60 percent. |
| Morocco | One out of three households connected by 2013. |
| South Africa | Household broadband penetration should be at least 15 percent by 2019. |
| Sweden | By 2010, near ubiquitous access to two Mbit/s service. <br><br> By 2015, 40 percent of households and businesses should have access to 100 Mbps. <br><br> By 2020, 90 percent of households and businesses should have access to 100 Mbps. |

| Country | Goal for Broadband Service Delivery, Access and Adoption |
|---|---|
| United Kingdom | By 2012, two Mbit/s service to all households. |
| United States | By 2020, 100 million households with access to actual (not advertised) speeds of 100 Mbit/s, and universal connections with actual speeds of at least four Mbit/s download and one Mbit/s upload. |

*Source: Rob Frieden for the World Bank and Telecommunications Management Group, Inc.*

As Table 2.1 shows, however, countries differ in their approach to setting targets and goals.  Some focus on improving access, while others seek to set specific targets for data transfer speeds.  Other countries have also sought to develop national broadband strategies as shown in Box 2.3.

**Box 2.3.  Broadband Strategies in Middle-Income Countries**

**Chile** was the first Latin American country to announce a national broadband strategy.  The strategy identifies ICT as a priority for economic development.  Chile has also planned and implemented ICT policies from both the supply and demand sides.  On the supply side, the government has authorized four Worldwide Interoperability for Microwave Access (WiMAX) operators as regional providers, and the regulator plans to award additional spectrum for a third generation (3G) operator to introduce a new operator.  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 May 2010, Chile's wireline broadband penetration was 10.66 percent, while mobile broadband penetration was less than half that, but growing at a much faster rate.  Chile's goal is to provide Internet access to 3 million rural households by the end of 2011.  By 2014, the country hopes that 100 percent of schools and 70 percent of households have broadband, and by 2018, 100 percent of households will be served by broadband.

**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 have been given 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 2.4 GHz and 3.5 GHz bands.  In June 2010, Turkey had penetration rates of nine percent for wireline broadband and 4 percent for mobile broadband.

**Malaysia** developed its Information, Communications, and Multimedia Services (MyICMS) 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.  Although these targets were not met, the results have been impressive—the household broadband penetration rate in the country topped 53 percent in October 2010.  Now the government is focusing on WiMAX, 3G, and fiber to the home (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 where the government will invest MYR 2.4 billion (USD 700 million) in the project over 10 years, with Telekom Malaysia covering the remaining costs.  The partnership is expected to cost a total of MYR 11.3 billion (USD 3.28 billion).

*Sources:  OECD, Directorate for Science, Technology And Industry, Committee for Information, Computer and Communications Policy, Working Party on Communication Infrastructures and Services Policy, National Broadband Plans, June 15, 2011, available at http://www.oecd.org/dataoecd/22/41/48459395.pdf; Yongsoo Kim, et al., Building Broadband: Strategies and Policies for the Developing World, World Bank, (June 2010).  Cisco, Broadband Barometer for Chile (2011), available at http://newsroom.cisco.com/dlls/2011/prod_020811.html.  Malaysian Insider, Broadband penetration target for 2010 exceeded, says Muhyiddin, (Oct. 27, 2010), available at http://www.themalaysianinsider.com/malaysia/article/broadband-penetration-target-for-2010-exceeded-says-muhyiddin/.*

## Recognize that implementation of a plan will take time and persistence

In many cases, the success of programs that have increased broadband adoption has simply been the result of longevity.  Some countries prioritized broadband in the 1990s or early 2000s and have thus been working on promoting broadband for quite a number of years, thereby providing them with a meaningful head start over other countries.  For example, in 2000 Sweden enacted its IT Bill, which established the pillars of its ICT strategy as competence, confidence, and access.[18]  Sustained, focused efforts with continual updates over a number of years contribute to the long-term success of any broadband strategy.  Conversely, seeking a "one-shot" solution that can simply be achieved with minimal time and resources is not likely to produce a sustainable long-term outcome.

## Develop research mechanisms to track progress of plan

As broadband technologies and applications evolve over time, the various segments of the broadband market will change as well.  Further, notions of digital literacy and underserved populations will also be in flux.  A number of agencies and organizations are already tracking various parts of the broadband equation.  To keep up with this dynamic and ever-changing sector, governments may wish to create an ongoing, multi-year, broadband-specific research program that tracks population use, ongoing barriers and levels of digital literacy.  This program could serve a complementary function to the ministry or regulator's efforts to encourage the supply-side parameters of broadband (e.g., network build-out, speeds and capabilities).  The program could be housed within the agency responsible for broadband development or could be run out of one of the existing government agencies that perform such research.  The ongoing issues of measurement and assessment, including international benchmarking, are discussed in more detail in section 2.7.

Pilot projects can play an important role in ongoing research and development (R&D) efforts related to broadband deployment.  Such projects can help demonstrate the viability of a new technology or service, but more importantly may help to identify those policies and strategies that do not work very well.  This may be a cost-effective approach to broadband development as it allows concepts, plans and methods to be tested on a small scale before committing larger amounts of resources.  In the United Kingdom, for example, Broadband Delivery UK (BDUK), a unit of the government, gives out grants (supplemented with private funds) for pilot projects to build/upgrade broadband networks in rural areas.  Once the upgrades are completed, Internet Service Providers (ISPs) will gain access to the infrastructure, which may use any technology, on a wholesale basis.  Box 2.4 summarizes the elements governments should consider as they develop their broadband plans.

**Box 2.4.  General Elements for Governments to Consider When Creating Policies and Strategies**

- Establish specific plans and policies that define broadband development and contain concrete, measurable objectives that can be used to develop specific strategies to achieve success.

- Ensure that plans address mechanisms for improving the supply of broadband through infrastructure build-out as well as promoting demand for broadband services and applications.

- Allow ample opportunity for stakeholder input in developing plan.

- Be realistic when establishing objectives—recognize and take into account that implementation of a plan will take time and persistence.

- Focus on long-term success by developing sustained, focused efforts (with continual updates) over a number of years.

- Avoid seeking a "one-shot" solution that can simply be achieved with minimal time and resources as this is not likely to produce the best outcome.

- Consider developing an ongoing, multi-year broadband-specific research program that would track population use, ongoing barriers, and levels of digital literacy to track progress of a plan and determine whether objectives are being met or modifications need to be made.

- Develop one coordinating agency as responsible for implementation of the plan.

*Source:  Telecommunications Management Group, Inc.*

## 2.3.2  Provide a National Focal Point for Broadband and Develop Broadband Capacity

To optimize the benefits of broadband, it is key to have a comprehensive national-level focus on promoting broadband use, a clearinghouse for successful projects, and a consistent evaluation of what works and what does not.  An important part of establishing and maintaining that focus over time will be developing capacity-building programs for government officials to provide education on how broadband can provide benefits across many sectors of the economy.  Such programs, in turn, can help to shape the development of effective broadband development strategies throughout all levels of government from local training programs to national network regulatory regimes.

Numerous countries have established agencies or special offices specifically to oversee broadband development issues.  In Sweden, for example, the IT Policy Strategy Group recommended the creation of an internal strategic coordination function to oversee holistic IT policy development and implementation.  This internal coordination function was also envisioned to improve coordination between central government, local authorities, county councils and the business sector.  The United Kingdom now has a Minister of Digital Inclusion.  Brazil has appointed a Digital Inclusion Secretary housed within the Ministry of Communications that will be in charge of the National Broadband Plan, as well as of all digital inclusion projects that are currently being carried out by various branches of the federal government.

Often, broadband development efforts are overseen by the ministry responsible for communications or the regulator.  In many cases, this responsibility is exercised in conjunction with a comprehensive broadband development plan.  In Singapore, for example, the government developed and is actively pursuing its Intelligent Nation 2015 (iN2015) master plan, which is designed to transform Singapore into "an intelligent nation and a global city, powered by info-communications."[19]  As part of that plan, the Next Generation Nationwide Broadband Network (Next Gen NBN) is being developed to bring fiber to homes and businesses across the whole territory.  A wireless broadband network is also part of the strategy.  All these efforts are being overseen by the Infocomm Development Authority (IDA), which is providing the government leadership in the development of these networks.  In India, the Ministry of Communications and Information Technology established an advisory group with members from telecommunications companies, industry associations and various government departments (including health, education and rural development) to help guide India's plan for a national fiber network that is envisioned to reach all villages and towns with more than 500 people.  India's approach is particularly

noteworthy because it not only recognizes the importance of a central focal point, but also the cross-cutting impact of broadband on various sectors of the economy and the need for a coordinated approach that involves all relevant agencies.

The decision regarding whether to set up such an agency or office will depend on the local situation in each country, and will need to take into account existing laws and institutional responsibilities as well as the ability of the government to provide adequate funding for such an activity.  For developing countries with limited financial and human resources, devoting a whole agency or branch of government to broadband development may seem ambitious.  Nevertheless, given the importance of broadband development and its potential role as a general purpose technology (GPT) capable of supporting advances in many different sectors of any economy, developing such human resource capacities will be critically important.

The issues surrounding the development of effective broadband policies are extremely complex and cover a wide range of disciplines, including engineering, law and economics, among others.  This will require governments to build capacity so that trained, knowledgeable professionals can guide the implementation of a country's broadband plan from concept through construction and adoption.  Without such leadership, even the best laid plans may fail through inattention and neglect.

### 2.3.3   Consult with Stakeholders

The development of broadband plans should involve the participation of all relevant stakeholders, both public and private.  As such, governments should provide for a public consultation process that allows ample opportunities to obtain input from the private sector, consumers, and other relevant stakeholders.  Given the complexity, varied issues and broad impact of broadband, these transparent discussions are an important part of bringing stakeholders to the table in an open, objective and neutral manner so as to maximize cooperation between the public and private sectors.  A variety of mechanisms can be used to foster stakeholder input—presentation of filings by stakeholders, workshops, hearings, and inputs made through an online comment mechanism on regulatory website or blog.

#### Benefits of Consultation

Consultations are also important because investors will lose confidence if the government is seen as taking unilateral steps—even if such steps might have positive outcomes.  If government initiatives are seen as damaging, they might undermine efforts to develop an enabling regulatory regime that supports investment and growth.  Consultations and discussions are also proven mechanisms for regulators and ministries to understand the varying potential challenges and opportunities that are part of the policy development process.   Opening discussions to all stakeholders and maintaining ongoing, clear communication make the process more effective. Transparency also ensures that regulatory reforms consider and satisfy public interests and that the process occurs without bias to any one segment of the market.  Moreover, exchanging ideas in an open, transparent setting helps regulators develop effective relationships with stakeholders and increases their capacity and knowledge, making it easier to counter potential resistance.  Box 2.5 below provides a summary of the benefits of transparent regulation.

**Box 2.5**.  **Benefits of Transparent Regulation**

1.  <u>Efficiency and Effectiveness:</u> Open processes enhance consensus and create confidence in the regulator. Increased public participation promotes diverse ideas in decision-making and increases support for rules and policies, making implementation easier. In addition, transparency can lead to greater efficiency by ensuring that duplication of functions is avoided.
2.  <u>Certainty and Reliability:</u> Regulatory credibility and legitimacy builds stability, essential for attracting

investment. This is particularly important in newly liberalized markets, where potential entrants need to trust that their investments are protected from arbitrary action and that further commercial development will not be thwarted by sudden changes to "the rules of the game."

3. <u>Accountability and Independence:</u> Openness promotes accountability and legitimacy, reinforcing regulatory independence and reducing political and industry interference. Stakeholders will have confidence that their views will be heard, without bias, by the regulator. Where regulatory actions are exposed to public view, regulators are more likely to engage in careful and reflective decision-making.

4. <u>Continuity:</u> A stable set of rules governing transparency will transcend political changes and outlast political appointments, ensuring a continuous regulatory record regardless of who is in charge of the regulatory agency or which political party is in office.

*Source: International Telecommunication Union, Trends in Telecommunication Reform 2002, Chapter 6.*

## Principles of Effective Consultation

The principles of good regulatory decision-making are universal: (a) transparency; (b) objectivity; (c) professionalism; (d) efficiency; and (e) independence.[20]  Although all of these principles are necessary for successful regulation, transparency is particularly critical, as it provides accountability and legitimacy to regulatory decisions. In the context of telecommunications regulation, transparency refers to the openness of the process of exercising regulatory power, which, in turn, ensures the fairness, accountability and credibility of the results.[21]

Although public consultation procedures can vary from country to country, minimum procedural safeguards are generally instituted to make sure that there is maximum participation in the decision-making process, such as: issuing public notice of consultations; allowing for a proper comment and reply comment period; publishing the comments and reply comments submitted by interested parties; and publishing the consultation results and final decisions.  Box 2.6 describes the objectives that the government of Anguilla set out for its public consultation process.

### Box 2.6.  Objectives of a Public Consultation

- To obtain input, information and feedback from persons affected by the proposed decision, other stakeholders and the public so as to ensure that consumers have the best telecommunication services possible in terms of choice, quality and value for their money.

- To acquire substantive information and knowledge from stakeholders, regulatory and industry professionals and other regulatory institutions so as to effect an orderly transition to a fully liberalized and competitive marketplace.

- To ensure that the Commission has investigated all aspects of an issue; and

- To ensure transparency of decisions of the Commission.

*Source: Anguilla, Administrative Procedures Regulation, 2004.*

Public consultations can take different forms depending on: the nature of the issue being consulted; the number of people that could be affected by the decision; the impact on the market; and whether a formal written consultation process is mandated by legislation. Public consultations can range from informal meetings to more formalized and structured written consultations (see Practice Note 2.2). Some of the forms of public consultations used by regulators are:[22]

- Formal invitations for written submissions;

- Individual meetings with one or more interested parties;

- Meetings, seminars, and workshops with representative groups and other interested parties;

- Issuing draft documents containing the preliminary view of the regulator and soliciting comments from the public at large before taking a final decision;

- Public hearings;

- Surveys;

- Consultation with independent advisers; and

- Discussions and consultation with regulatory professionals and regulatory institutions in other jurisdictions.

Many regulators find the written consultation process to be the most efficient means of conducting a public consultation. The U.K. regulator, The Office of Communications (Ofcom), will usually engage in a formal consultation process to seek the written views of the public. However, recognizing that formal consultation has its limits in reaching smaller businesses or community groups or individuals who lack time and specialist skills, Ofcom supplements the formal written consultation with other methods of gathering information, such as having meetings across the country, holding open meetings, operating online bulletin boards, or organizing focused discussion groups.[23]

Application of these principles and processes for public input has been an essential element in the development of national broadband plans and strategies around the world.  Typically, the level of engagement of stakeholders through consultation and open decision-making processes rises as a broadband plan becomes more detailed and ambitious.  Australia, for example, developed its National Broadband Network (NBN) Plan in April 2009, beginning with a two-month public consultation entitled "National Broadband Network: Regulatory Reform for 21st Century Broadband."[24]   The NBN consultation set out the proposed regulatory reforms for the roll-out of the NBN, as well as the consultations that will accompany each stage of the reform process, particularly regarding the facilitation of fiber network deployment and consumer protection safeguards, including universal access, retail price controls and enforcement of consumer protection rules.

India also initiated its National Broadband Plan with a public consultation.  On June 10, 2010, the Telecommunications Regulatory Authority of India (TRAI) released the "Consultation Paper on National Broadband Plan."[25]   The consultation was originally open for approximately one month and was supposed to close on July 7 with the opportunity to present reply comments by July 15.  However TRAI extended the consultation period to July 20 for initial comments and July 27 for reply comments due to stakeholders' requests.[26]   With the extension, TRAI received over 71 initial comments and six reply comments from industry associations, consumer advocacy groups, service providers, equipment vendors, other companies such as Google, consultants and interested individuals, all of which TRAI published on its website.[27] This open and transparent consultation process allowed TRAI to release its "Recommendations on the National Broadband Plan" in December 2010.  These recommendations include the creation of a state-owned National Optical Fiber Agency (NOFA) that will build out a nationwide fiber network by 2013 with the help of State Optical Fiber Agencies (SOFAs).[28]

**Practice Note 2.2. The Public Consultation Process**

Public Consultation
Process

## 2.3.4   Ensure Broadband Policies Support Other Sectoral Strategies

As policymakers and regulators consider policies and strategies to promote broadband development in their countries, it will be important to consider the issues in the broader context of larger economic and social goals.[29] <mark>Module 1</mark> discusses how broadband applications and services are increasingly intersecting with virtually every other major sector of the economy—including education, health, banking, the environment and climate change, and cybersecurity. Tackling such cross-sector goals will require: (i) close coordination among various regulators so that policies and approaches support each other; (ii) policy approaches and regulatory frameworks that are broad enough for policymakers to consider the relevant interrelated issues; and (iii) a high degree of committed leadership at the most senior levels to ensure that all parts of government work together to promote the development of broadband as part of the more general goals of promoting social and economic growth.  Despite increasing recognition of the importance of broadband and its impact on the policies and implementation of programs in other sectors, most countries' laws do not typically address the jurisdictional issues related to other sectors of the economy vis-à-vis broadband.  As a result, it will be increasingly important for governments to adopt provisions outlining the cooperative arrangements between the ICT/broadband regulator and other governmental agencies.  For agencies not used to working together—and which come to the same issues with vastly different points of view—such guidelines or arrangements will be crucial to ensuring that policies and decisions are mutually supportive of both broadband development and sector-specific goals and programs.  This section briefly describes how broadband development policies interact with policies in other key sectors of a country's economy.

### Expanding the Regulator's Mandate

In most countries, the telecommunications/ICT regulator operates separately from the broadcasting and video content regulator.  This stems from the past, when different technologies were used to deliver communications, broadcast and data services.  In today's converged world, however, where broadband networks are capable of delivering all of these services over one infrastructure, nearly 30 countries have established a converged regulator to better adapt and respond to an environment where distinctions based on services and networks are becoming blurred.  These countries include Australia, Finland, Iraq, Italy, Japan, Kenya, Mali, Malaysia, South Africa, Singapore, Uganda, and the United Kingdom.  In some of these countries, the jurisdiction of the telecommunications regulator has been expanded to include broadcasting, content (e.g., video programming) and Internet services.  As such, converged regulators can provide "one stop" service for businesses and potential licensees and also give consumers a single agency for all matters relating to the communications sector.  Although many countries see benefits in the converged approach, many countries still maintain some distinctions based on their specific circumstances and policy approaches.  For example, most OECD countries still have separate regulators for broadcasting and telecommunications, and content regulation in many countries is typically addressed by a separate ministry or government authority (e.g., in India and Saudi Arabia) or by the broadcasting authority (e.g., in Botswana and Chile).  In India, in fact, two entities are responsible for content regulation; the Ministry of Information and Broadcasting monitors content related to broadcasting and film while the Ministry of Information Technology regulates Internet content.

In many countries a shift from ex ante regulation to an ex post approach is taking place in the ICT sector. With this dynamic comes a much greater focus on competition matters.  Thus, one particular area that policymakers will have to address involves how the competition laws of the country will be developed and enforced.  If a country has a set of general competition laws and a separate regulator to handle these issues, the ICT regulator may, or may not be granted jurisdiction over telecommunications matters. In such cases, the challenge is to establish clear rules that specify how jurisdiction will be shared and/or how overlapping issues will be handled in order to avoid conflicts between agencies. For countries without general competition laws, it is often the case that the ICT regulator gains additional authority to guard against unfair or anticompetitive conduct.   In this case, new electronic communications laws or regulations are likely to expand the traditional mandate of the ICT regulatory authority.

For many countries without a long-standing competition law framework, liberalization of the ICT sector has been the impetus for governments to expand the mandate of ICT regulators to include the regulation of competition matters related to the telecommunications market.  Based on their expertise and experience with the sector, regulators receive expanded powers to resolve issues related to sector-specific competition laws when no overarching competition framework exists in the country.  The Kingdom of Bahrain, for example, does not have any general competition laws, but one of the main responsibilities of the Telecommunications Regulatory Authority (TRA) under the Telecommunications Law is to "promote effective and fair competition among new and existing Licensed Operators."[30]  Based on this mandate, the TRA has effectively introduced competition to the telecommunications markets, including local and long distance fixed services, international gateways, mobile services and Internet services.

Conversely, in countries with general competition laws and agencies to govern these issues, the specific electronic communications or telecommunications law can still give authority to the telecommunications/ICT regulator to issue rules and decisions related to competition in the ICT sector. The challenge in such countries is to ensure that any jurisdictional overlap between different agencies does not result in conflicting rules or "forum shopping" by parties seeking the best outcome.  Therefore, it is necessary that the country's laws provide clear guidance on exactly what the boundaries are for each authority as well as outlining the procedures that will be followed where jurisdiction may be jointly held; in order to issue coherent, consistent and effective decisions. In some cases, competition and ICT authorities issue guidelines or publish memoranda of understanding on how they will work together on competition related matters in the ICT sector.  This can be very helpful in avoiding duplication and inefficient use of public resources as well as giving all parties legal certainty as to what agency holds what responsibilities (see Box 2.7).  In the United Kingdom, for example, the Office of Fair Trading (OFT) has general powers to enforce EU competition mandates and the country's Competition Act, but it shares jurisdiction over electronic communications, with Ofcom, which was granted its competition powers under the 2003 amendment to the Communications Act.  As a result, OFT then published a letter addressing the agencies' concurrent jurisdiction and providing an initial overview of how they would work together, a process it expanded on in further guidance.[31]

**Box 2.7.   Relevant issues for coordinating competition and ICT authorities' jurisdiction in the ICT sector**

Taking into account the specific provisions of the legal framework, the following lists some issues that should be considered when establishing guidelines on the exercise of concurrent powers over competition matters in the ICT sector:

- Exchanging information to determine which authority has jurisdiction over a specific case;

- Determining which authority is better suited to exercise the concurrent powers in relation to a specific case;

- Resolving disputes as to which authority should exercise the concurrent powers in relation to a specific case;

- Preventing the simultaneous exercise by more than one than one authority of concurrent powers in relation to a specific case;

- Processes for transferring a case from one authority to another; and

- Sharing of staff and resources between authorities.

*Source: Adapted from Office of Fair Trade (OFT) of the United Kingdom, Concurrent Application to Regulated Industries (December 2004).*

Some developing countries have pursued a similar approach.  In Mauritius, for example, in March 2010 the Competition Commission (CCM) and the Information and Communication Technologies Authority (ICTA) signed a memorandum of understanding (MoU) governing their concurrent jurisdiction over the ICT sector.[32]  Where the two agencies have overlapping powers, the MoU establishes a set of guidelines to promote cooperation and coordination when dealing with cases of anti-competitive behavior.  It also sets forth the responsibilities of both agencies in such matters; and establishes mechanisms for communication and sharing of information between CCM and ICTA with the aim of minimizing duplication of work and facilitating prompt and efficient resolution of cases.

## Cooperation with Sector-specific Agencies

Despite increasing recognition of the importance of electronic communications laws and policies and their impact on the policies and implementation of programs in other sectors, most countries' laws do not typically address the jurisdictional issues related to other sectors of the economy vis-à-vis broadband.  As the influence of ICT and broadband policy continues to grow, it will be increasingly important for governments to adopt provisions outlining the cooperative arrangements between the ICT regulator and other governmental agencies. Since such cross-sector initiatives are still relatively new, it is unclear how successful they will be in the long term; can agencies develop the good working relations that will lead to effective policy outcomes?  While there is great potential to capture high-level expertise from multiple agencies; these collaborative efforts are also likely to result in new challenges, such as jurisdictional conflicts or funding issues that will need to be addressed by executive leadership and/or further legislative guidance in the form of new laws.  The following sections describe how the ICT regulator may need to work with a variety of other sector-specific ministries or agencies.

**Cooperation between ICT regulators and environmental agencies.**  Traditionally, limited overlap has existed between the environmental and ICT regulatory issues, with the possible exception of electromagnetic field (EMF) and radiofrequency field (RF) emissions from broadcasting and mobile communications towers or from handheld mobile devices.  However, increasing concerns about climate change and the environmental impacts of ICTs, along with the growth of "green ICT" initiatives, will likely require new levels of cooperation between the ICT and environmental regulators.  In February 2010, for example, Egypt implemented its Green ICT Strategy through a joint Memorandum of Understanding (MoU) signed by both the Ministry of Communications and Information Technology (MCIT) and the Ministry of Environmental Affairs (MEA).[33]

Other countries have begun similar coordination efforts in order to take a more comprehensive approach to meeting environmental and ICT policy objectives.  In Singapore, for example, multiple

agencies have begun to collaborate on new cross-sector initiatives.  In November 2009, for example, the government launched of the "Intelligent Energy System," a pilot project to test smart grid technologies.[34]  The project requires the cooperation of the ICT regulator and the regulators in charge of energy, the environment, economic development, science and technology research, and housing and development.  More recently, the Singapore government established the Energy Efficiency Programme Office (E$^2$PO), led by the National Environment Agency (NEA) and the Energy Market Authority (EMA), to promote the adoption of energy-efficient technologies, develop local expertise in energy management and support research and development in green ICTs.[35]   As shown in Figure 2.5, E$^2$PO includes Singapore's ICT regulator, IDA, as well as nine other agencies with responsibilities in various sectors.

**Figure 2.5.  Ten Singapore agencies involved in the Energy Efficiency Programme Office, including ICT Regulator**
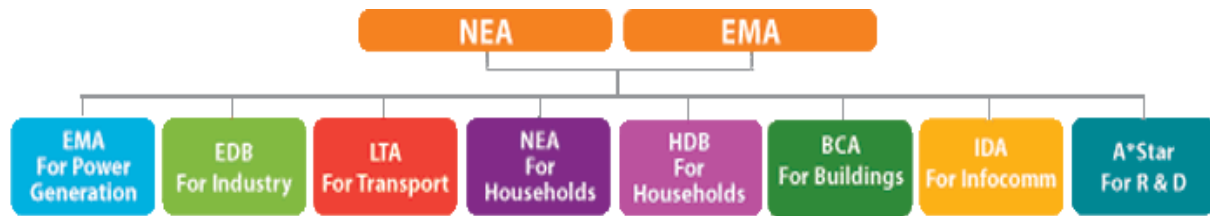


*Source: IDA Singapore.*

**Cooperation between ICT regulators and law enforcement agencies.**  The relationship between law enforcement agencies (LEAs) and telecommunications regulators goes back many years, based on the need for LEAs to lawfully intercept and access electronic communications (e.g., wiretapping) as part of their investigative processes.  IP and broadband networks, however, pose new challenges to law enforcement and ICT regulators as the use of communication networks to commit crimes becomes more widespread and a more direct threat to a broader range of activities and users.  As more business and personal activities and transactions have moved online, the number of crimes committed using communications networks, applications and services has grown, and is expected to continue to grow as broadband networks become more ubiquitous.  Although ICT regulators have begun to play a stronger role with respect to consumer protection issues such as spam, these laws have traditionally required LEAs (or defense or security agencies) to take the lead due to public safety and national security interests in issues including interception of communications, data privacy, cyber theft and fraud.  Against this backdrop, it is expected that increased cooperation and coordination between telecommunications/ICT regulators and LEAs will be necessary to combat increasingly common and sophisticated cybercriminals.

In particular, the telecommunications/ICT regulator's role in combating the various forms of cybercrime is likely to increase due to its technical expertise.  This is likely to involve:  1) assisting LEAs in the technical/forensic investigation of cybercrimes; 2) coordination of various LEAs and national security agencies at local and national levels; and 3) assisting service providers and consumers in understanding their rights and obligations.  As cybercrime has become an increasing concern, some countries have even given the ICT regulator the lead in implementing laws designed to prevent or prosecute cybercrimes.  The recently passed digital piracy law in the United Kingdom, for example, assigns most of the implementation and enforcement powers with Ofcom, rather than a LEA (see Box 2.8).  As with any type of potentially overlapping jurisdiction, the laws and enabling regulations should clearly define the roles of all parties, as well as provide adequate resources for enforcement.

**Box 2.8.  Ofcom's expanded role in enforcing digital piracy law in the United Kingdom**

- The Digital Economy Act of 2010 (DEA) assigned Ofcom new duties to create and implement obligations regarding online copyright infringement.

- Ofcom, rather than a law enforcement agency, will enforce these obligations through a code of practice, which details a three-stage notification process for informing subscribers of infringements and requires ISPs to provide infringing subscribers' IP addresses to the relevant copyright holders.

- Ofcom's powers include deciding upon the appropriate enforcement action against any person found to have breached the code, including imposition and collection of a financial penalty up to £250,000.

- The DEA further requires Ofcom to establish an independent appeals tribunal for subscribers who have had copyright enforcement actions taken against them.

*Source: Ofcom, Consultation on Online Infringement of Copyright and the Digital Economy Act 2010: Draft Initial Obligations Code.*

**Cooperation between ICT regulators and education sector authorities.**  Education is another area where the potential benefits of telecommunications have long been recognized.  In many countries, so-called "distance learning" projects go back almost 30 years.[36]  Today, as the benefits of broadband for education have become clearer, regulators and education authorities are increasingly working together to ensure that schools and universities have access to broadband networks and can benefit from a growing array of e-learning and knowledge programs.  As governments seek to encourage such programs, it will be critically important to forge alliances among private actors, donor agencies and non-governmental organizations to maximize the successful integration of broadband and education.

The benefits of collaboration are clear.  In Afghanistan, for example, the Ministry of Education (MoE) and the Ministry of Communication and Information Technology (MoCIT) are collaborating on a project to improve both the education and ICT sectors.[37]  Beginning in September 2008, the MoE and MoCIT launched a "One Laptop per Child" (OLPC) project in a public-private partnership with the United States Agency for International Development (USAID), Roshan, a mobile operator in Afghanistan, and Paiwastoon, a local information technology company.  The MoE distributes the laptops to schools, and the MoCIT ensures the quality of the content, as well as maintaining the technology.  By March 2010, more than 3,700 laptops had been distributed in Afghanistan through the OLPC project.[38]

Since extending connectivity often involves multiple players from the government, as well as private sector providers, the ITU toolkit also provides a useful checklist of issues for policymakers and regulators to consider as they work to develop a broadband and education initiative (see Box 2.9).

**Box 2.9.  ITU School Connectivity Checklist**

The ITU has developed a checklist of issues that should be considered by policymakers and regulators when implementing school connectivity initiatives.  In particular, the checklist highlights the need for good collaboration between the relevant stakeholders and tight coordination between school connectivity programs and the country's national educational and ICT plans. Some of the other factors the checklist identifies are that:

- School connectivity plans should be consistent with policies to promote overall ICT connectivity within the country;

- School connectivity plans are best coordinated with policies, plans, strategies and programs for

> universal service, as well as broadband and digital and Information Society agendas;
>
> - Close coordination must exist between the ministry responsible for education, the ministry responsible for ICTs/broadband, and the telecommunications/ICT regulator, to ensure that universal service funds and obligations are formulated within a plan for school connectivity that concretely describes the roles of all parties; and
>
> - Private sector and non-governmental organizations (NGOs) can play key roles in advancing school connectivity, and they should be invited to participate in the development of school connectivity plans at an early stage.

*Source:  International Telecommunication Union, Connect a School, Connect a Community, Module 1: Policies and Regulation to Promote School Connectivity (2009).*

**Cooperation between ICT regulators and healthcare authorities.**  The benefits of broadband and ICTs for healthcare are a more recent development.  One of the most important facets of effective and efficient healthcare is the timely collection and sharing of information among healthcare professionals. This includes, for example, real-time monitoring of patient data, long-term collection of routine examinations and tests, and time-critical diagnoses of conditions based on x-rays, MRIs, etc.  For public health, the collection of data can help to identify outbreaks of infectious diseases and long term trends in the success or failure of public health initiatives.  Broadband and ICTs are particularly well-suited to serving all these tasks with their ability to process and communicate large amounts of data quickly and efficiently.  Because of these benefits, there are many areas in the medical field in which broadband networks and ICTs are being used to improve health outcomes.  E-health initiatives include electronic records; long distance consultations and diagnoses via video conference; and patient monitoring using various mobile devices.

As the number of applications grows, ICT regulators and health care authorities will find it useful to work together to improve both health outcomes and broadband development—as these often have mutually reinforcing objectives.  In fact, governments and regulators are increasingly coming to realize the benefits of such collaboration.  The U.S. Federal Communications Commission (FCC) National Broadband Plan, for example, dedicated an entire chapter to e-health and broadband, and specifically recommended greater cooperation with the U.S. Food and Drug Administration (FDA), to "clarify regulatory requirements and the approval process for converged communications and health care devices."[39]

The effective use of broadband and ICTs for medical or e-health applications and programs will require coordination between multiple agencies and ministries, potentially including not only communications and health, but also science, education and finance.  ICT regulators need to work closely with these other agencies to develop mechanisms to enable the healthcare sector to develop creative solutions to healthcare issues and effectively leverage the benefits of broadband connectivity.  Such efforts should include not only doctors and hospitals, but also institutions that are less directly involved in health care implementation and administration, such as schools/universities, social service agencies and research facilities.  Some of the important initiatives to be considered may include:

- Subsidies or other financial support for communications networks to link key institutions, such as hospitals and universities;

- Setting or identifying standards (a common e-health form, for example) to enable interconnection between various stakeholders;

- Developing or updating service rules governing electronic services used to share medical data; and

- Provisions regarding privacy of data transmitted via such services.

**Cooperation between ICT and banking regulators: m-banking.**  The financial services world is already one of the larger users of broadband and ICT services.   Huge amounts of money are transferred electronically every day and all around the world.  In the last decade, more and more financial services have moved on-line, allowing individuals and businesses to conduct their banking services without ever having to go to an actual bank.

With the rise of mobile wireless services, customers have begun to demand that their financial services be available not only on computers or at banks, but on their mobile devices, so-called m-banking.  The use of mobile networks for providing financial services can produce enormous benefits, particularly in those countries without a well-developed or widespread banking system.  However, with these benefits also come challenges that the traditional banking world has not had to confront, especially in the areas of privacy and security of customer data.

As a result, good coordination between the different agencies involved will be crucial to support a secure and effective m-banking environment.  For example, although financial services are outside the purview of telecommunications regulations, regulators can encourage the development of the m-banking market by working with their counterparts in the finance ministry to develop policies that support new banking and business models and that also recognize the importance of privacy, security and trust in the new m-banking world.  This is likely to require forging new relationships with the financial services authorities in order to develop a framework that is appropriate for m-Banking services.[40]

As they consider how to promote m-banking in the context of broadband development—and especially in considering how to bring both services to un- or underserved communities—ICT   policymakers and regulators should seek to adopt policies that will increase investment and entry into the mobile broadband market.  Development and expansion of mobile networks leading to increased penetration is a necessary condition to continue to expand on the success of m-banking services.  Similarly, regulators should enact and enforce rules – directly or in cooperation with competition authorities – to ensure competitive mobile markets. This is particularly important since first mover advantages and specific technical/service conditions of m-banking (e.g., lack of interconnectivity of m-banking services[41]   or differentiated fees between on-network and off-network transactions) may allow dominant mobile providers to further strengthen their positions.  For example, in August 2010, the Communications Commission of Kenya (CCK) raised concerns with the competitive effects of certain conditions associated with Safaricom's successful M-Pesa service.[42]  The CCK found that mobile money transfer services have a significant impact on the competitive landscape in the telecommunications market in Kenya as they created a "club effect"—since higher rates are charged to non-registered users versus registered users, more consumers would be motivated to join the less-costly "club."  There are also other benefits to promoting m-banking since it may be the new operators, seeking to differentiate themselves from the existing or dominant operators, who may be more willing and able to develop new services quickly.

On the financial side, banking regulators (e.g., central banks, finance ministries or banking regulatory authorities) will need to be flexible and creative to adapt traditional banking regulations to enable m-banking.  For example, even defining who can be a "bank" (i.e., banks, mobile providers, and retailers) may need to be addressed so that new players can develop new services, while at the same time protecting the stability of the financial system as a whole, the integrity of transactions, and the safety of customers' deposits.[43]

Furthermore, the m-banking sector is still nascent; so there is as yet no common, accepted business model or set of best practices.  In addition, since each country's financial system is different (more or less well-developed), it is probably still too early for financial regulators to prescribe specific regulatory models.[44]   For example, financial regulators in Afghanistan, the Philippines, West Africa and the European Union have adopted regulations that enable a role for nonbanks, striking a balance between service availability and the need to mitigate the risks presented by the involvement of a service provider that is not subject to full banking regulation.[45]  On the other hand, a number of countries, such as Kenya and Cambodia, have not issued e-money regulations, but have nevertheless permitted such nonbank models on an *ad hoc* basis through "no objection" letters, conditional approvals or other means.[46]

## 2.3.5  Develop Policies for Both Sides of the Broadband Coin:  Supply and Demand

The experience in high-penetration countries shows that successful broadband diffusion requires that both supply- and demand-side factors be addressed (see Figure 2.6).  While supply-side policies focus on promoting the build-out of the network infrastructure over which broadband applications and services can be delivered, the main goal of demand-side policies is to enhance the awareness and adoption of broadband services so that more people will make use of them.

**Figure 2.6.  Framework for Government Intervention to Facilitate Broadband Development**
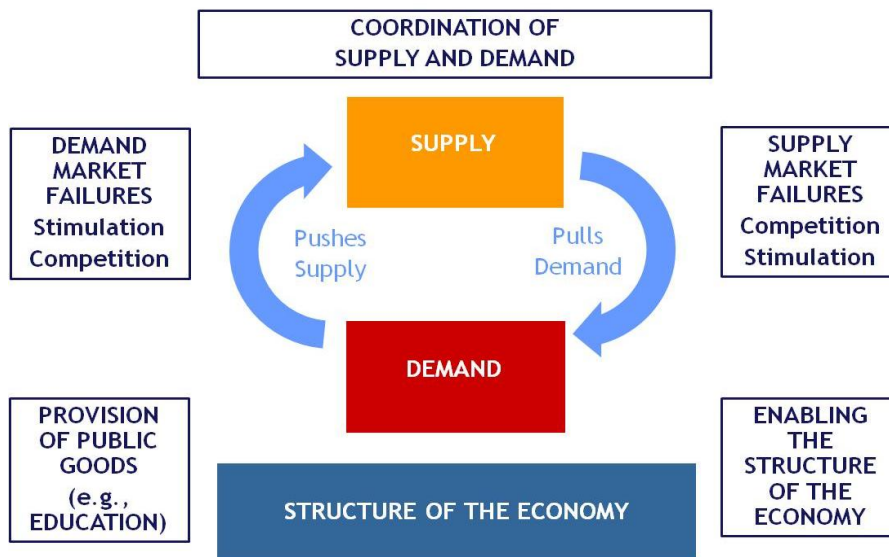


*Source:  Arab Republic of Egypt, Strategic Options for Broadband Development, World Bank Report (2010).*

The interaction of both supply- and demand-side factors is crucial to achieve the highest penetration and adoption of broadband.  However, these factors do not always appear naturally as market failures may hinder their development.  For instance, broadband diffusion can be limited if the market is not able to reach the required critical mass that leads to a sustainable growth cycle.  More importantly, even if both types of factors (i.e., supply- and demand-side) are present in an economy, they will not reach their full potential if they are not coordinated, which may result in slow supply of broadband infrastructure or in poor demand and uptake once networks are available.  For this reason, high broadband penetration countries have comprehensive broadband policies that coordinate both supply- and demand-side actions.  In addition, most plans that have been introduced – both in developed and developing countries – incorporate both supply- and demand-side policies.  Such complementary strategies have been defined in addition to market liberalization and regulatory initiatives aimed at

promoting broadband in general, as well as focusing on universal access obligations or special conditions that favor projects in high-cost or low-income areas.  Universal access obligations and financing are briefly addressed in section 2.6 below, and discussed in more detail in Module 5.  In assessing the strategic options for improving broadband build-out and adoption (supply and demand), it is important to remember that many different factors are involved, and no two countries have followed identical routes.  Nevertheless, it is possible to recognize certain common elements in national broadband success stories.  In reality, most countries will use a mix of policies, with supply-side policies generally focusing on how to stimulate private sector investment in networks, especially in the early years, while demand-side policies may be more long-term and focused on how governments can help drive broadband demand and adoption.

## 2.3.6   Sequence Policies for Maximum Effectiveness

Different policies are appropriate for different stages of a country's broadband policy development.  As part of the overall implementation strategy, it will be very important to ensure that individual strategies and programs begin at the appropriate time.  For example, it will not make sense to establish digital literacy or Internet use programs before users have access to the services they need to learn about.  Thus, policies and programs must be implemented in a step-wise, complementary fashion, based on the specific conditions in the country.  This section will address how to sequence policies and programs so that they match the country's needs and progress.

Based on a 2010 World Bank study of countries that have pursued broadband development policies, Table 2.2 provides a conceptual summary of the key policies, regulatory, and programs that those countries used to develop their broadband ecosystems and the general stages in which these policies were introduced:  promote, oversee and universalize.[47]

**Table 2.2.  Key policies and programs for building the broadband ecosystem**

| Component | Early stage: Promote | Mass market: Oversee | Universal service: Universalize |
|---|---|---|---|
| Networks | • Develop an enabling environment through policies and regulations that promote investment and market entry<br>• Reduce administrative burdens and provide incentives and subsidies for R&D, pilots, and network rollout<br>• Create certification systems for cyber buildings<br>• Allocate and assign spectrum for wireless broadband services | • Consider infrastructure sharing, including unbundling the local loop<br>• Reallocate spectrum to increase bandwidth | • Undertake, using public/private partnerships, as appropriate deployment of open access broadband networks in high-cost or remote areas<br>• Coordinate access to rights of way |

| Component | Early stage: Promote | Mass market: Oversee | Universal service: Universalize |
|---|---|---|---|
| Services | • Provide broadband networks to schools, government, etc. (government as an anchor tenant)<br>• Standardize and monitor service quality | • Create an enabling environment for intra- and intermodal competition<br>• Ensure nondiscriminatory access for service, application, and content providers | • Consider expanding universal service obligation to include broadband |
| Applications | • Undertake government-led demand aggregation<br>• Government agencies as early adopters and innovators Provide e-government and education applications<br>• Promote creation of digital content<br>• Develop local content and hardware sector | • Support secure, private, reliable e-commerce transactions<br>• Implement intellectual property protections | • Develop advanced e-government programs<br>• Offer grants to community champions and broadband demand aggregators |
| Users | • Provide low-cost computers and other user devices, for instance in education<br>• Develop digital literacy programs for citizens | • Establish ethical guidelines for information use | • Expand universal service programs to underserved communities<br>• Create community access centers<br>• Subsidize user devices for poor households |

*Source:  Yongsoo Kim, Tim Kelly, Siddhartha Raja, Building Broadband: Strategies and Policies for the Developing World, World Bank (June 2010) at 114.*

The policies and regulatory tools in Table 2.2 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, while others would be self-sustaining from service fees (as with e-government programs) or cost savings (as with infrastructure sharing).

Most important, every country the World Bank surveyed—even those with state-led approaches—has sought to create an enabling environment for private investments and market mechanisms to develop broadband networks. The main variation is that some countries, such as Finland, France, the United Kingdom, and the United States, have let the market try its hand at building broadband first, while others, such as Australia, Japan, Korea, and Sweden, have used competition policy in combination with public-private partnerships and a more active role for the state early in the process.

Today, though, all the countries surveyed have moved firmly toward spurring broadband growth through a combination of public and private initiatives. Countries such as the United Kingdom and United States that once shied away from developing national broadband strategies have developed them. Even Finland, which has long relied on the private sector to build broadband networks, has developed a USD 265 million broadband plan that includes USD 88 million in public funding. The government will support the construction of faster, more widespread networks.

## Promote:  Jump-starting broadband development

Many developing countries have low broadband penetration and are in the initial stage of market development. These countries may wish to focus initially on policies that promote the broadband market. Promotional policies can encourage the supply side, such as inducing investment in the broadband network, and the demand side, such as raising citizen awareness about broadband benefits and easing subscription barriers.

Policies that focus on building, extending or upgrading broadband networks are often the first things policymakers consider when they have decided to promote broadband development.  There are a number of initiatives that governments can take in order to spur broadband network development. Some of the most important policies are summarized here and are discussed in more detail in section 2.4.1:

- Reduce entry regulations to facilitate competition.

- Use spectrum frequency policies to facilitate wireless service.

- Provide government support for national backbone construction.

- Take aggressive steps to reduce providers' investment costs.

In conjunction with early policies to encourage the build out of broadband networks, policymakers may also see the need to raise the awareness of and stimulate demand for broadband services, particularly among those populations least likely to be broadband users.  This can help to ensure that as broadband services are introduced, there are users willing and able to utilize them.  Some of the most important demand stimulation policies are summarized here and discussed in more detail in section 2.5:

- Promote digital literacy.

- Distribute low-cost devices and terminals.

- Have government serve as an anchor tenant.

- Develop online content and local media.

- Encourage small and medium-size enterprises (SMEs) to use broadband and e-commerce.

## Oversee: Facilitate competition-led growth through consistent oversight

Once the basic broadband building blocks of supply and demand have been addressed, policy development may turn to ensuring that private investment and competition can continue to flourish and users' rights are protected.  In this stage, the basic aim of government intervention is to foster service development under a competitive market structure.  Even countries with the least government market intervention have implemented competition policies and achieved broadband diffusion.  This explains why policies that facilitate competition are the most important, and thus must be implemented consistently and compellingly from the initial to maturity stages of market development.  Policies that may be pursued in this regard involve supporting as much as possible new entrants competing with the

incumbent; encouraging both facility- and service-based competition and regulating unfair business practices with regard to both competitors and consumers.  Such policies are described in more detail in section 2.4.1.

### Universalize: Focus on widespread diffusion as broadband market grows

A goal for many countries is to "universalize" broadband; to make broadband services available to as many people as possible so as to maximize the economic and social benefits that broadband can bring.  A farsighted policymaker would envision nationwide diffusion of broadband from the outset and pursue that goal through specific long-term plans.  In many ways, policies to universalize broadband are often extensions of policies adopted earlier for telephony, but may require changes to national laws, regulations and funding, such as by defining broadband as part of a country's universal service obligation.  Such policies can seek to expand universal service programs to include broadband and provide financial support for network rollout in rural and underserved areas. Universalization policies can include digital inclusion programs that go beyond simply educating potential users by providing subsidies for low-income households to purchase broadband devices or even subscriptions, and building Internet access centers in remote areas and schools.  Section 2.6.2 discusses these policies and how to fund them in more detail.

## 2.4  Building Infrastructure:  Promoting the *Supply* of Broadband

Most developing countries have not yet seen their broadband networks penetrate more than a few percent of their populations.  Hence, governments can play a key role in promoting and accelerating the growth of the broadband market.  Promoting the build-out of broadband networks throughout a country will likely require governments to pursue multiple strategies, depending on local circumstances.  As each country has its own unique history, regulatory structure/framework, economic conditions, social goals/expectations and political processes, the path a country follows to improve broadband networks and services will necessarily have to reflect its specific advantages and disadvantages.  This section addresses the issues that policymakers and developers may face in promoting broadband network development.  It identifies the various components of a nationwide broadband network and identifies the issues and policy approaches to address the challenges associated with promoting the buildout of broadband networks and services.

### 2.4.1  Core Policies to Promote the Buildout of Broadband Networks

As countries seek to build frameworks and strategies to support the development of broadband networks and services, it is important to identify the policies that can help drive the development process. Although the specific policies adopted in each country will differ depending on the unique circumstances each faces, some general policy approaches may be applicable across the world.    This section describes these general policy approaches and identifies some of the specific policies previously used to promote broadband buildout in many countries.  Section 2.4.2 describes specific policies that are applicable to the different levels of the broadband supply chain.

As an overall consideration, it is generally accepted that the private sector should be the primary driver of broadband development in most cases.  Particularly when government debt is high and resources are limited, sufficient public money may not be available for broadband infrastructure spending.  Consequently, policymakers and regulators must consider how best to attract and encourage private sector involvement and investment in broadband.  This, in turn, will require governments to do an honest evaluation of the extent to which their country represents—or can be made into—a profitable market opportunity for private sector investors and operators.  Questions to be answered may include:

Are companies willing to invest? If not, why not? Will such companies drive the broadband market forward on their own or will they need help? What government strategies, policies and regulations can foster and support private sector initiatives and what policies may hold back investment? This is the approach that many countries have taken; they have attempted to facilitate and, where possible, accelerate, broadband rollout through regulatory measures or policy changes rather than more direct forms of intervention such as investment.

There will be instances, however, in which purely private sector-led approaches will not be sufficient for broadband to develop. In those cases—due to factors such as historical market structure, geography or low population density, for example—private sector players will be unwilling to invest capital where they perceive that they will get a low (or no) return on their investment. For these areas, it will be necessary for the government to develop policies and strategies designed to address competitive and investment challenges. Such intervention can take various forms as discussed below, and are summarized in Table 2.3. For a more comprehensive view of the various policies and programs for promoting the build-out and uptake of broadband, see Practice Note 2.3.

**Table 2.3. Checklist of Policies to Promote the Supply of Broadband Networks**

| | |
|---|---|
| **Promote competition and investment** | • Implement policies/regulations to create conditions to attract private investment in broadband networks |
| | • Implement technology and service neutral rules/policies giving operators greater flexibility |
| | • Promote effective competition for international gateways and possible policies for service-based competition for gateway operators to provide access to their facilities on wholesale non-discriminatory basis |
| | • Develop policies to facilitate inter-platform competition |
| **Encourage government coordination** | • 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 |
| | • Incorporate broadband planning into land use/city planning efforts |
| **Allocate and assign spectrum** | • Assign additional spectrum to allow new and existing companies to provide bandwidth-intensive broadband services |
| | • Allow operators to engage in spectrum trading |
| **Promote effective competition and encourage investment** | • Encourage multiple providers to share physical networks (wireline and wireless), which can be more efficient, especially in low-density areas |
| **Facilitate access to rights of way** | • Facilitate access to public rights-of-way available for building broadband networks. This can help ease construction of both long distance (backbone) and local connections |
| | • Develop policies that provide open access to government-sponsored and dominant operator networks enable greater competition in downstream markets |
| **Facilitate open access to** | • Develop policies that provide open access to government-sponsored and dominant operator networks enable greater |

| | |
|---|---|
| **critical infrastructure** | competition in downstream markets |
| | • Consider implementation of local loop unbundling if necessary to facilitate competition |

*Source: Telecommunications Management Group, Inc.*

**Practice Note 2.3. Policies and Programs for Promoting Broadband in Developing Countries**

Promoting Broadband
in Developing Countrie

## STEP 1:  Reduce Barriers to Entry

The first step in stimulating competition and encouraging the private sector to build out broadband networks is to reduce the barriers to entering the broadband market.  Often legacy regulations can explicitly prevent new entrants or discourage investors by placing a complicated or onerous regulatory burden on them.  Broadband development can be stimulated by lowering or removing such barriers and allowing greater competition to flourish.

Civil works are the biggest fixed and sunk cost in broadband network construction. They account for more than two-thirds of the cost of fiber optic networks (see Figure 2.7)[48] and wireless networks.[49] They also play a major role in increasing the cost of network deployment for new service providers as well as incumbents.  Such costs can thus be a major barrier to entry for potential new entrants.

**Figure 2.7.  Typical cost components of a fiber optic network**
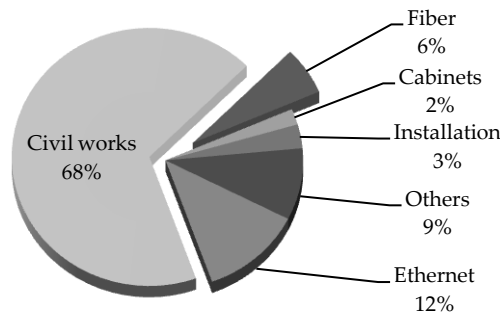


Government policy support is essential for new market entrants to compete effectively with dominant incumbents. This is because economies of scale and network externalities play significant roles in the success of communications providers. Institutionalized consideration for new entrants will significantly increase their motivation.   Korea illustrates the importance of direct and infrastructure-based competition in the development process. In contrast to the cautious deployment of broadband in a number of countries, the Korean government has encouraged intense competition between broadband providers. Thus Korea's success can be attributed to the power of government direction and market competition working in parallel.

In fact, the emergence of disruptive competitors was one of the key enablers of rapid broadband development in both Korea and Japan.[50] Powerful competitors joining the initial stage of market development drastically increased broadband penetration, with affordable prices achieved through

aggressive price cuts. Thus, it is crucial that government make the best of regulatory policies so that powerful competitors, even if not disruptive, can compete on a level playing field with the incumbent.

Competition policy is ideal when networks and services compete with each other at full capacity. But due to practical limitations—such as limited investment, subscriber lock-in, and subscriber networks being bottleneck facilities—competition policy is likely to focus more on networks or services. Whether to focus on facility- or service-based competition depends on which is more appropriate for new providers to become and stay competitive in a short period. The decision may depend on country conditions, including the size of the communications network, the status of competition, and the structure of regulation. Another influential factor is whether alternative networks (cable broadband, wireless broadband, and so on) cover the entire country.

Facility-based competition makes providers compete in the retail market while also constructing a network. It brings competition to network improvement by expanding investment. But it can also result in redundant investments.  Service-based competition allows new providers to use the network of the dominant facilities operator. This cuts the time to market for new entrants and reduces upfront investment. But it can also depress long-term investments by the dominant facility operator and delay network upgrades. Furthermore, new providers might lack incentives to engage in network construction. But service-based competition can also create many opportunities if new providers enter the market smoothly, attract subscribers at the initial stage, and facilitate network investment with their profits.

Comparing the experiences in Korea and France is instructive. In Korea, facility-based competition was intense from the initial stage of the broadband market due to deregulation and the development of cable TV networks, so services were diffused quickly. But by the time the market reached maturity, depending only on facility-based competition was considered insufficient, so service-based competition was adopted through local loop unbundling.  In France, by contrast, cable TV network development was relatively weak due to the development of satellite broadcasting. Further, cable TV providers, also serving as communications service providers, had little desire to start broadband businesses. Hence, France adopted a service-based competition regime from the initial stage to facilitate the deployment of services. And the country has succeeded in encouraging service providers to increase investments, improve networks, and engage in facility-based competition.

Constructing a backbone network covering the entire country is a top priority for many developing countries, especially where such networks are limited to urban centers or a few intercity routes. But deliberations are needed on which competition policy they should choose. For those without an alternative network covering the entire country, it is typically more effective to adopt both service- and facility-based competition rather than applying nationwide facility-based competition policies. However, in large cities with sufficient demand, facility-based competition in the subscriber network may be more effective.

For areas facing economic challenges in constructing an alternative network, it is reasonable to implement aggressive service-based policies as well as facility-based policies that encourage construction of a wireless alternative network through the allocation and award of ample spectrum. For areas where even the dominant incumbent does not own a fixed line network, competition must be expanded through policies allowing nondiscriminatory entry of competitors for government-supported network construction.

Governments can consider a number of reforms to address these issues as discussed in the sections below.

**Remove limits on the number of network licenses.** In many countries that have nominally "liberalized" their network markets, there is a formal or informal limit on the number of licenses issued.[51] There is little economic justification for such a limit, however, since many types of networks do not require scarce resources. This is particularly true for wireline networks, which do not use radio spectrum. Experience from around the world indicates that markets can successfully support multiple network operators in most cases. Experience also indicates that where multiple licenses have been issued, operators are willing to invest a substantial amount of financial resources in network infrastructure.

**Ease access to rights-of-way.**  Most of the cost of constructing wireline networks lies in the civil works. By lowering the barriers to and cost of accessing and the rights of way associated with public infrastructure and lands (e.g., roads, railways, pipelines, or electricity transmission lines), governments can significantly increase incentives for private investment in broadband networks at all levels of the supply chain.  Such incentives can be achieved in several ways, but primarily by making rights-of-way readily available to network developers at low cost and simplifying the legal process and limiting the fees that can be charged by local authorities for granting rights-of-way.  The United States, for example, has had a policy since 2004 that assists telecommunications providers seeking access to rights-of-way on federal lands.[52]

**Facilitate access to government infrastructure.**  Networks are often built along existing infrastructure networks such as roads, railways, pipelines, or electricity transmission lines.  Governments can provide direct access to existing infrastructure which it owns through state-owned enterprises.  For example, the railway company could partner with one or more operators to build fiber-optic cable network along the railway lines.  This approach was used very successfully around the world to develop extensive backbone networks at relatively low cost.  In January 2011, for example, Serbian Railways and PTT Srbija agreed to jointly construct telecommunications infrastructure along Serbian Railway's corridors, totaling 2,031 km.[53]

Governments can also specifically provide for network development in the design and construction of other types of infrastructure.  For example, by pre-installing ducting when new roads are built and then leasing these ducts to operators wishing to lay networks, governments can significantly reduce telecommunications operators' costs because adding communications equipment (such as cables) to other infrastructure projects is relatively inexpensive (see Figure 2.8).

**Figure 2.8.  Average cost of infrastructure installation per kilometer (Index: Water=100)**
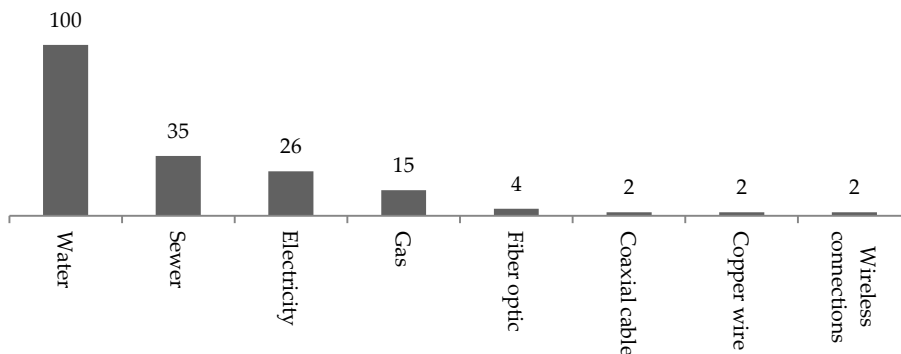


*Source:  OECD, Broadband Growth and Policies in OECD countries, 2008, p. 62.*

Including broadband in land use planning efforts may also promote build-out and reduce costs.  For example, requiring all new housing and building developments to include broadband infrastructure, particularly fiber cables, alongside other utility requirements, including electricity and water can help to

lower long-term costs by ensuring that broadband infrastructure is laid at the outset; as such, avoiding the higher costs associated with retrofitting.

National connectivity can also be enhanced by allowing the owners of electricity transmission networks, pipelines, and railway networks to act as wholesale bandwidth providers.  Such companies have a major cost advantage in the development of fiber-optic backbone networks, for example. In practice, many infrastructure companies have already laid fiber-optic cables as part of their internal communications systems, and many of these cables have substantial unused capacity. Kenya Power & Lighting Company Limited (KPLC), for example, an electrical utility, is leasing dark fiber running along its backbone to service providers.[54]  In Norway, the fiber backbone of Ventelo spans the entire railway infrastructure, covering 17,000 km.  Ventelo is the second largest wholesale provider in Norway offering dark fiber and collocation services.[55]  By encouraging these (usually state-owned) networks to establish operating companies to run the fiber assets and by licensing them, they can be brought into the formal telecommunications market as providers of backbone capacity. This has been successful in some Sub-Saharan African countries, such as Uganda and Zambia, but not in others, such as Ghana. Whether infrastructure companies are successful in becoming commercial backbone network operators appears to depend on differences in the institutional environment (that is, whether the company is given sufficient political incentives and the regulatory freedom) and in managerial capacity, rather than on the technical characteristics of the networks.

**Promote open access to existing networks.** Network operators and service providers wishing to enter the downstream market (that is, building access networks and offering services to customers) must either build their own backbone network or access the network of another operator.  In many cases, potential new entrants and investors may see the costs of constructing an entirely new broadband infrastructure as prohibitive, and prefer to lease or otherwise use capacity on an existing network.  In those cases, the terms under which operators can obtain access to the networks of other operators will have a significant impact on the success of their business and will influence whether effective competition in the downstream market develops.  At the same time, the demand created by these downstream operators will affect the financial viability of the backbone networks, since they are the entities that generate traffic and revenues on the networks. By promoting effective competition in the downstream market, governments will help stimulate backbone network development.

The role of the regulator is crucial, since the regulator often defines and enforces the terms of access. The decision about whether to directly regulate the terms of access to infrastructure has a major effect on the investment incentives. Under the traditional model of liberalization followed in Europe, in which the incumbent operator dominated the market, the priority for the regulator was to provide access to these operators' networks for companies entering the markets since this was seen as being crucial to the development of competition. Subsequently, as competition has emerged, regulators have been required to develop systems for determining which operators should be regulated and how.

In the European Union, this system is based on the framework of general competition regulation that set out how regulatory authorities determine whether or not competition is functioning effectively and what remedies should be applied where it is not. In the developing world (for example, most countries in Sub-Saharan Africa), such frameworks often do not exist. Regulators will therefore need to develop alternative sets of guidelines to govern how access to the infrastructure of private operators in competitive markets is regulated. This will involve a tradeoff between supporting the development of competition in the downstream market and maintaining the incentives to invest in upstream infrastructure. In areas of a country where public support is provided for backbone infrastructure, this tradeoff is relatively straightforward, since one of the conditions of public support will be the provision

of wholesale services on regulated terms. In other areas of the country and in other parts of the infrastructure, the tradeoff may be more difficult to determine.

**Promote infrastructure sharing.**  Many governments have sought to promote greater deployment of both wireline and wireless networks by encouraging or even requiring competing providers to share infrastructure.  In most cases, infrastructure sharing has been instituted in areas where it was concluded that competing physical infrastructures were not economically viable (such as in rural or remote areas) or where the construction of competing infrastructures could prove unacceptable for social or political reasons (too much civil works disruption or too many wireless towers at prime locations).  Module 3 further addresses how countries are implementing infrastructure sharing policies for wireline broadband providers.

Infrastructure sharing can be broken down into two categories: active and passive (see Figure 2.9).

**Figure 2.9.  Passive and Active Infrastructure Sharing**



| **Passive Sharing** | • Access to rights-of-way, poles, ducts, trenches, sewers and towers.<br>• Benefits include reduced roll-out costs, deployment times and operating costs, as well as less environmental stress due to less digging or placement of antennas on towers, buildings or poles. |
|---|---|
| **Active Sharing** | • Parts of the network (usually of the dominant/SMP operator) must be available to competitors at regulated or wholesale rates.<br>• May include local loop unbundling, bitstream or wholesale access and/or resale. |

*Source: ITU*

Infrastructure sharing has advantages for both wireline and wireless network operators.  By sharing network infrastructure, builders of networks can significantly reduce costs and make investment in them more commercially viable. This is particularly relevant for fiber networks in urban areas where the cost of laying new fibers is high or in rural areas where the revenues generated by such networks are low.  In some cases, operators have a commercial incentive to enter into these sharing arrangements. For example, in Nigeria, where there has been extensive fiber-optic cable network rollout, operators have entered into a variety of network-sharing agreements aimed at reducing costs and improving quality of supply.  In addition, operators may also be required to install multiple fibers in their cables, even if they only need one.  These additional "dark" (unused) fibers may not be used initially, but are held in reserve for future use by an existing operator or new entrant.  This may be a very cost-efficient way to manage fiber networks because installation (and the associated civil works costs) only needs to be done once as opposed to multiple rounds of digging to install multiple fibers.

With wireless networks, particularly in low-density areas where the economics may not support multiple competing infrastructures, carriers can share cell towers and some backhaul facilities as a way of reducing network build-out costs and bringing competition to such areas more quickly.   Such arrangements have slowly been gaining acceptance in both developing and developed countries, particularly as carriers seek to manage costs when expanding their networks or upgrading their services to support higher speed broadband.[56]

For example, several countries in the European Union promote infrastructure sharing among mobile operators to reduce the cost and increase the coverage of mobile broadband networks. As a result,

many operators in European countries have reached agreements to share 3G and 4G networks.  For instance, Telefonica and Vodafone have agreed to share their mobile networks in four European countries, including Spain, Germany, Ireland, and the United Kingdom to improve their mobile broadband coverage in these countries.[57] In Sweden, Tele2 and Telenor agreed to form a joint venture to deploy a nationwide 4G LTE (long-term evolution) network. The agreement includes the sharing of active network infrastructure, such as the RANs (radio access networks) and of spectrum in the 2600 MHz and 900 MHz bands.[58] The operators expect to provide access to mobile broadband to 99 percent of the population at speeds of up to 80Mbps in rural areas and 150 Mbps in urban areas by 2013.[59] In France, the regulator has taken a further step and required mobile operators to present a plan to share their mobile networks and provide coverage to 95 percent of the population. If the plan does not meet the regulators' expectations, the regulator will mandate operators to share their mobile broadband infrastructure to achieve the coverage goal.[60] The combination of different infrastructure-sharing obligations on the incumbent operator and the promotion of mobile broadband networks in countries such as Spain have resulted in significant increases in mobile broadband coverage and service adoption (see Practice Note 2.4).

**Practice Note 2.4. Infrastructure Sharing in Spain**

Infrastructure Sharing
in Spain

Despite the advantages of infrastructure sharing, governments should exercise a degree of caution when implementing such measures. One concern is that such arrangements are difficult to enforce if the parties are not willing to undertake enforcement on a commercial basis. Though requirements to share facilities are already included in many operators' licenses, they are rarely implemented or enforced if the operators are unwilling to enter into the arrangements. In Bahrain, for example, the regulatory framework established when the market was liberalized, required the incumbent operator, Batelco, to share its surplus fiber and duct space with new entrants on regulated terms. Despite ongoing efforts by the regulator to enforce such arrangements, this policy has had limited success, and entrants have opted instead to develop their own wireless-based backbone infrastructure. The regulatory authority in Bahrain is now revisiting the legal and regulatory framework that provides competitors with access to Batelco's infrastructure. It has also introduced more detailed rules on network sharing (see Box 2.10).

**Box 2.10.  Network Sharing in Bahrain**

Article 3(c) 13 of the Telecommunications Law of The Kingdom of Bahrain gives the regulatory authority the right to require operators to share infrastructure. The details of this requirement are given in guidelines issued in 2008.Telecommunications operators in Bahrain are "required to adopt joint infrastructure installation methods when more than one provider wishes to lay telecommunications infrastructure at the same location and within a timeframe not exceeding one year" (Section 1.11 [a]). The operators are required to share the costs of such joint network construction on a pro rata basis. The article goes further in encouraging infrastructure sharing through the following provisions:

- If operators are unable to reach a commercial agreement on a joint project, they are required to go to the regulatory body for "mediation and/or a binding decision."

- Operators are not permitted to undertake fiber network development in a particular area if a fiber network has been constructed in the same area within the past 12 months.

- Operators are required to install at least 20 percent reserve area in their ducts for future use by other operators.

> - Operators are prevented from using spare ducts for themselves or blocking other operators from obtaining access to them.

*Source: Government of Bahrain 2008. Legislative Decree No. 48 of 2002 Promulgating the Telecommunications Law.*

A second reason for caution lies in the concern that facilities sharing may help sustain collusive agreements between competing operators. This has been a major issue in Europe, where mobile operators seeking to share mobile infrastructure faced resistance from the European Commission.[61] The European Court of First Instance, however, subsequently ruled in favor of the operators.[62] In many developing countries, with their increasingly competitive telecommunications markets, competition-related issues may be of less immediate concern, particularly when balanced against the need for new infrastructure investment. Policy makers may consider that the risk of collusion is outweighed by the benefits of infrastructure development in rural and otherwise unprofitable areas. Additionally, rules requiring active infrastructure sharing may curb incentives to invest in networks—incumbents may opt against network upgrades since they must share their infrastructure with competitors while new entrants may opt against deploying their own networks in order to continue reselling capacity from the incumbent.

## STEP 2:  Facilitate Enhanced Competition and Investment

In the context of a private sector-led approach to broadband development, it is recognized that allowing competition to flourish will usually lead to greater deployment and efficiencies in network build-out. Once policies have been established to encourage new players to enter the market, government policymakers must also ensure that laws and regulations support fair competition and continued investment. In fact, a key lesson from the countries surveyed in the World Bank's *Building Broadband* report is that competition is critical to successful broadband market promotion.[63]  Each country studied used different mechanisms to spur competition and promote broadband market growth.  Some focused primarily on facilities-based competition, while others focused more generally on increasing the level of competition at the service level.   The presence of established, competitive telecommunications operators in many countries has also contributed to broadband market development.

In the long-term, liberalization and promotion of competition among facilities is also the best way to guarantee lower costs.   For example, the initiation of the Southern and East Africa Cable System (SEACOM) network that links Kenya, Madagascar, Mozambique, South Africa, and Tanzania resulted in Kenya Data Networks (KDN), a Kenyan data services provider, announcing that it would reduce its Internet prices by up to 90 percent.[64]   However, liberalization may be difficult in some developing countries, particularly those with small populations that are geographically isolated, or are small island developing states (SIDS)[65] with limited access to multiple sources for connectivity. Module 7 discusses the challenges faced by these unique countries.   Specific countries may exhibit features that make developing competitive markets in certain segments of the supply chain particularly difficult.

For countries seeking to improve the competitive nature of their broadband markets, several strategies can help, as discussed below.

**Remove constraints on network providers.**  Some countries, for example in Sub-Saharan Africa, impose constraints on the activities of both backbone network operators and the users of those networks. Constraints include restrictions on the sale of network services and requirements to purchase backbone network services from specific operators, usually the state-owned incumbent operator.   Removing these restrictions would allow operators to buy services from and sell services to whichever operator

they wished.  By doing so, traffic could be consolidated, providing an incentive to upgrade networks to fiber-optic cables and thereby reduce average costs and improve quality of service.

From the moment a new service provider enters a market, the dominant incumbent usually devises strategies to maintain its dominance, while the entrant struggles to increase its market share as quickly as possible.  As market volatility decreases and competition intensifies, traditional regulatory issues for fixed line telephony— such as interconnection, facilities access, and sharing of passive infrastructure— are likely to emerge in more complicated forms for broadband. In addition, broadband facilitation leads to the convergence of communications and broadcasting and blurs their borders, making regulatory issues even more complex. Thus special efforts are needed to enhance regulators' ability to respond to such challenges.

**Improve the regulation of interconnecting networks.** One of the key constraints on the development of network services in many developing countries is difficulty in enforcing contracts and service-level agreements.  To address such issues, the regulatory authority could improve the situation by:

- Establishing clear regulations on interconnection at the backbone level;

- Amending licenses to increase the enforceability of such rules, if necessary;

- Setting out effective quality controls and clear dispute resolution procedures; and

- Collecting accurate quality of service information to facilitate market functionality and dispute resolution.

Governments might, for example, reach a regional agreement on principles of open-access regulation or on the way in which a specific type of multi-country network is regulated.  One example of this type of approach is the telecommunications-related commitments that countries make when joining the World Trade Organization. These commitments have introduced a limited degree of cross-country harmonization in the way in which the telecommunications sector is regulated.  Further agreements of this type could be established at the regional level.

By entering into a regional regulation agreement, governments may be able to provide additional assurance that investors will not face excessive political risk originating at the national level.  However, regional approaches to the governance of the telecommunications sector have proven very difficult to implement in practice.  Even in the European Union, where a strong move toward harmonization of sector regulation in the context of general economic and institutional integration has take place, telecommunications sector regulation remains the responsibility of national regulatory authorities, albeit within an overall regulatory framework defined at the European level.

Because regional approaches to regulatory capacity building and technical assistance in dealing with backbone networks are likely to be easier to achieve than complete regional regulatory harmonization, they may be a more effective way of improving the quality of regulation.  Examples of the former approach include developing regional benchmarking data on prices and quality of service for backbone network services, standardizing reference interconnection offers (RIOs), and standardizing license terms and conditions. Existing regional associations of regulatory authorities in Sub-Saharan Africa, for example, provide a potential basis for such regional approaches to regulating backbone networks.

**Provide regulatory certainty**.  Governments should seek to provide as much certainty as possible regarding their regulatory approaches to broadband buildout.  This is particularly true with spectrum and licensing issues.  Such certainty will give operators and investors confidence in making investments in wireless network infrastructure.  The ministry and/or regulator will need to state clearly, for example, what their policies and plans are for identifying and reallocating spectrum for wireless broadband,

establish clear technical and service rules that will govern the service and establish clear, transparent and equal license terms. Operators need to know that spectrum is available, in which bands, or when more is coming. In order to develop good business cases, they also need to know under what terms spectrum will be released, if there will be coverage or universal service obligations, etc. With a clear and fair framework in place, investment likely will flow into the marketplace. Conversely, it will be hard for investors and network operators to commit to a commercial deployment in those markets where the regulatory and licensing framework is not clear.

**Consider risk guarantees and insurance.** Companies operating in a risky environment are likely to place a premium on scalability and reversibility in their network infrastructure investment decisions. Scalability means that network investments take place in small increments, rather than large one-off expenditures. Scalable investments allow operators to expand their networks as demand develops, hence reducing the risk that networks are over dimensioned. Reversibility reflects the ability of a network operator to reverse investments and sell or reuse capital equipment if necessary.

Some types of network investments are more reversible than others. Microwave and satellite transmission equipment, for example, can be moved and used in another part of the network if necessary. The majority of the capital cost of a fiber network lies in civil works, such as construction of trenches and installation of ducts, which cannot be moved once built. Investment in such networks is largely irreversible (sometimes referred to as "sunk costs"). In uncertain political and regulatory environments, operators are likely to favor more flexible investment in wireless network technology over fiber-optic networks. The risk of investment in fiber-optic cable networks could be mitigated, however, through the use of financial instruments such as partial risk guarantees and political risk insurance.[66]

**Reduce commercial risk through demand aggregation.** Two key risks faced by entrants into any market are the risk that demand does not develop as anticipated and that the cost of obtaining customers turns out to be higher than anticipated. These risks can significantly raise the economic cost of an investment and create a disincentive for operators to invest in infrastructure, particularly in physical assets that may constitute a sunk cost. One way that governments can reduce these risks is to act as a central purchaser of services on behalf of all public institutions at all levels (including, for example, schools, health centers, and local government). By doing this, operators effectively deal with a single large customer rather than multiple smaller customers, hence reducing commercial risks. Such a strategy was undertaken on a large scale in the Republic of Korea, where the government promoted the rollout of high-speed backbone infrastructure by acting as a single purchaser of broadband connectivity on behalf of public institutions, hence reducing operators' risk of investment. A comparable approach was adopted by the government of Ireland with respect to submarine fiber infrastructure. Both cases are described in Box 2.11.

**Box 2.11. Examples of Infrastructure Development through Demand Aggregation**

**Republic of Korea**

The government of Korea provided financing for the development of the country's broadband infrastructure in the form of a prepayment for the provision of broadband services to public institutions. Between 1995 and 1997, the government provided $0.2 billion toward the overall $2.2 billion cost of building an optical fiber network. The remaining funding was provided by the private sector, mainly Korea Telecom. The second phase, between 1998 and 2000, focused on the access network, and the government contributed $0.3 billion of the total required investment of $7.3 billion. The final phase, between 2001 and 2005, involved the upgrading of the entire network. In this phase, the government contributed $0.4 billion toward a total cost of $24 billion. In exchange for this upfront payment, operators were required to provide broadband services to public institutions for an extended period.

The government's financing was effectively a prepayment for services that, although representing only a small percentage of the total investment cost, provided the private sector with sufficient incentive to develop its networks.

It is significant that the Korean initiative was done in the context of an overall policy promoting broadband that included full market liberalization to establish infrastructure competition among operators and demand-side stimulation through initiatives such as ICT literacy training, free broadband access to all schools, 11 e-government projects, and support for the provision of inexpensive personal computers for low-income households.  The result of this combined policy has been an explosion of network investment and usage of broadband services. All cities, towns, and villages are now connected by high-speed networks and the cost of broadband services is low.

**Ireland**

In 1999, Ireland's Industrial Development Authority, under the Ministry of Public Enterprise, entered into a public private partnership (PPP) with Global Crossing under which the latter would build a fiber-optic ring that would provide subsidized international connectivity to Ireland's rapidly expanding telecommunications operators, ISPs, and ICT firms.

Global Crossing developed, owned, and operated the infrastructure. The government purchased the capacity in bulk and resold it to all operators on an open-access and uniformly subsidized pricing structure. By acting as an "anchor tenant," the government provided risk reduction sufficient enough to allow the private company to invest. At the same time, by on-selling the capacity at uniform and nondiscriminatory rates, this structure supported the development of the downstream market through ensuring that both small and large operators had access to inexpensive international capacity.

*Source:  Mark Williams, Broadband for Africa: Policy for Promoting the Development of Backbone Networks, GICT, World Bank, August 2008, p. 43.*

Because companies in some developing countries have had difficulty in collecting revenues from public institutions for utility services such as water and electricity, an issue to consider in relation to commercial risk is the extent to which the credit risk associated with the public sector as a customer offsets the commercial advantages of bulk purchase of backbone services. Use of prepayment and escrow mechanisms can reduce this credit risk.

**Improve quality of service.**  One ongoing issue in the provision of local broadband access is the problem of quality of service.  A significant difference often exists between advertised speeds and actual speeds achieved by users (see Figure 2.10) in both the wireline and wireless contexts.  The problem is that the advertised speeds are usually based on the theoretical capability of the technology or standard.  In reality, however, numerous factors make such speeds very difficult or even impossible to achieve, including network congestion or (for wireless networks) radio interference.

**Figure 2.10. Difference between Advertised and Actual Speeds, United Kingdom**
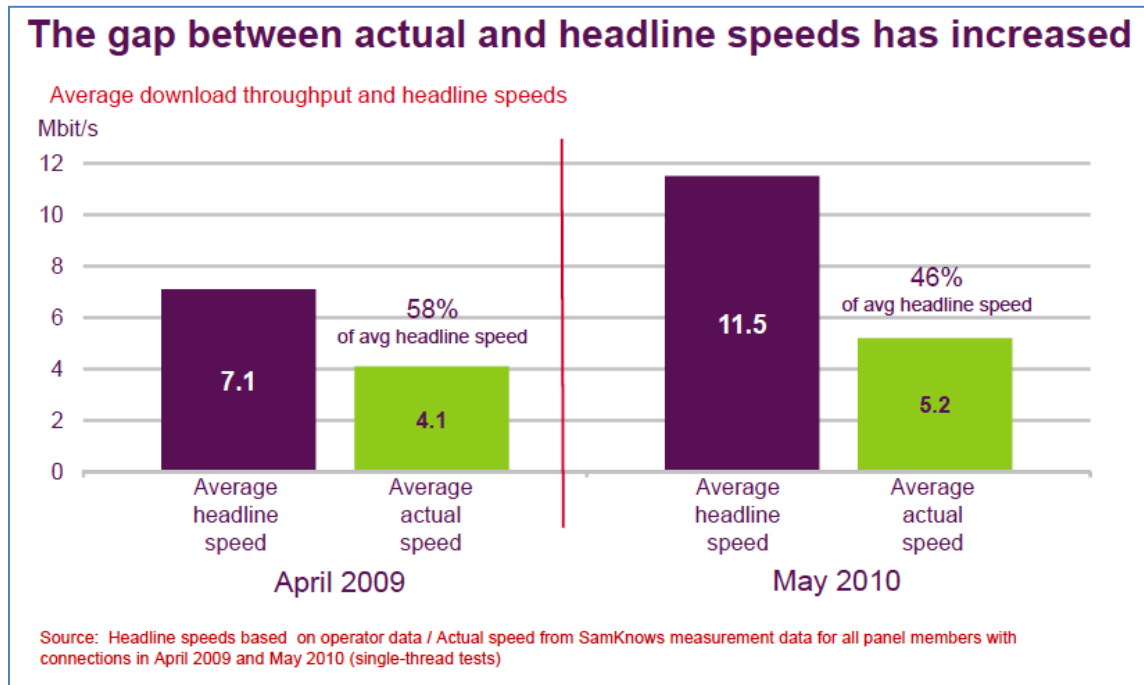


*Source: Ofcom, The Communications Market 2010: UK, available at http://www.ofcom.org.uk/static/cmr-10/UKCM-5.10.html.*

In an effort to manage network quality, many providers are moving away from unlimited broadband packages and adopting so-called "fair use policies" in order to control and regulate traffic. One practice is the use of data caps where providers establish a threshold on the amount of data that can be downloaded per month. Once the cap is exceeded, the subscriber either must purchase additional download volume, or the subscriber's speed is reduced or in the worst scenario, service is terminated for that month. Some operators establish different caps for domestic and international traffic. Another practice is controlling the use of high-bandwidth applications or access to traffic-intensive sites through restrictions or degrading service. This practice has been banned in some countries as a violation of network neutrality. Providers have been known to "throttle" service by limiting the subscriber's bandwidth when they have exceeded data caps or try to access traffic-intensive sites.

These network management practices have been contentious since they are often covered by the "small print" of customer contracts and many users are not aware of them. In an effort to alleviate consumer concerns about service quality, some governments monitor and compile reports on service quality. The Telecommunications Regulatory Authority (TRA) in Bahrain, for example, publishes data on wireline broadband performance.[67] The TRA measures upload and download speeds for different broadband packages, DNS response (time taken in milliseconds to translate a domain name to its IP address) and ping (send an echo request to a server to test latency). In other countries, although governments do not publish quality of service reports, they offer sites consumers can go to in order to check their speeds.[68]

## STEP 3: Address anti-competitive behavior

Even if all the policies discussed above are implemented, it is still possible that competition can be stymied. In many cases, this is due to the presence of large, vertically integrated (often former monopoly) providers that are dominant across markets and use their power to thwart new entrants and suppress fair competition. In some cases, regulators have tried for years to curtail such behavior, but

without success.  In such extreme cases, governments must look beyond purely regulatory remedies to the underlying structure of such companies to see if they are distorting market forces.  If so, policymakers may consider ways to break up the company to promote greater and fairer competition in the market.

 As detailed in Module 3, vertical integration refers to instances where a single firm controls multiple levels of the supply chain and is able to realize both greater economies of scale and lower costs of production.   Although in a competitive market, vertical integration can result in lower retail prices and better, more varied services, it can create barriers to entry in markets where certain operators are dominant.[69]  Where needed, regulators may seek to impose various obligations on dominant operators in order to promote competition, including (see Module 3 for a detailed analysis on these obligations):

- **Accounting separation:** Typically requires the dominant and vertically integrated operator to maintain separate records for its upstream and downstream costs and revenues in order to allow the regulator to set wholesale prices for the regulated upstream services.  The records are typically subject to independent audit and may also be made publicly available.   Although the operator must make its costs transparent, under this remedy it is able to continue benefiting from the operational efficiencies of vertical integration.   This remedy is prevalent in many countries and less intrusive than functional or structural separation.

- **Functional separation:** If accounting separation does not sufficiently curb anti-competitive behavior, a regulator may require the dominant provider to establish a new business division—separate from its other divisions—to manage the network and provide wholesale services to all retail service providers on a non-discrimination basis.   In many cases, other regulatory obligations are used as a complement to functional separation, such as LLU and/or providing bitstream access. (See Box 2.12 for an overview of functional separation and broadband uptake in the United Kingdom.)

- **Structural separation:** Involves full disaggregation of the vertically integrated operator's wholesale and retail divisions into separate, individual companies, each with its own ownership and management structure.  All benefits associated with vertical integration are eliminated.[70] Structural separation is extremely difficult to reverse and can dramatically affect the market, such as by increasing regulatory uncertainty and impacting infrastructure investment. Additionally, it is difficult to allocate the separated firms' assets and liabilities in order to ensure the ongoing viability of both entities.[71]   As a result, regulatory authorities rarely impose structural separation as a remedy, and only after other regulatory interventions have failed.

**Box 2.12.  Functional separation and broadband uptake in the United Kingdom**

British Telecom (BT), the incumbent operator in the United Kingdom, proposed to the regulator to functionally separate its network division in 2005 after the regulator's review of the market.  The main obligations undertaken by BT were as follows:

- Establish a new and operationally separated division (Openreach), staffed with British Telecom's employees responsible for network operations. Management was to be completely independent from BT and the compensation system was to be based on the success of this division only;

- Provide services under the obligation of equivalence of inputs. Therefore, the new division had to provide to competitors the same services and products it offers to British Telecom under the same conditions, including prices, and with the same information systems and processes provided to British Telecom; and

- Create an independent body, the Equality of Access Board, to monitor compliance with these

obligations.

Since these undertakings were adopted and BT's functional separation was implemented, competition in the broadband market boomed. In 2005, BT had 37 percent of market share. By 2008, its market share was reduced to 25 percent, with more than 20 operators offering broadband over Openreach services. Broadband uptake increased substantially, fuelled by competing operators using BT's wholesale services. By 2008, more than half of broadband access was provided by competing operators over BT's infrastructure (Figure 2.11).

**Figure 2.11. Broadband lines growth in the United Kingdom by infrastructure-type operator**
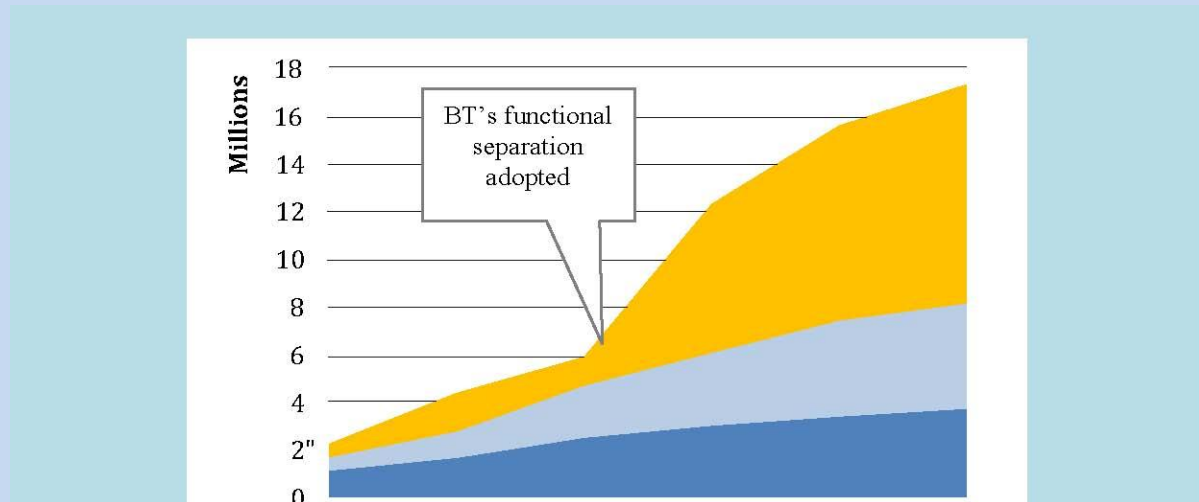


*Source: European Commission (2009)*

The experience in the United Kingdom shows that functional separation is not a substitute for other regulatory obligations but a complement that is imposed in addition to other obligations. For instance, functional separation cannot succeed in eliminating the bottleneck in the domestic step of the supply chain without the simultaneous mandate of local loop unbundling (LLU) and bitstream obligations that help eliminate the bottleneck in the local connection step (see below for a further description of these obligations). Indeed, LLU and bitstream obligations are currently the most important source of competition in the United Kingdom.

LLU and bitstream obligations existed before functional separation was in place but their use was limited due to British Telecom's constraints (see Figure 2.12). It was only because functional separation eliminated both bottlenecks (domestic and local connection) simultaneously that broadband competition could be fostered in the United Kingdom's market.

**Figure 2.12.  LLU lines growth before and after functional separation is adopted in the United Kingdom**

*Source: European Commission data*
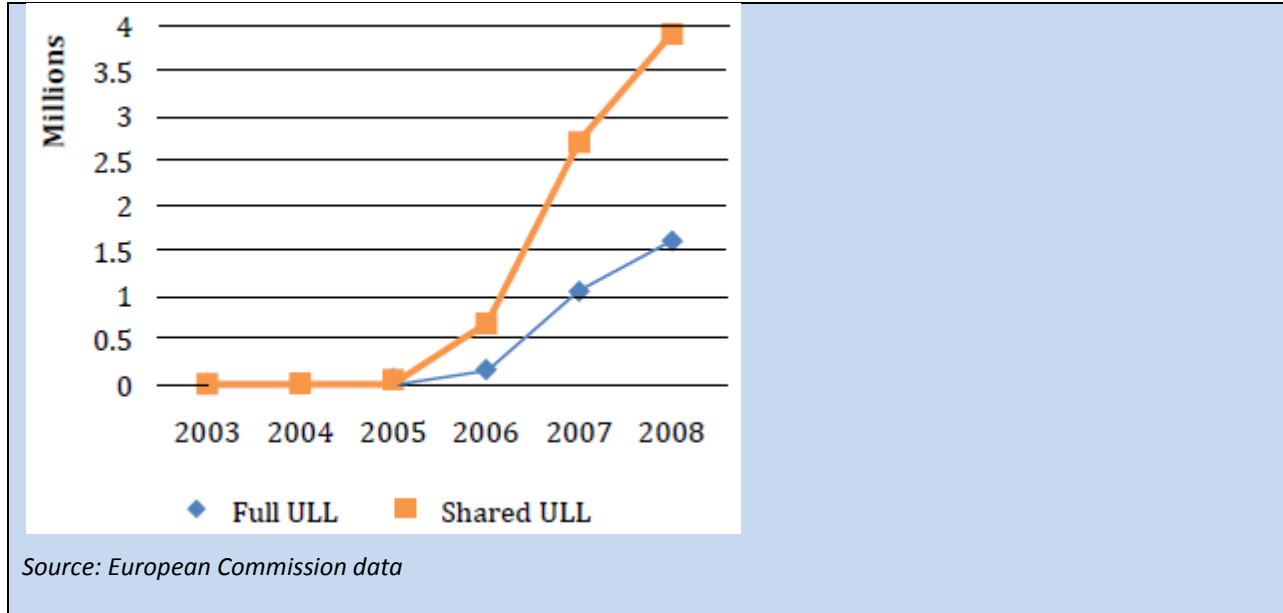
*Sources: Webb (2008) and Nohe (2009); ARCEP, Functional Separation: Pros and Cons, in La Lettre de lÁutorité, English Version, 55 (March-April 2007).*

## 2.4.2 Enabling Policies to Eliminate Bottlenecks in the Broadband Supply Chain

Broadband networks are not simple things; they consist of multiple components, all of which must work together in order for broadband services to be delivered to end users in the most efficient and effective way possible. For purposes of analysis and policy development, the broadband supply chain can be broken down into four discrete parts or levels:

1. **International connectivity:** The country's connection to the rest of the world; provided by fiber optic (usually submarine) cable or satellite.

2. **Domestic backbone:** Traffic carried between fixed aggregation points within a network; provided by fiber optic cable, microwave or satellite.

3. **Metropolitan and backhaul:** Connection between the backbone and local networks or cell site to network; provided by fiber optic, microwave or cable.

4. **Last mile:** Link between the customer and the network; provided by fiber, xDSL, cable or wireless.

The most common market failure on the supply side is the absence of competition due to the historic monopolist provision of telecommunications services. However, there can be other market failures, such as lack of economies of scale or threshold market failures that impede the deployment of broadband infrastructure in rural areas. In order to be most effective, competition must be present throughout the different levels of the broadband supply chain (see Box 2.13). If not, bottlenecks arise and the benefits of broadband diffusion are severely reduced. For instance, if domestic and local levels are competitive, but access to international connectivity is limited or too expensive because only one provider of submarine cable exists, broadband prices will remain high and diffusion will not achieve its potential. The same can happen if all other levels in the supply chain are competitive, but local connectivity is limited to one single operator. As such, it is important to develop enabling policies to eliminate bottlenecks across the broadband supply chain.

**Figure 2.13. Addressing Bottlenecks:  Policies on the Supply Side**

| SUPPLY CHAIN | ADDRESSING ALL LEVELS OF THE **SUPPLY CHAIN** |
|---|---|
| | • International Coordination |
| | • Access to Landing Stations (e.g., Submarine Cable) |
| | • Inter-Platform Competition<br>• Spectrum Availability<br>• Infrastructure Sharing<br>• Functional Separation<br>• Subsidies/Incentives for Infrastructure Development /Direct Roll- Out (Open Access Model) |
| | • Elimination of Barriers<br>• Unbundling of the Local Loop<br>• Technology/Standard Neutrality |

*Source:  Adapted from Arab Republic of Egypt, Strategic Options for Broadband Development, World Bank Report, p. 56 (2010).*

High-penetration countries have been successful because they have addressed competition market failures throughout the supply chain. However, the particular conditions of each specific broadband market may give rise to different bottlenecks and thus require different policy approaches. Not all countries have identified the same bottlenecks in the supply chain, nor have they adopted the same competition policies to ensure competition. However, it is possible to identify two main approaches to competition policies: inter-platform competition and intra-platform competition. The first consists of ensuring competition among different network platforms with limited access to the incumbent's infrastructure by alternative operators. The second one, intra-platform competition, consists of establishing access obligations on the incumbent's network to allow alternative operators to gain economies of scale before incurring the high fixed costs of network deployment. Some countries, such as the United States, put the emphasis on inter-platform competition, whereas others, such as the European Union countries, stress intra-platform competition through unbundling of the local loop (LLU) and other obligations (see section 2.4.1).[72] Nevertheless, the goal of both policy approaches is the same: to increase competitive conditions and achieve sustainable competition in the long term.  Nor are the two approaches mutually exclusive.  Most countries that have achieved high broadband diffusion, such as Canada, Denmark, Korea, the Netherlands, Norway, and Sweden, have combined both approaches throughout the supply chain.

Multiple policy initiatives are needed to effectively create this enabling environment for infrastructure competition. They can be divided into four groups: (i) removing regulatory obstacles; (ii) reducing the cost of investment; (iii) removing political and commercial risks; and (iv) promoting effective competition in the downstream market.

The following sections discuss each step in the broadband supply chain and policies that can help promote greater deployment of broadband networks at each step.

## Promoting International Connectivity

In order to provide the physical connections between widely separated broadband resources and consumers, countries must establish international links (gateways) to connect to the world's Internet and telephone networks.  The technologies providing long haul transmission, such as fiber optic cable and satellites, typically have very high investment costs.  While initial "sunk" costs are high, they have very low incremental costs to accommodate additional users.  These technologies also enable carriers to activate additional capacity on an incremental, graduated basis as demand grows.

As detailed in Module 5, the vast majority of international telecommunications traffic is carried by undersea cable systems—more than 95 percent according to some estimates.[73]  This reflects the advantages of fiber optic cable in terms of bandwidth and latency compared to satellite.  Undersea fiber optic cables can transmit data at speeds measured in Tbit/s, while even the newest communications satellites offer speeds below 1 Gbit/s as well as higher latency.  As of early 2011, there were more than 120 major submarine cable systems, with another 25 planned to enter service by 2015.[74]  Nevertheless, for many developing countries, international connectivity continues to be a bottleneck in the development of broadband connectivity.

First, submarine cables are quite expensive to deploy, with costs that routinely reach into hundreds of millions of U.S. dollars.  As such, many are financed by consortiums of operators rather than a single investor, such as the Eastern Africa Submarine Cable System (EASSy), which has landing points in nine countries and connects to several additional landlocked countries and is funded by 16 African and international shareholders, all of whom are telecommunications operators and service providers.

These huge costs of deploying undersea fiber optic and satellite networks present a challenge for many developing countries, particularly land-locked countries that lack coastal regions to support a landing station for undersea cable.  The transit costs to tap into undersea cables can be significant as national and regional fiber backbones may not be available to tap into the undersea cable  (although this is becoming less of an issue over time as landlocked countries complete some type of fiber connection to the international cables through neighboring countries).  Even where landlocked countries are able to negotiate a virtual coastline so that they own and operate a cable landing station in a neighboring country's territory, they are dependent on the neighboring country to provide reliable and reasonable prices for transit.

Many SIDS, mainly in the Pacific Ocean, face a connectivity challenge since they are distant from undersea fiber routes and facilities-based competition in the international connectivity markets may not be economically supportable, especially those that generate small amounts of traffic.  Regulatory restrictions or high costs may restrict service providers from accessing undersea cables.   As a result, such countries often have to rely on the use of alternative technologies, such as satellites that often carry a higher price premium.

Second, capacity on these networks tends to be owned by a few carriers and wholesale arrangements are not always optimum for smaller players.  Likewise, a few global IP carriers dominate wholesale access to the Internet and smaller ISPs are forced to pay one-way interconnection charges. Submarine cables connect to domestic backhaul networks at a cable termination station, which is—but may not be—the same facility as the cable landing station (i.e., where the cable makes landfall).  Because all operators in a market, particularly new entrants, may not have the resources to own and operate a cable landing station, the owners of such stations, generally the incumbent operators in newly liberalized markets, may be required to provide access to the station, and therefore to the cable, on reasonable terms to competing service providers.  Limited access to landing stations can have a chilling effect on the diffusion and take-up of broadband services.   Conversely, limited opportunities or

burdensome regulations related to cable landing can discourage interest in that market among cable operators, again creating a connectivity bottleneck.

Despite the constraints, the most efficient way to lower costs and keep pace with demand is through liberalization and promotion of competition among facilities that provide international connectivity, in particular international gateways, submarine cables, and landing stations.  As such, it is important to ensure that there is more than one international carrier and international gateway, and where possible, redundant international cables and other facilities linking a country to competitive global communication networks.

For countries without a well-functioning international connectivity market, targeted *ex ante* regulation may be required to address market failure.[75]  Governments and regulators may need to implement competitive policies with respect to issues such as submarine cable landing stations, open access, and infrastructure sharing to eliminate such bottlenecks (see section 2.4.1).

In addition, countries such as India[76] and Colombia have adopted various obligations on international gateways, landing stations and submarine cable systems.  In Colombia, for example, after conducting a review of wholesale inputs for broadband Internet access, the regulator found that cable landing stations constituted essential facilities and required landing station operators to provide access to their facilities on non-discriminatory terms and to publish a reference access offer.[77]

Self-regulation can also be a tool for reducing costs and increasing access to facilities required for international connectivity.  Consortium agreements for submarine cable systems, for example, are progressively including non-discrimination and open access clauses whereby third parties are guaranteed access to facilities and capacity at comparable terms to those offered to the facilities' owners or subsidiaries.    For instance, the Eastern African Submarine Cable System (EASSy), which runs from South Africa to Sudan with connections to all countries along its route, includes such safeguards. Launched in 2010, EASSy allows any consortium member to sell capacity in any market in the region to licensed operators on non-discriminatory terms and conditions.[78]

## Building a Domestic Backbone

The second level of the broadband supply chain is the national backbone network, which is essential for broadband connectivity since it provides the link from international gateways to local markets, as well as domestic connectivity between major cities and towns. These links require large capacities because their function is to aggregate traffic from different areas of the country and then carry it on to the next node or city.  Historically, such links were provided by satellite or microwave systems, but in the last decade, fiber-optic cables have come to provide the vast majority of backbone links due to significant improvements in capacity and reliability, coupled with lower long-term maintenance costs.[79]

Countries face several challenges in seeking to develop and promote national backbone networks.  The first relates to technology. The choice of a national backbone strategy is highly dependent on a country's size and topography, regulatory environment and broadband market size.  Different technologies are used for backbone connectivity, such as fiber, satellite, and microwave (see Module 5 for more information on the individual technologies).  In reviewing the different technologies it is important to bear in mind that the selection of the appropriate backbone connectivity option often depends on the distance to be covered and the forecasted capacity requirements.  Fiber optic cable is typically perceived as the optimum solution for national backbone connectivity given its high capacity and upgradeability. As a result, different mixes of technologies will be employed and private investors and policymakers will need to examine the tradeoffs between bandwidth needs, CAPEX, operating expenses (OPEX), upgradeability and regulatory impacts, among others. Nevertheless, fiber optic cable is typically

perceived as the optimum solution for national backbone connectivity given its high capacity and upgradeability.

A second major consideration is cost.  Building backbone networks is very capital intensive; requiring significant investments. In countries with large physical distances to cover (and/or low population densities in some parts of the country), this fixed cost may difficult for private companies to justify. Most of the cost of constructing wireline networks lies in the civil works.  These costs represent a major fixed and sunk investment, and a real risk to network operators in the face of uncertain demand. Beyond the absolute cost, such networks also account for a significant portion of the costs of building a full-fledged broadband network.

A key lesson from a World Bank study on backbone networks in Sub-Saharan Africa is that many countries do not provide incentives for private investment and competition in backbone networks.[80]  In many cases, in fact, there are direct disincentives against competition. In order to defray the costs of deploying and operating a backbone network, investors and operators seek to load as much traffic onto the backbone as possible.  This is often accomplished by reselling capacity to downstream providers on a wholesale, non-discriminatory basis.  This also helps to establish competition across multiple tiers of service.[81]

**Approaches to promote backbone development**

Policymakers considering ways to build out broadband backbones will have to address many complex issues, but they also have a range of policy options available to them.  From a policy perspective, promoting private investment in backbone networks, can help to reduce the overall financial burden on the public sector of ensuring widespread and affordable broadband availability.   Encouraging investment in and effective competition among backbone networks also allows market forces to aggre-gate traffic onto higher-capacity networks, thus reducing costs and stimulating downstream investment and competition among ISPs sand other data users. The policy of promoting infrastructure competition to support the development of backbone networks is consistent with the experience of developed countries going back many years. For example, in a 2006 report, the Organisation for Economic Co-operation and Development (OECD) observed that "opening markets to facilities competition and the rapid development of technology [has] resulted in highly competitive backbone markets in most OECD countries. The development of geographically dispersed Internet exchange points (IXPs) in larger countries has further assisted the development of a competitive market."[82] In the same report, the OECD observed a similar effect in developing countries: "[t]he same competitive forces that have driven down the cost of telecommunication are now at work with broadband access to the Internet. From early 2004 to mid-2005, average broadband prices fell 75 [percent] in India. For example, a 256 [kilobits per second] xDSL connection with 400 [m]megabytes of data transfer included, is available from Bharat Sanchar Nigam Limited (BSNL) for less than USD 6 per month."[83]

Governments with high broadband penetration and adoption have intervened in this section of the broadband supply chain mainly by subsidizing the construction of or connection to backhaul networks and by rolling out backbone networks to connect public institutions throughout the country.   For instance, in Canada the government has subsidized the connection of rural areas to backhaul networks. Chile has financed the extension of broadband connectivity to rural and isolated areas through an ad hoc public fund to avoid distorting the market and to crowd-in private investment (see Box 2.13).  In Iceland and Luxembourg, the government has built a network connecting public institutions, such as research centers and government offices.  In Japan, the government promotes the roll-out of fiber optic networks to regions without broadband connectivity.[84]

**Box 2.13.  Extending connectivity to rural and isolated areas in Chile**

Contrary to other countries, Chile did not establish a universal service fund to extend the coverage of telecommunications networks to underserved areas. Instead, it created an *ad hoc* fund, the Fondo *de Desarrollo de las Telecomunicaciones* (FDT), financed with public funds (from both the federal government and the regions). No specific contribution from operators is related to the funding of the FDT. Indeed, in Chile there is *no* universal service obligation for telecommunications operators. The rationale for this is not to distort the telecommunications market with a tax on an operator's profits.

The current fund was created for a 10-year period and is anchored in the Ministry of Transport and Telecommunications. Initially, the FDT was restricted to financing projects that extended public telephony in underserved rural and low-income areas. However, in 2001 the regulation of the FDT was modified to allow for funding a broader set of projects, including the extension of broadband connectivity and the use of ICTs among the population in target areas. The fund is administered by a board comprised of the representatives from several ministries (including the Ministry of Transport and Telecommunications, the Ministry of Economy, the Ministry of the Treasury, and the Ministry of Planning and Cooperation), as well as  representatives of the Chilean regions.

**Projects of the FDT**

The initial mission of the FDT was to provide public telephony to 6,000 underserved localities. However, as this objective was achieved and Internet became more important to society, the FDT changed its focus to provide Internet access and other telecommunications services, including radio and television broadcasting, in underserved areas.

Following the adoption of the 2007-2012 ICT national strategy, the FDT substantially increased its importance as a policy tool to expand broadband connectivity to isolated and rural areas. The fund increased its budget significantly, which allowed it to finance a larger number of projects and to set more ambitious goals, such as providing rural broadband connectivity to the entire rural population of the country.  The FDT has been used to provide funding to private operators to develop connectivity and infocenters projects, among others. For all the projects, subsidies are distributed through competitive bidding (using a reverse auction model). Some of the projects related to broadband that have been funded by the FDT include:

- *Infocenters for rural areas (2002-2009).* The FDT offered subsidies to install Internet centers (infocenters) in rural areas. Infocenters comprise several PCs and Internet connections. E-training sessions are also conducted in these centers. The purpose of the infocenters is both to increase access to the Internet in rural areas and to educate the population on the use of the Internet. From 2003 to 2004, the fund awarded subsidies of US$ 4.9 million for 294 Internet centers in rural areas. The FDT has continued providing funds for infocenter projects, awarding additional funds in 2007.

- *Extension of Internet connectivity to rural schools (2005).* The FDT offered subsidies to connect 1,000 rural schools to the Internet. Subsidies amounted to US$6.5 million.

- *Deployment of fiber optic networks to connect isolated areas (2007).* The FDT offered subsidies for more than US$4 billion to extend fiber-optic networks and provide broadband connectivity to isolated areas.

- *Broadband connectivity to the rural population (2008).* FDT offered subsidies for USDS70 million to provide connectivity of at least 1 Mbps to 3 million people in rural areas (40 percent of the Chilean population) and boost ICT use among agrarian and touristic industries in those areas.

*Sources: Subsecretaria de Telecomunicaciones (Government of Chile), Fondo de Desarrollod e las Telecomunicaciones ; P. A. Stern and D. N. Townsend, Nuevos Modelos para el Acceso universal de los Servicios de Telecomunicaciones en América Latina. Informe de Países (REGULATEL, 2007).*

Governments also have other means to stimulate the deployment of backbone networks, including: borrowing from multi- and bi-lateral agencies; encouraging operator build-out; promoting open access and facilities sharing.  These topics are discussed in more detail in Module 5.

The backbone policy development process is discussed in more detail in the following section, but can be summarized in the policy "road map" shown in Figure 2.14.

**Figure 2.14.  Roadmap for Backbone Network Policy**
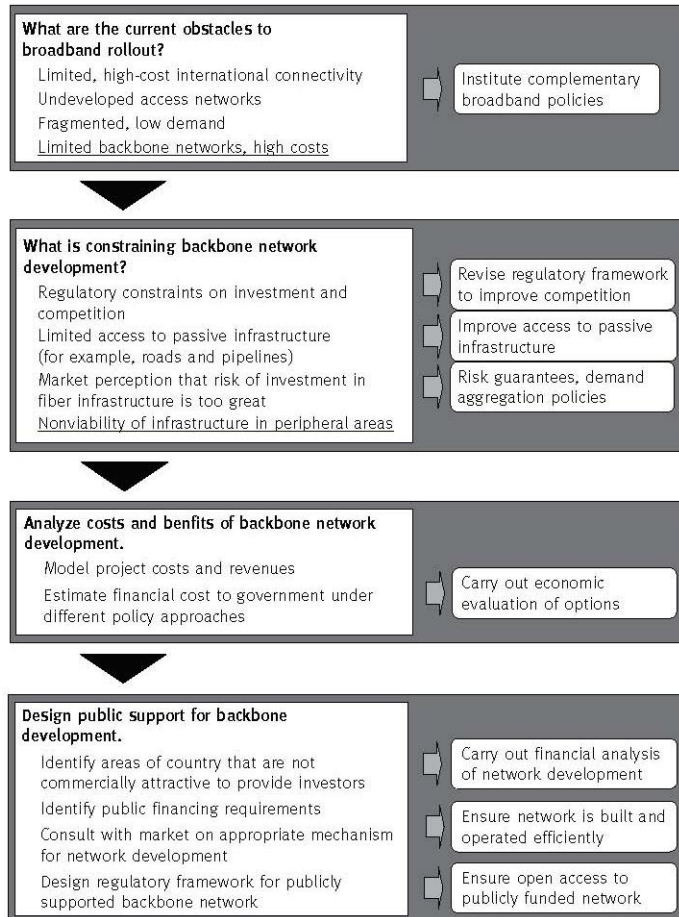


*Source:  Mark Williams,* Broadband for Africa: Policy for Promoting the Development of Backbone Networks*, GICT, World Bank, August 2008, p. 59.*

**Assess the Costs and Benefits of Support to the Development of Backbone Networks.**  A key step in implementing the backbone policy framework is an assessment of costs and benefits.  Estimating the value of the benefits is challenging for two reasons.  The first reason relates to defining the benefits of backbone networks.  As one element of the broadband supply chain, backbone networks, on their own, do not deliver the final product (that is, broadband connectivity) to customers.  If backbone policy is not placed within the overall context of broadband policy, it is unlikely to be effective in increasing connectivity to end users.  However, by doing so, it is difficult to attribute causality directly to the

backbone policy, since the benefits could be equally ascribed to policy actions taken on international connectivity or access networks.

The second reason relates to uncertainty surrounding future broadband development in many developing countries.  Since the economic benefits arise from lower prices and greater consumption of broadband connectivity, any attempt to estimate the benefits of backbone policy will require a forecast of broadband take-up following policy implementation.

Notwithstanding these challenges, it is possible to undertake a basic analysis of the costs and benefits of an overall policy designed to boost broadband connectivity.  The starting point of this analysis would be an assumption that the government undertakes a comprehensive approach, aimed at all the major potential bottlenecks in the broadband market.  Potential benefits of this type of broadband policy lie in the additional consumer surplus that would be generated by meeting increased demand for broadband connectivity and the long-term boost to economic growth that might accrue from increased broadband connectivity.  There are few robust estimates of the parameters required for such calculations so there would be a considerable margin of error surrounding any such estimate of the benefits. Estimating the costs of broadband policy initiatives, however, is likely to be more straightforward since these are based on defined actions by the government to which cost estimates can be attached.

In practice, decisions on public expenditure are rarely based only on cost-benefit analysis, and political priorities often have a greater impact on the allocation of public resources. In such circumstances, or where an accurate estimate of the benefits of public support to broadband connectivity is not available, an analysis of the costs of the different policy options would still be useful, as it would allow policy makers to make decisions on the basis of information on the relative costs of each potential course of action.

**Determine the Institutional Implications of Backbone Network Policy Recommendations.**  An important issue to consider in designing the appropriate policy framework for promoting backbone networks is the implications for the institutions that govern the sector, typically the ministry responsible for of communications and the regulatory authority.  The policy options outlined here vary both in the burden they place on these institutions and on the extent that their success depends on their being able to perform their functions.  For example, issuing new licenses typically does not require institutional capacity beyond that which already exists in most countries.  However, designing complex consortium structures with regulated terms of access places a much larger burden on a government or regulatory authority.  Given the limited capacity of many regulatory institutions in some developing countries, the dependence of the success of the policy options on the regulatory authority is an important factor to take into account in designing the overall backbone policy framework.

The challenges faced by regulators in implementing backbone network policies can be divided into three categories. The first relates to the technical difficulty associated with implementation of the policy. For example, defining standard quality of service criteria for backbone services in order to improve the functioning of the market is less technically demanding than developing complex consortia-based invest-ment projects. The second is an institutional challenge related to the capacity of public institutions to make and enforce decisions relating to the sector. This capacity is determined by a number of factors, such as the legal framework that defines the institution's powers, the financial resources of the institution, and the availability of skilled staff in the institution. The third challenge relates to the political economy of the ICT sector. Some policy decisions may act directly counter to the interests of one or more parties in the market or the government. For example, in countries where backbone services are monopolized by an incumbent operator, liberalizing the wholesale market may adversely affect the profits of the incumbent, particularly in the short term. Liberalization may therefore meet significant institutional resistance, thus making other policy options easier to implement.

**Box 2.14.  Wholesale Licensing to Promote Backbone Development**

One way of encouraging investment in backbone networks is to issue "carrier" (wholesale-only) licenses. Such licensees would be permitted to build backbone networks and then sell capacity to other operators, such as mobile operators or ISPs.  The advantage of this approach is that it encourages investment and competition specifically in the backbone segment of the market.  It also avoids problems of discrimination by the backbone network among retail operators.   Such carrier networks are a common feature of backbone network markets in developed countries in which there are several companies that have built networks and provide services on a purely wholesale basis to other operators. The potential opportunity for these types of operators is shown in Kenya, where KDN has developed 1,900 kilometers of fiber network infrastructure, and in Nigeria, where there are more than 20 licensed fixed operators, including two national carriers and seven national long-distance operators developing high-capacity backbone networks.

*Source:  Mark Williams, Broadband for Africa: Policy for Promoting the Development of Backbone Networks, GICT, World Bank, August 2008.*

## "Middle Mile" and Metropolitan Connectivity

The next level in the broadband supply chain consists of the links needed to connect smaller towns and villages to the backbone network and provide links in and around metropolitan areas.  These links are often referred to as the "middle mile" because they exist between the backbone and the local access networks, and often serve to connect rural areas to the backbone networks.   As with backbone networks, these links can be provided by a number of technologies, including satellite and microwave networks, but fiber optic lines are increasingly being used because of their higher capacity.    This part of the broadband supply chain also includes so-called metropolitan area networks (MANs), which are often established in and around major cities to link high-traffic business users and the links used to transport traffic from wireless base stations to an aggregation point in the network, such as a mobile telephone switching office or other network node (also known as "backhaul).

The middle mile can often be forgotten by policymakers, who may want to focus on backbone or last mile projects.  But building out just those two levels of the network will be ineffective since a bottleneck will exist between the two that will either lead to slow speeds (too much capacity trying to fit onto too small bandwidth) or high costs (lack of competition on middle mile routes), or both.  Hence, policies to address middle mile and backhaul problems, such as promotion of facilities-based competition or open access requirements, are just as important as they are for other parts of the network.

Numerous governments have plans to provide broadband to rural areas through the stimulation of middle mile, regional networks or links. For instance, the Norwegian government has a program to subsidize the roll out of broadband infrastructures in areas with no existing infrastructure in place. The goal of the government is to connect 99 percent of the population through fixed broadband coverage.[85] Similarly, Sweden has a national program that provides funds to municipalities to deploy broadband networks and connect these metropolitan networks with the national backbone network. Despite having almost a third of the population living in rural areas and being a very low population-density country, Sweden has achieved one of the highest broadband coverage rates in rural areas. More importantly, such coverage is mostly based on fiber networks, providing similar high speeds as those offered in urban areas (see Box 2.15).

Developing countries are beginning to focus on backhaul networks as a means to increase broadband deployment.  South Africa, for example, established a state-owned, fiber-based infrastructure provider, Broadband Infraco, to provide national backhaul connections on a wholesale basis.[86]  In Brazil, the government struck an agreement with five fixed-line operators to build out broadband backhaul

networks to 3,439 unserved municipalities in exchange for being relieved of obligations to install 8,000 dial-up facilities.[87]  Numerous other governments have plans to provide broadband to rural areas. For instance, the Norwegian government has a program to subsidize the roll out of broadband infrastructures in areas with no existing infrastructure in place.  The goal is to connect 99 percent of the population through fixed broadband coverage.[88]  Similarly, Sweden has a national program that provides funds to municipalities to deploy broadband networks and connect these metropolitan networks with the national backbone network.  Despite having almost a third of the population living in rural areas and being a very low population-density country, Sweden has achieved one of the highest broadband coverage rates in rural areas (see Box 2.15).

**Box 2.15.  Targeting the rural access gap in Sweden without distorting the market**

The Swedish government established as a goal in its national broadband strategy that all households and businesses should have access to broadband infrastructure.  Indeed, Sweden considers broadband as an essential infrastructure for economic development.  Although the government lets the private sector take the initiative on the expansion of the market, it believes that the ultimate responsibility to ensure access to broadband in all parts of the country rests with the State.  The Swedish government established a program to fund the deployment of broadband networks in those areas where private investment was absent.  The government regularly monitors broadband infrastructure and publishes maps with current infrastructure deployments.  The purpose of the Swedish fund is to stimulate broadband infrastructure roll-out in rural areas, especially low populated areas, where private investment is not present because of economies of scale or threshold market failures.  The plan provides funds for the different steps of the domestic supply chain where network infrastructure is needed: domestic backbone, regional network, local network and access network.

The funds can be executed by local municipalities, which are allowed to build regional and local fiber networks. However, in order to ensure that private investment is not crowded out, the Swedish government established the following conditions:

- The funds must be used in areas with no private operators present;

- Municipalities must conduct a procurement process with open access to private investors in order to crowd in the private sector;

- The network must be open-access for its lifetime with de facto structural separation between the infrastructure provider and the service provider (i.e., any private investor can use the infrastructure to provide broadband services); and

- Fiber networks must be able to allow for high-capacity transmissions, including multimedia applications.

As a result of these measures, Sweden has achieved one of the lowest urban/rural gaps in the European Union despite having one of the lowest population densities in the region.  Indeed, as of 2008 only 1.6 percent of the population remained without broadband access.  Moreover, the rural population has access to similar speed levels as the urban population do thanks to the emphasis on high-bandwidth infrastructure, such as fiber networks. Indeed, Sweden has the second highest penetration of FTTH of the OECD countries.

*Source:  OECD, Broadband Growth and Policies in OECD Countries, (2008).*

From a policy perspective, the issues associated with promoting the development of the middle mile are often similar to those involved with backbone development, namely promoting buildout in areas that may not otherwise attract private sector investment or where competition is limited.  Government

initiatives related to the middle mile often revolve around connecting rural areas that are unserved or underserved and in which market forces have not been able to economically support broadband network development. In today's fiscal environment, where government spending is constrained and private companies may be hesitant to make large investments, governments will have to balance the need to promote increased network coverage with the reality that multiple, competing infrastructures are not likely to be economically efficient in some areas. Other ways to drive availability—as a first step—must be considered. Recognizing the importance of backhaul for mobile broadband in India, for example, the Telecommunications Regulatory of India (TRAI) recommended to the Ministry of Communications that license conditions should be amended in order to allow service providers to share their backhaul links, noting that such sharing should be permitted using either wireless or fiber optic links.[89] TRAI maintained that, particularly where traffic is low in rural and remote areas, backhaul sharing would boost coverage, reduce maintenance efforts, and lower costs. For a more detailed discussion of infrastructure sharing, see Module 3.

## Local Connectivity—the "Last Mile"

Broadband local access networks, sometimes known at the "last mile" or "local loop" refer to the links between the network and the end user. This is the last link in the overall broadband supply chain, and is the most common bottleneck in that chain. As a result, local access issues have been the subject of much attention in recent years as countries have attempted to ensure that their citizens have access to broadband networks—largely through trying to eliminate unserved and underserved broadband areas. The issues in building out networks to end users largely mirror those at other points in the supply chain—promoting greater competition and addressing market failure/monopoly issues—but there are specific problems and challenges that policymakers and regulators must address as they attempt to promote greater broadband development at the local level.

In addition, although there are some common elements, the challenges and solutions to local access issues are slightly different in a wireline as opposed to a wireless context. This is due to the economics of the technologies involved, their different technological bases as well as the different regulatory regimes they have traditionally operated under. The following sections discuss the policy issues associated with wireline and wireless access networks in detail.

**Wireline Access Technologies.** A number of wireline and wireless broadband technologies are used today to support local access networks, including cable television, fiber, xDSL, wireless and/or satellite links (see Module 5 for a complete description of these technologies). DSL is the dominant means of broadband provision today, but cable broadband providers hold significant market share in some countries and FTTP is now being rolled out in many countries. In addition, certain other options are being used for wireline broadband access such as Ethernet-based Local Area Networks (LAN) and Broadband over Powerline (BPL).

Although the availability of many different broadband access options increases consumer choice, stimulates inter-modal competition, enhances quality and innovation and is generally associated with lower retail prices; most areas will not be able to use all these options for historical, technical, economic, regulatory or financial reasons. As governments seek ways to promote broadband development, they will need to recognize the strengths and limitations that their existing level of infrastructure development and market situation provides—both for its upgrade possibilities as well as in developing appropriate incentive and/or competition policies. Policymakers seeking to promote the development of and enhance competition in the last mile face a series of challenges. First, local access networks in most countries were built by (former) monopoly incumbent providers, which were often state-owned. Market liberalization has taken place in many countries—which at least gives alternative providers the

legal right to exist—but such efforts have been limited in their effectiveness in many cases because the historically dominant providers often exercise their incumbent power to stifle competition.  This can take the form of drawn-out challenges to legal and regulatory frameworks as well as anti-competitive conduct designed to hobble new entrants' ability to compete. Another significant problem for policymakers is that the local loop is the most costly and difficult part of the network to replicate by alternative operators. Civil works represent even a higher share of costs (from 50 percent to 80 percent) in the local part of the network than in backbone or middle mile applications. Wiring customer premises, especially at apartment buildings, is also a relevant cost for local network deployment.[90] Together these issues create a market condition where the legal/regulatory situation may not be a "level playing field," where investment costs are high and returns on investment not clear.  Policymakers and regulators must tackle each of these issues if they wish to promote sustainable broadband development.

Governments have adopted varying approaches to promoting competition in the local loop based on their own unique markets.  As a result, the degree and extent of *ex ante* regulation of the access network, particularly on the wireline side, has varied significantly, ranging from a light-handed, deregulatory approach towards more extensive restrictions and obligations.[91]   Many countries, particularly in Europe for example, in an effort to prevent the large incumbent providers from leveraging their market power, have adopted *ex ante* regulations focused on preventing high prices and low quality of service.   Such regulations may also include rules relating to "open access;" sharing of passive infrastructure or more intensive obligations requiring the sharing of active network elements, including sharing access node switches or unbundling the local loop.[92]   A wide range of both developed and developing countries have implemented such approaches, including Denmark, France, Japan, Korea (Rep.), the Netherlands, Nigeria, Norway, Saudi Arabia, Sweden, South Africa and the United Kingdom.[93]

Further, although such open access requirements began with legacy wireline networks (i.e., the old PSTN), they are now also being applied to fiber broadband networks in some countries.  France, for example, has set up extensive regulations governing how fiber should be deployed in the country; defining different approaches for urban and non-urban areas.[94]   Other countries, however, are taking a different approach.   Germany, for example, is pursuing a more *ex post* approach to last mile fiber regulation. The Federal Network Agency decided in January 2011 that in the future, only *ex post* controls would be imposed for new fiber loops from Telekom Deutschland GmbH.[95]

One of the main policies being used to promote retail competition in wireline networks is Local Loop Unbundling (LLU), as detailed in Module 3.  Regulators may use LLU where facilities-based competition is limited or to induce price competition between facilities-based and services-based competitors.  While LLU enables faster market entry by new competitors since they do not have to build out their own infrastructure, LLU can also discourage new infrastructure investment by the incumbent operator. Many countries have required the incumbent wireline operators (which are often the former monopoly providers) to provide wholesale access to its exchanges and the local loop network to enable existing competitors and new market entrants to resell these services to end users without having to build their own networks.  LLU obligations generally involve full unbundling (incumbent must offer wholesale access to the entire copper local loop); line sharing (incumbent provides voice telephony over the copper local loop while competitors provide DSL over the same line); and/or bitstream access (incumbent sells DSL on a wholesale basis to competitors).

Most European and some OECD Asian economies now have laws on LLU, with New Zealand and Switzerland both having put policies in place since 2008.  Other countries, like the United States, have considered, but not mandated LLU or have not yet developed a policy, like Mexico.

Where implemented, LLU obligations have proven quite effective at increasing competition and reducing prices, especially in countries where inter-platform competition (i.e., existing competing

networks, such as cable) was not present or had limited coverage.  Even in countries with existing competitive networks, LLU obligations have reduced prices and increased competition.  On the other hand, countries where LLU obligations have not been implemented tend to have higher prices than those that have imposed such obligations.  For instance, according to the OECD, the average price per Mbit/s in the United States is more than twice as high as in Japan, as of September 2011.[96]  The price of Mbit/s in Switzerland in 2006, before it established LLU obligations, was 19 times more expensive than in Japan and 5 times more expensive than in France.[97] The combination of LLU obligations with other access obligations has also proven successful in increasing inter-platform competition through the ladder of investment (see Box 2.16).

**Box 2.16.  Increasing competition through unbundling of the local loop and the ladder of investment**

LLU obligations are intended to facilitate competition among service providers. They are especially relevant where no infrastructure-based competition (e.g., competitive cable networks) exists because the local loop acts as a bottleneck for the development of competition. In the European Union, LLU is seen as part of what is called the "investment ladder".[98]

The investment ladder allows for the introduction of competition in the broadband market through a set of obligations imposed on the incumbent's network. Each of the obligations in this set is designed to be a "rung" of the investment ladder; imposing a higher level of investment for the alternative operator. As the operator increases its market share and generates economies of scale, it climbs the rungs of the ladder, extending its infrastructure and investment commitment. Ideally, the alternative operator "climbs up the ladder" and ultimately deploys an end-to-end network that allows for infrastructure-based competition in the market.

**France**

France has seen the effectiveness of the investment ladder approach. There was no competition to the wireline networks because there was little cable coverage (around 25 percent of population); therefore, LLU obligations were crucial to introducing competition in the broadband market.[99] France established the three rungs of the ladder of investment, allowing alternative operators to use the incumbent operator's network to gain market share. This resulted in a substantial increase in broadband competition, despite the lack of infrastructure-based competition. About half of broadband connections in France were achieved through the use of these obligations by alternative operators (Figure 2.15).

**Figure 2.15. Ladder of investment in wireline networks in France**
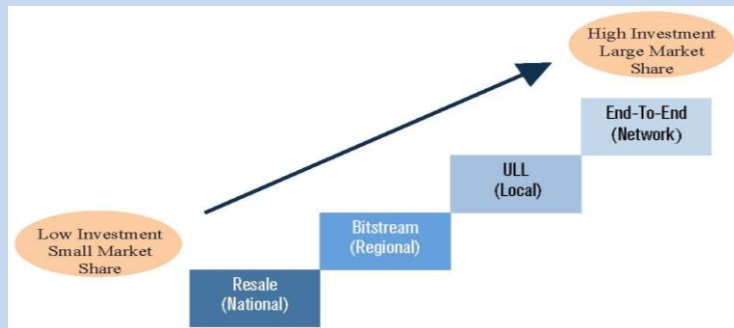


As the operators gained market share, they climbed the rungs of the ladder of investment, from resale to bitstream, and later, from bitstream to share unbundling and full unbundling. The last step was the deployment of end-to-end networks. As of today alternative operators, such as Iliad, are FTTH deployment in France; forcing the incumbent operator, France Telecom, to roll out its own FTTH network.[100] This does not mean, however, that alternative operators will always deploy a full end-to-end

network with national coverage. Usually, they climb the investment ladder regionally, and there are areas, such as rural areas, where low demand or profitability requires them to stay in the bitstream rung.

**The Netherlands**

LLU has even been successful in countries with effective inter-platform competition. For example, the Netherlands had extensive cable infrastructure in place when broadband surged, with cable operators leading the broadband market early on—in 2002, there were nearly one million cable lines, representing about 80 percent of the market. However, the national incumbent telecommunications operator, which could benefit from economies of scale, began leading the wireline broadband race.  The introduction of LLU obligations allowed other DSL operators to enter the market and increase competitive conditions. By 2005, even though cable operators had reduced their market share to 40 percent, alternative operators using LLU had almost 16 percent of the market, containing the incumbent's operator growth in market share.[101] Indeed, a study conducted by the Dutch regulator OPTA concluded that if the Dutch market had only two infrastructure operators, it was unlikely that competition would be as effective as it had been so far.[102]

The combination of multi-platform competition of cable and DSL networks and intra-platform competition through LLU obligations has been very effective in reducing prices and increasing broadband penetration. By 2007, the Netherlands had one of the lowest prices of the OECD and its penetration was one of the highest in the world.[103]

*Source:  Telecommunications Management Group, Inc.*

**Wireless Access Technologies.**  Wireless technologies have become the primary local access solution for many developing countries (see Module 1).  Because the deployment of wireline access solutions has historically been quite slow in many countries, particularly in rural areas, mobile voice networks—largely funded by private investment—have been deployed to offer services to developing country users that had no access before.  And now, because of advances in technology, this model appears set to be repeated in the broadband market.

Technological innovations offer the near-term opportunity for widespread broadband wireless access to the Internet.  As discussed in detail in Module 5, with the introduction of 3G and 4G technologies, wireless networks are expected to compete directly against, and be substitutes for, wireline broadband within the next decade.  In Austria, in fact, the regulator (RTR) determined in 2009 that DSL, cable modem, and mobile broadband connections for residential consumers are substitutes at the retail level.[104]  A 3G technology called Long Term Evolution (LTE) is now being deployed around the world in several frequency bands.  The first deployment was by TeliaSonera when it simultaneously launched networks in Stockholm, Sweden, and Oslo, Norway, at the end of 2009 using the 2.6 GHz frequency band.  Verizon's LTE network launch in the United States in December 2010 is noteworthy for using the 700 MHz frequency band.  Going forward, the next generation of wireless access technologies (so-called 4G) promises even greater speed and broadband capability.  The ITU has been working on standards for the next generation of wireless systems for a number of years.  One of the most significant requirements is peak data rates of 100 Mbit/s for high mobility and 1 Gbit/s for low mobility.  In January 2012, the ITU announced that two technologies met the requirements for IMT-Advanced: LTE-Advanced and WiMAX-Advanced.  Deployment of these technologies is expected over the next several years.

To their credit, policymakers and regulators around the world have embraced the potential for wireless to contribute to larger economic (growth) and social (universal access) goals through its ability to serve unserved areas and provide competition in the local access market.  They have made spectrum

available, authorized multiple licenses and generally provided the regulatory and investment conditions in which wireless was able to thrive.

In fact, many countries have already identified wireless as an integral part of their national broadband initiatives (see Practice Note 2.5).

**Practice Note 2.5. Wireless Components of Broadband Plans**

Wireless National
Broadband Plan_WB.

As governments seek to promote broadband in the local access market, however, a number of challenges specific to wireless will need to be confronted, including lack of adequate spectrum resources to support broadband networks and inflexible regulatory regimes that limit service providers' ability to offer new services or that restrain market forces.  To increase the coverage of wireless broadband networks, governments have pursued numerous policies, the most important of which are: providing additional spectrum for wireless broadband networks, allowing a flexible use of the spectrum, and introducing spectrum trading.  Some governments have also established obligations on wireless providers as part of the licensing process in order to speed deployment and ensure coverage of rural areas.  The following sections explore some of the challenges governments face as they seek to promote wireless broadband and identify potential solutions that can speed wireless broadband development.

**Allocate Additional Spectrum.**  As policymakers and regulators consider ways to promote wireless broadband, it will be important for spectrum policies to consider the expected increases in data traffic that wireless services will generate, both as a result of increasing numbers of subscribers and the use of more data-intensive services and applications.[105]  With subscribers using wireless networks for more of their broadband needs, throughput requirements will increase significantly in the "last mile" wireless link (and also for backhaul and backbone connectivity).  To support this expected increase in demand, more spectrum will likely be needed, especially in urban areas.  To address this need, regulators are implementing policies that promote the most efficient and effective use of spectrum resources, including allocating unused spectrum for broadband use and freeing up underutilized spectrum bands. .

Internationally, multiple bands have been allocated by the ITU for fixed and mobile use that could be used to provide broadband services.  These international allocations are designed to promote harmonization to the greatest extent possible and encourage manufacturers to build equipment for these bands in order to promote economies of scale and scope.  Governments looking to add spectrum for broadband uses can consult with the ITU and its Table of Frequency Allocations to help them identify those bands that might be most suitable in their countries.

**Figure 2.16.  Spectrum Identified Internationally for International Mobile Telecommunications (IMT)**
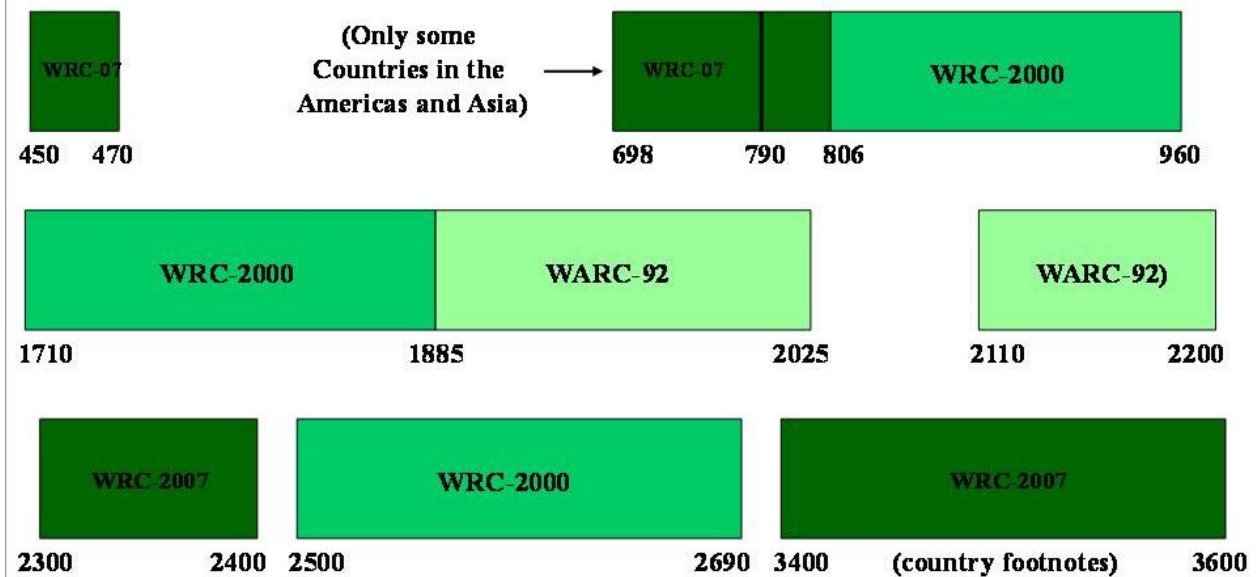


*Source:  Telecommunications Management Group, Inc.*

Spectrum use varies from country to country, and so, the process of finding spectrum for broadband use will differ accordingly.  In many developed countries, for example, the spectrum is often very intensively used.  This makes finding spectrum for broadband uses particularly difficult, as oftentimes existing users must be moved out to clear the way for new uses (sometimes known as "refarming").  In many developing countries, by contrast, the spectrum may be less intensively used, making it easier to find available spectrum that can be repurposed for wireless broadband use.

Most OECD countries have awarded spectrum for 3G and 4G services or are preparing to award it. In European countries, 3G bands were awarded in the early 2000s. Other countries, such as the United States, Canada, and numerous countries in Latin America did not auction 3G spectrum until much later, but permitted operators to use 2G spectrum for 3G services. Countries are also moving towards providing 4G spectrum, which allows higher broadband potential than 3G does. Following the transition to digital television, countries are looking at 700 MHz and 800 MHz as a potential band for 4G technologies. In addition, most countries have also awarded broadband wireless access (BWA) spectrum to provide WiMAX-type technologies, including Korea, France, Germany and Sweden.[106]

So, the first step in finding additional spectrum for wireless broadband use is to take stock of the existing spectrum situation in the country.  This may be as simple as inventorying existing spectrum bands and identifying unused spectrum, or it may entail a much more difficult analysis of inventorying spectrum, determining how intensively various bands are being used, and making political/social/economic value judgments as to what spectrum could be most easily or effectively transferred to wireless broadband use.  Such processes are often the subject of a public consultation, subject to any national security or defense interests, if government-used spectrum is involved.

For many countries that have or are developing national broadband plans, a spectrum inventory process is often an important part in the overall plan.  In the United States, for example, the executive branch made it a priority to find additional spectrum for broadband.[107]  As part of its national broadband plan, the FCC subsequently recommended identifying 500 MHz to be made available for advanced broadband uses.[108]  Other parts of the U.S. government, meanwhile, have begun a process to identify what spectrum might be transitioned to broadband use.[109]

Of course, all of this takes time. From start to finish, the process will last many months at the fastest, but more realistically may take several years depending on how intensively a country's spectrum is used, how many incumbent users might be displaced and the length of any public consultations or proceedings that are required.  In addition, these efforts are often characterized by intense political pressure on regulators and policymakers from all sides—those not wishing to move or who want to be compensated, and those anxious to have access to the spectrum as soon as possible in order to build new networks or serve existing customers better.  When government agencies are the current spectrum holders, this process can be even more politically-charged and challenging.  Therefore, given the rapid diffusion of data-enabled mobile devices, the increasingly bandwidth-hungry nature of the services and applications being developed, and the rapid uptake of such devices and services by users across all socio-economic groups, the process of identifying and transitioning spectrum for broadband use should be started as soon as possible.

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 upfront earnings through spectrum sales but reduce potential investments, or if they want to shift maximum financial resources to investments that will expand the market and hence long-term revenues. In Japan, for example, the incumbent and market entrants did not pay for spectrum when securing licenses to provide wireless services—allowing the companies to maximize infrastructure investments.

The move toward digital television is providing an opportunity to use the parts of the spectrum freed by this move for wireless broadband services. Digital television services are far more spectrally efficient than analog television systems, so the digital switchover frees up spectrum in those bands. This spectrum—the so-called digital dividend—could be used for a range of services, but broadband has been gaining wide support.  The United States and Germany concluded the process to award digital dividend spectrum in the 700 and 800 MHz band in 2010.[110] The United States saw initial deployments of wireless broadband services in this spectrum at the end of 2010.[111]  Sweden completed its 800 MHz auction of the digital dividend in March 2011 with three winners bidding a total of SEK 2.054 billion (USD 325 million).[112]  France held its combined 800 MHz and 2.6 GHz auction in December 2011, raising a total of EUR 2.64 billion (USD 3.45 billion).[113]  Other European countries are planning to award digital dividend spectrum within the next year, including Switzerland and the United Kingdom.[114]

Once spectrum is allocated, there are additional policy and regulatory considerations to consider.  In general, these relate to overall spectrum policy and extend to specific requirements that may be placed on the terms and conditions of a license.  For example, to encourage competition, some government impose spectrum "caps" on the total amount of spectrum an individual operator can have or the amount of spectrum that an operator may have in particular bands or the amount of spectrum it can acquire in a particular auction.  These spectrum caps are designed to prevent the hoarding of spectrum by incumbent operators with greater resources and to promote competition by bringing new entrants into the market.  These types of spectrum caps are not typically static and as services developed, and the needs associated with wireless broadband increase, such caps may be relaxed or lifted in order to allow existing carriers ability to obtain additional spectrum to provide advanced services. In Brazil, for example, the government relaxed its spectrum cap rules when it assigned 3G spectrum.[115]  In addition, it also set a band specific cap for 4G bands, specifically the 2.5 GHz band and the 3.5 GHz, recently.[116]

**Flexible Allocations.**  A second major tool for promoting wireless broadband development is for governments to allow flexible use of spectrum.  Depending on individual circumstance and timing, flexibility may be applied to both current and future commercial assignments, with the objective of facilitating technological evolution and promoting the development of advanced services.  Flexibility in this context is often called technology and/or service neutrality.

Around the world, spectrum management is moving away from traditional administration, which involved allocating spectrum to specific uses, toward more flexible, open spectrum management regimes. To optimize the performance of markets and establish a level playing field for all operators, spectrum management needs to increase the role of market forces in allocating spectrum among uses, assigning it to users, and pricing its use. That may involve a number of arrangements. Some economies use auctions as a market mechanism to assign spectrum (e.g., Germany, Hong Kong, China, Singapore, the United Kingdom, and the United States. At the same time, countries such as Australia and New Zealand are developing markets for tradable spectrum rights. Several countries are also opening parts of the spectrum to unlicensed use, an approach that has encouraged the growth of Wi-Fi networking worldwide. Furthermore, countries are allowing more flexibility in the use of the spectrum. In Europe, countries such as France, Spain, Italy, and Portugal eliminated technology restrictions for 2G spectrum.[117] Countries such as Australia, Canada, the United States, and the United Kingdom allow secondary markets and plan to move forward towards spectrum trading.[118]

Earlier spectrum allocation defined one set of frequencies for one service (i.e., voice, data [including broadband], or broadcasting). Traditional classifications allowed regulators to levy different fees, use different assignment mechanisms, and impose different conditions on different types of spectrum licenses. For example, most countries have assigned broadcasting spectrum for free through administrative licensing, and since the 1990s have assigned telecommunications spectrum through market mechanisms. The terms and conditions associated with a specific service are often embedded in a service provider's license.

Now, however, new technologies enable multiple services to be provided over one network, or allow multiple services to be provided using the same spectrum. As a result, the old, very narrowly defined allocations of spectrum to specific uses is rapidly fading away; being replaced with more generic and flexible allocations that allow providers to best match their network and services to market demand.[119] Wireless broadband extends this concept by expanding potential uses of spectrum—and changing the value of the resource and challenging assumptions about allocating spectrum for specific uses. If there is no longer any difference between these types of spectrum, the old regulatory asymmetries that defined very narrow services cannot stand.[120] Instead, spectrum assignments will need to be—and are increasingly becoming—flexible.

What does this mean for policymakers and regulators? Governments around the world adhere to general guidelines set out in the radio spectrum management frameworks such as those of the ITU. These guidelines provide member countries with some flexibility in allocating spectrum bands for one or more uses. Now, with broadband possible over wireless networks, it might be necessary for a review of these guidelines to align them with emerging technological and market developments. Such a review will ensure the continued benefits of global spectrum coordination and harmonization, while allowing greater flexibility and more efficient utilization.

**Technology neutrality.** The move towards more flexible spectrum allocations reflects, and is derived from, advanced technologies that break down the historical barriers between telecommunications services. As policymakers and regulators consider how best to harness and exploit these new technologies to promote broadband growth, it will be very important not to overly constrain what the technology can do and operators can offer. Governments should seek to provide wireless operators as much flexibility as possible to meet the demands of the market.

The first element in ensuring a flexible environment is to promote technology neutrality. Even as some countries have moved toward technology-neutral spectrum management, others continue to define which technologies service providers should use in a given band. In India, cellular networks must use either the global system for mobile (GSM) or the code division multiple access (CDMA) standard. Now,

with advanced wireless systems such as 3G networks and broadband wireless, countries are defining specific broadband wireless or 3G technologies for use in specific bands, such as the 2.5 GHz band, where both of these technology families lay claim.  However, the EU, by contrast, is making its spectrum more flexible.  In 2009, it issued a Directive relaxing the requirement to use only GSM technology in the 900 MHz band.[121]  It will now be up to the individual EU governments to implement the directive. France, for example, has issued guidelines to its overseas markets on a framework to allow the use of UMTS not only in the 900 MHz band, but also in the 1.8 and 2.1 GHz bands.[122]  Now, advanced technologies can be deployed based on user demand and operator choice.  This should make it much easier for operators to upgrade to new services as technology advances.

Changes in technology are also important to consider when allocating new spectrum or considering how to promote greater flexibility in existing spectrum. One of the starkest examples relates to developments in 3G technology. Because 3G cellular systems appeared some years after second-generation (2G) systems, many countries gave them new bands in which to operate. The most common was the 2.1 GHz, and more recently the 2.5-2.6 GHz band.  Many service providers spent a great deal of money to acquire this spectrum. But 3G technologies are now available for commercial deployment in the bands used by 2G systems. This development is creating debates about fairness in these countries. Service providers that paid large sums to acquire spectrum in the 2.1 GHz band for 3G services now have to devalue their spectrum holdings and face higher capital costs because lower 2G frequencies have better propagation characteristics.  For instance, one Australian 2G operator estimates that it would reduce its capital costs by 40 percent by using the lower frequencies.[123]

The change in the valuation of 2.1 GHz spectrum is an important example of changes in the market and technology and their implications.  The ITU's 1992 World Radiocommunication Conference defined the 2.1 GHz band for 3G services. Eight years later, at the conference in 2000, the 800, 900, and 1,800 MHz bands were defined for 3G services, and by 2006 manufacturers were beginning to develop wideband code division multiple access (WCDMA) and code division multiple access, evolution, data-optimized (CDMA EV-DO) technology in these bands. Similarly, the 2.5 GHz band was originally marked for technologies including 3G and beyond. But the 2007 World Radiocommunication Conference added WiMAX to the list of 3G international mobile telecommunications-2000 (IMT-2000) technologies, thus allowing regulators to attempt to avoid tying spectrum bands to specific technologies.  In fact, the ITU has dropped the term "IMT-2000" now in favor of the broader term "IMT," which is now used in all ITU Recommendations.

Regulatory symmetry requires that spectrum assignments be technology-neutral to promote investment and growth. Otherwise, countries might lose investments and lag behind in growth simply because of their spectrum regimes. For example, 3G services have yet to take off in China, partly because the country delayed spectrum assignment until its indigenous time division synchronous code division multiple access (TD-SDCMA) standard was finalized and ready for deployment.

**Service neutrality.**  In contrast to technology flexibility, which addresses only what technology an operator can use, service flexibility refers to exactly what services an operator may provide.  In the past, as noted above, operators were limited to providing only the services that specifically defined in their license (e.g., voice or video, but not both).  But with the transition to digital technology and better processing capabilities, advanced systems are now capable of transmitting all kinds of services.  Thus, wireless operators can now provide voice, high-speed data services and video over their networks. Service and licensing terms now must be modified to allow the operators to realize the benefits of this flexibility.

Spectrum management is moving towards more open, flexible models. The ideal situation for spectrum management would likely be one where regulators do not specify which services are offered over a

specific band of spectrum or which technology is used to offer them. Instead, regulators focus on promoting competition and ensuring that spectrum users are following certain guidelines—such as noninterference in each others' operations. Flexible-use rules are becoming increasingly common, particularly in the context of discussions about the digital dividend. Many countries are pursuing service-neutral spectrum allocations.[124]  For example, the U.S. FCC allows service providers to use the 700 MHz spectrum for:

> [F]lexible fixed, mobile, and broadcast uses, including fixed and mobile wireless commercial services (including FDD- and TDD-based services); fixed and mobile wireless uses for private, internal radio needs; and mobile and other digital new broadcast operations. These uses may include two-way interactive, cellular, and mobile television broadcasting services.[125]

In the United Kingdom, Ofcom's 2007 statement on the digital dividend outlined how the agency decided that it would give "users the freedom to decide how spectrum is used and clear incentives to use it efficiently." [126] It envisions the uses of this spectrum to be wireless broadband, mobile television, digital terrestrial television, and local television, but does not limit its applications. Ofcom expects that this approach will enable the introduction of innovative technologies and services, increase competition, and provide "a significant contribution to the United Kingdom, as the overall benefit from the use of the digital dividend is estimated to be GBP 5 billion to GBP 10 billion (USD 9.8 to USD 19.6 billion equivalent) of added benefit to the economy over 20 years."[127]

For the ultimate in flexibility, some regulators are actively organizing the spectrum as a "commons," expanding on the idea and success of unlicensed spectrum. Supporters argue that a commons regime creates incentives to innovate and develop spectrally efficient technologies such as smart radios, which automatically detect and use vacant spectrum. Further, these efficient technologies reduce spectrum scarcity by creating more efficient systems such as mesh networks. Commons regimes do not place restrictions on the network bandwidth assigned to specific networks— allowing networks based on new ultra-wideband technologies, for instance, to provide high-speed connections not otherwise possible.

Indeed, a similar mechanism has already worked in many countries with unlicensed bands in the 2.4 GHz and 5 GHz spectrums. Aside from simple rules limiting the maximum transmitter power or defining the rights and responsibilities of spectrum users in terms of interference, there are no technology or service limitations.[128] This open band has been credited with spawning Wi-Fi technology. Wi-Fi was among the earliest wireless technologies supporting wireless triple play.  Similar outcomes are possible in an open and flexible environment for spectrum use.

Moving to these more flexible spectrum use regimes will enable broadband by supporting the development of new technologies, the entry of smaller or new service providers, and more efficient spectrum use.  Efforts to link revisions to the spectrum management regime thus can be linked to moves toward a converged regulatory regime.

**Greater Use of Market Mechanisms Can Promote Broadband.**  Markets can usually act faster than governments to match supply and demand for spectrum services.  As a result, governments are increasingly seeking to rely more on market forces to help them meet wireless (broadband) needs.  The move to market mechanisms is evidenced by two important trends: assigning spectrum to operators using a competitive process and charging market-based prices for acquiring or using spectrum. Having a competitive, transparent means of assignment also gives service providers greater access to spectrum. In conjunction with a regime that allows flexible use of spectrum, such competitive assignment enables new models of service provision.

Spectrum trading is another important development. Implemented in countries such as Australia and New Zealand, this approach allows later entrants to a market to purchase spectrum use rights from

existing licensees, thereby reducing constraints on the timing of their market entry. In the absence of secondary market mechanisms through spectrum trading, new service providers would have to wait for government-administrated assignment, which may slow the rollout of new services and reduce the potential for competitive service provision.

Despite the important advantages of moving toward more flexible arrangements for spectrum assignment and a greater role for market forces, there are also risks that in a poorly regulated environment, some firms could establish or reinforce market power by controlling key high-value spectrum bands. Thus, it is critical to ensure that the outcome of moving toward market mechanisms is an increase in market competition, supporting the introduction of new services and providers. Moving toward market-based assignment, pricing, and use will allow new service providers to access spectrum competitively, allowing them to provide innovative services over wireless networks.[129]

**Coverage Obligations.** Another way in which governments can promote wireless broadband availability throughout a country is to establish coverage obligations at the time of initial licensing. In fact, most licenses include specific coverage obligations in their terms and conditions. Denmark, for example, has established coverage requirements for the 800 MHz band digital dividend licenses to be auctioned in May 2012.[130] The coverage obligation in Denmark is pursuant to the government's objective of ensuring universal access to a broadband connection of at least 100Mbps by 2020. As such, the coverage obligation on 800MHz licenses carry will be aimed at providing mobile broadband to areas where broadband is not currently available. In such areas, licensees will be required to cover 99.8 percent of households and enterprises and provide 98 percent outdoor coverage (excluding forests) with a mobile broadband service of at least 10Mbps by the end of 2014. The coverage obligation can be met by using frequencies governed by the license or other frequencies available to the licensee.

License requirements tied to coverage obligations, however, must be carefully considered. Requirements that are too easy to meet run the risk of not significantly expanding broadband coverage. Conversely, overly strict requirements are unlikely to be met, and could result in either no interest in a license (meaning nothing would get built) or lower payments if the license is awarded through an auction.

## 2.5 Encouraging Adoption: Promoting *Demand* for Broadband

As discussed in Module 1, the broadband ecosystem involves more than just the physical networks; it also includes applications, services, and users. Policymakers have thus begun to realize that simply focusing on building networks may be necessary to promote broadband development, but it is not sufficient. As a result, demand stimulation is becoming an important part of broadband development strategies and policies across the world. Addressing demand-side issues is important because constructing networks and providing services entails significant costs and risks for investors, particularly if they are unsure if there is an audience for their products. To help reduce such risks, government may need to assist broadband development by raising public awareness of and stimulating demand for these services.

In general terms, demand for broadband services, applications and content is thriving and may not appear to need a large amount of government effort to spur adoption by those who have broadband access. Broadband use is clearly growing quickly and is heavily driven by private sector content and, to a lesser but important extent, user-generated content. In 2010, for example, 40 percent of all consumer Internet traffic was video[131] which was 1.6 times the video traffic of the previous year and mostly comprised of private sector-created or user-generated video.[132] In addition, with the first availability of broadband services, demand (measured by subscriber growth, for example) may be initially very high—

reflecting pent-up demand among users who previously had no broadband access.  In such cases, governments may decide that there is no need for demand stimulation.  In Kenya, for example, at the end of September 2010, broadband subscriptions increased to 84,726 subscribers from 18,626 in the previous quarter (a growth rate of over 450 percent) without any specific attempts by the government at demand-side stimulation.[133]  Nevertheless, in most high-penetration countries, governments have sought to complement supply-side policies that focus on building infrastructure with demand-side efforts that seek to drive demand for broadband access and services.
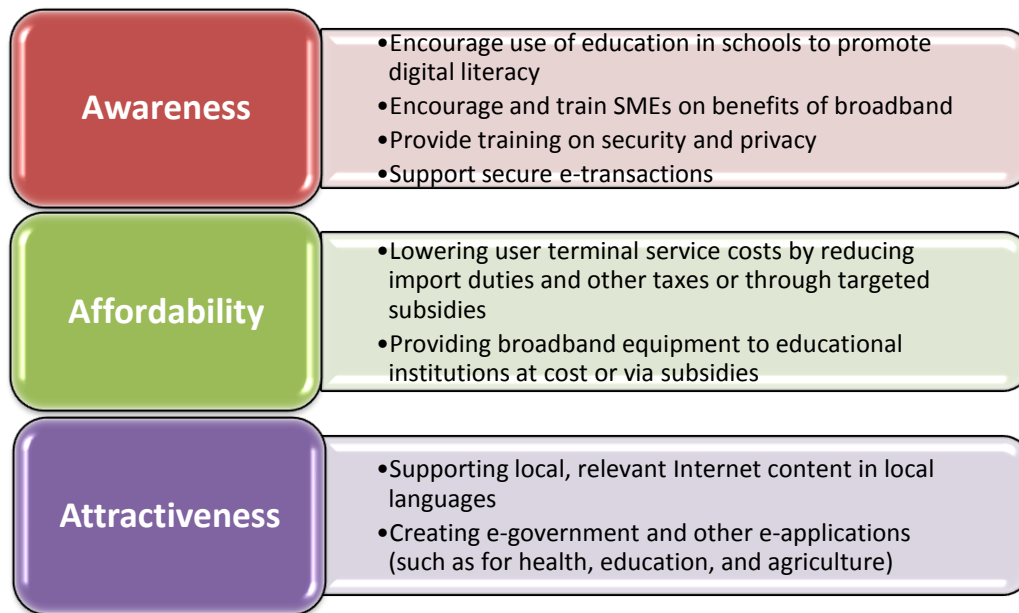
Policies to promote demand will need to be tied to the development of the broadband market.   In the early stages of broadband market development, policies may need to focus on educating population at large of the benefits of broadband and educating them in how to use it (digital literacy).  As time passes, however, demand growth can be expected to slow as the potential pool of users evolves from motivated early adopters to potential users that do not necessarily understand all that broadband has to offer and may be concerned with the potential threats to privacy and data security.  This is when government policies to stimulate demand may have the most beneficial impact by targeting potential users, such as elderly persons and those in disadvantaged groups, who may not be able to afford or are not aware of the benefits offered by broadband.[134].  By educating users through digital literacy programs, governments can help drive adoption to a broader user base and educate them at the same time.  Such programs may become increasingly important in order to avoid the social and economic inequities associated with broadband "haves" and "have nots."

The role of government in stimulating demand will vary by country.  In some countries, with more technically literate populations, there may be less need for direct government intervention.  The appeal of social networking and video streaming as an entertainment source may be more self evident than more mundane uses such as e-government or multimedia mail.  In such cases, demand will be driven by attractive offerings made available by private sector developers.   In other cases, however, basic illiteracy, lack of understanding of what the Internet can do, or cost may require governments to step in to help fill out and aggregate demand particularly among at-risk groups.  Policies to support digital inclusion will be an important leveler to ensure that broadband can bring benefits to all segments of the population.

## 2.5.1  A Model of Demand Facilitation

Demand facilitation or stimulation refers to efforts to boost the adoption and use of broadband networks and services.  Such efforts typically address three broad categories of issues:  awareness, affordability, and attractiveness (see Figure 2.17).  In order to drive broadband adoption and use, policies must address these three categories, especially targeting those populations that are generally less likely to adopt and use broadband Internet services.  Mechanisms to address awareness include improving digital literacy, and encouraging the use of broadband in education and small and medium enterprises (SMEs), while affordability efforts focus on costs of both hardware and services, and attractiveness initiatives include promotion of services, applications and local content as well as delivery of government services over the Internet (e-government).  E-literacy and e-skills, in particular, are vital for broadband diffusion to succeed.  Recognizing this, governments with high penetration and adoption have been very active in trying to raise e-literacy.

**Figure 2.17.  The Three Pillars of Facilitating Broadband Demand**

| Awareness | •Encourage use of education in schools to promote digital literacy<br>•Encourage and train SMEs on benefits of broadband<br>•Provide training on security and privacy<br>•Support secure e-transactions |
| --- | --- |
| Affordability | •Lowering user terminal service costs by reducing import duties and other taxes or through targeted subsidies<br>•Providing broadband equipment to educational institutions at cost or via subsidies |
| Attractiveness | •Supporting local, relevant Internet content in local languages<br>•Creating e-government and other e-applications (such as for health, education, and agriculture) |

*Source:  Adapted from Yongsoo Kim, Building Broadband: Strategies and Policies for the Developing World, World Bank (June 2010).*

Demand facilitation strategies can be included in top-down national plans, can originate from grass-roots efforts or can involve the public and private sectors, as well as civil society.[135]  The scope of such strategies may be targeted at one particular obstacle to access, such as the high cost of connections or computer ownership, or may be broader, resulting in more comprehensive programs that attempt to address multiple barriers.[136]  The Dominican Republic, for example, established legislation to address not only the financing mechanisms needed to achieve broadband, but also the deployment of infrastructure and the acquisition and installation of terminal equipment such as computers, smartphones and other devices that enable consumers to use a  broadband connection.[137]  Demand facilitation may also involve packaging broadband with applications that appeal to specific sectors of the economy or groups within society.     These three main categories—or pillars—of facilitating broadband adoption are discussed below.

## 2.5.2  Awareness

Awareness of the benefits of broadband is an important first step in building demand for broadband services.  Despite relatively rapid deployment and uptake among some segments of the population, broadband is still unknown or not fully understood by many potential users, particularly in developing countries and particularly among specific populations in both developed and developing countries. Quite often, those lacking basic awareness of broadband tend to be those living in remote areas and/or members of a historically disadvantaged group, such as the elderly, women, people lacking formal education, people with disabilities, and the unemployed.  These groups need to be included in plans to enhance digital literacy in order to allow them to benefit from broadband and broader ICT services and applications.  Some of the reasons why people do not use broadband are discussed in section 2.2.3 of this module.

As policymakers seek to extend the use of broadband to more users, they will need to consider the full range of barriers to adoption and use and develop appropriate policies to address them.  Given the diversity of issues and the different needs of the different populations, it is likely that a range of

programs and initiatives will need to be developed. This is particularly critical given that as the average level of broadband penetration in a country grows, the social and economic costs of being excluded from access also increase.

In order for people to successfully use broadband, they must have the necessary interest and competency.  This is sometimes referred to as digital literacy, which has been defined as "using digital technology, communications tools, and/or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society."[138]  Digital literacy ideally makes users aware of and capable of accessing broadband applications and services.  This, in turn, widens the information available to them, provides new ways of learning and creates new employment opportunities.

There are several challenges to improving digital literacy.  First, some studies suggest that most people learn about ICTs informally through their own initiatives and assistance from friends, family and colleagues, rather than through formal education or training.  As a result, motivating people to continue to learn on their own is essential in order for them to adapt to the constant evolution in broadband services and applications without having to always resort to more formal (and expensive) training.  Second, although training is important, it does not necessarily build peoples' understanding of how broadband and associated technologies can transform their lives.  This risks the creation of a "value divide" in terms of the people who have broadband, but who widely diverge in their ability to derive value from it.  Programs must find ways to show people how broadband can be integrated into, and improve, their personal and business lives.  Finally, as broadband spreads to other platforms, particularly mobile phones in developing countries, the notion of digital literacy, which has typically been associated with learning on PCs, must be adapted to entail familiarity with using applications and services delivered via various mobile devices such as smartphones and tablets.  As further detailed in Module 6, there are several elements to consider when adopting formal training initiatives:

- **Basic Digital Literacy:** Basic digital literacy skills may be taught as part of general educational programs.  The extent of such need varies depending on the level of sophistication of the ICT sector and overall educational background of a country's inhabitants, but may encompass basic literacy (the ability to read and write); computer literacy (knowledge of how to use a computer keyboard and mouse); and online literacy (ability to use online resources and services).  Basic (and some advanced) skills are increasingly offered to students as part of their regular education curriculum, while adults or other potential user groups can obtain skills through community learning centers or similar institutions.  In addition, basic skills development may be needed by those who have been bypassed in the acquisition of ICT skills through formal primary and secondary education—either because they did not complete schooling or because ICT training was not available.  See Module 6 for further details on promoting digital literacy through the education system, community access centers to enhance digital literacy and advanced training for broadband development.

- **Small and Medium Enterprises (SMEs):**  One particular group that governments may wish to focus on for purposes of demand stimulation is SMEs.  Such companies may not have ICT expertise or knowledge of how broadband can benefit their business functions.  An Internet presence supported by broadband can help SMEs by providing them with the ability to reach new customers, interact with a wider range of potential partners, and tap a wide range of resources to support their business.  Concentrating on SMEs may also have important "pass through" effects, allowing governments to reach their employees at the same time.  SMEs are also likely to find e-government programs particularly helpful in interacting more efficiently with the government, whether to apply for permits, file taxes or supply/obtain government services.  To help SMEs use broadband networks and services most effectively, governments have

adopted a variety of innovative outreach programs. See <mark>Module 6</mark> for details on how countries have included SMEs in demand-side policies.

- **Privacy and Security:** As policymakers and private sector service providers consider ways to increase broadband use and promote online participation in personal, professional and governmental activities, privacy and security concerns will have to be addressed. Many potential users may be afraid of using broadband services for reasons related to privacy, security or identity theft. While consumer privacy and data protection is not a novel subject, broadband diffusion and technology innovation compound the potential risks of the collection, use, protection, retention, and disposal of a wide range of personal information. Increased data processing and storage capabilities, advances in online profiling, and the aggregation of online and offline information are allowing a diverse set of entities to gather, maintain and share a wide array of consumer information and data.

To address such issues, countries will likely need to revise their existing laws and regulations regarding privacy and data protection to ensure that they are relevant and applicable in the broadband context. This will require frameworks that strike the appropriate balance between the benefits to citizens and consumers of new and innovative technologies and the risks such technologies may create to their privacy and personal data. To date, two broad approaches towards personal data protection have been adopted around the world. Many countries, such as EU member states and many Latin American countries have opted for a rights-based approach to personal data protection. Under this system, personal data protection is regulated as a fundamental right[139] that applies to all personal data, irrespective of the type of data.[140] By contrast, countries such as the United States have mostly relied on "broad self-regulation and targeted sectoral legislation to provide consumers with data privacy protection."[141] Recent developments seem to be merging the two approaches, with the European Commission and the U.S. Federal Trade Commission proposing many common changes and upgrades to privacy protection in the wake of rapid technological developments associated with broadband services and the Internet.[142] This includes placing emphasis on informed consent, increasing the transparency of data collection, raising awareness, and increasing responsibility of data controllers (i.e., privacy by design).[143] See <mark>Module 6</mark> for further information on how training efforts can promote demand for broadband by alleviating concerns over data privacy.

## 2.5.3 Affordability

Another significant barrier to greater broadband use for many potential users is cost. In identifying demand-side barriers to broadband adoption, policymakers around the world have identified affordability as one of the main reasons that people do not use broadband services where they are available. The Pew Internet and American Life Project and the U.S. Department of Commerce, for example, have found that lack of affordability is one of the central reasons cited by those in the United States who do not subscribe to broadband at home.[144]

If a broadband access infrastructure is in place, users must be able to afford all costs associated with the broadband service. Two factors are important here: the ability to afford the hardware (e.g., personal computers, laptop/netbook computers, and smartphones) necessary to access the network, and the ability to pay for network access (e.g., recurring monthly service charges). The issue is that some users simply cannot afford either the upfront costs of equipment or the ongoing costs of broadband access plans.[145] In many developing countries, as well as among the low income populations in developed nations, the costs associated with hardware and network access are often substantial relative to income levels. While potential users may have acquired the necessary digital literacy skills, they may be hampered from making effective use of broadband services without affordable connections, services

and devices.  In addition, issues of affordability are often more pronounced in developing countries than in more developed nations.  Research by Ovum in 2010, for example, showed that prices for broadband services are up to three times higher in 15 emerging markets than in developed countries, despite lower wage levels in the emerging markets.[146]  Therefore, governments may opt to focus on providing support to consumers who cannot otherwise afford these costs, including through assistance to purchase broadband-enabled equipment (computers, smartphones, tablets, etc.), initial installation (up-front costs), or ongoing network access (subscription) fees.  As described further in Module 6, such support may be provided in a number of ways, including by:

- Subsidizing equipment and service providers, who in turn offer discounted prices to target population groups at less than prevailing prices;

- Providing subsidies directly to target users for the specific purpose of helping them pay for broadband;  and

- Including broadband access in lump-sum income support to households.[147]

## Equipment Affordability

The realization that demand for communications services, including broadband, does not generally increase if citizens do not have access to a personal computer (PC) or other broadband-enabled device has spurred policymakers around the world to introduce measures to facilitate ownership of devices or computers.   In fact, most policies that target affordability have focused on reducing the price of access devices.  The range of broadband devices is expanding and includes more traditional means of access, such as PCs and laptops, as well as smartphones and tablets.

There are numerous examples of innovative programs that have been successful in getting such devices into the hands of prospective users.  As discussed in more detail in Module 6, countries have introduced a variety of programs to subsidize the purchase of broadband-enabled devices. Some countries provide tax breaks for individuals and businesses to purchase PCs by allowing pretax income to be used or establishing a tax rebate for these purchases.  In France, for example, students receive a 50 percent tax refund for the costs of PCs, which has resulted in a surge of mobile broadband/netbook bundles offered to students by 3G mobile operators (see Box 2.17).  As addressed in Module 6, some countries, such as Italy and Korea, have also subsidized broadband connections.[148] In the case of Korea, subsidies focused on SMEs.[149]   However, for many people in developing countries, even discounted devices may be prohibitively expensive. [150]

**Box 2.17.  Country examples to make broadband hardware more affordable**

- France:  In France, the government offered a 50 percent tax refund to students buying a PC. Seeing a potential market untapped, mobile operators have been taking advantage of the government subsidy and have designed mobile broadband offerings to target students. For instance, Orange offers mobile broadband bundled with netbooks low-cost models to students with specific discounts. The addition of the government tax refund and other programs to facilitate PC access to students has made these offerings very attractive to the targeted group. For instance, Orange take up rate of the initial netbook bundle offering was above 50 percent.

- Netherlands: The Dutch government enacted a similar tax break that effectively reduced the cost of buying personal computers by 40 percent.  Under the program, which ran from 1997 through August 2004, Dutch workers could buy home PCs with pretax euros if the devices were also used for business. Employers deducted the purchase from pretax wages. The benefit could be claimed to buy a new computer every three years.

- United Kingdom: The UK's Home Access Programme addressed the needs of children in state-maintained education without online access at home. In February 2009, the government began a pilot across the regions of Oldham and Suffolk where local authorities began targeting families with children who could not afford home broadband access.  Packages were offered that provided computers and one year of internet access.  The program was so successful that it ran out of funding in May 2009.  A national version of the program launched in late 2009, but was wound down as a result of budget cutbacks across the UK government in 2010.  The final program applications were accepted in November 2010.  At that time, the agency administering the program noted that more than 250,000 families had benefited from increased access to technology at home, and 8,000 children with disabilities received technology tailored to their specific needs.  The town of Milton Keynes has an active subsidy program with a wide range of options for low-income residents.[151]  "Loaner" computers are available for ₤1.5/month and users can get a free laptop with a two-year subscription.

*Sources: Robert D. Atkinson, Daniel K. Correa, and Julie A. Hedlund, Explaining International Broadband Leadership, The Information Technology and Innovation Foundation (May 2008), available at http://www.itif.org/files/ExplainingBBLeadership.pdf.; World Bank, Facilitating Broadband Development: Funding Options, August 2010, available at http://www.itu.int/ITU-D/asp/CMS/Events/2010/ABBMN/S1A_Ms_Tenzin_Norbhu.pdf.; S. Grant and C. Laux, Mobile Broadband for the Masses (Cambridge, Mass.: Pyramid Research, 2009*

Despite such initiatives, computers for personal use are still very rare throughout many developing countries.  Mobile phones, however, have taken the world by storm, with an average global mobile penetration rate in 2011 of 87 percent, with 79 percent penetration in developing countries.[152]   In recent years, mobile service providers have begun to offer broadband services in addition to voice telephony and narrowband data services.  It is also becoming increasingly common for operators to offer discounted up-front prices for smartphones and other mobile devices to customers who sign up for a one- or two-year mobile broadband service contract.  The mobile phone subsidization business model is not without its detractors, and the practice is illegal in some countries due to concerns that consumers may be paying more for the device over the course of the contract than if the device were purchased up-front, as well as concerns that subscribers with an operator-subsidized device is "locked in" to that operator's network and cannot easily switch service providers.

## Broadband Access Affordability

In addition to the costs of purchasing a broadband-enabled device, lack of demand for broadband among low-income users is also often due to the recurring costs of the broadband access service.  In order to make broadband access more affordable, many governments have opted to subsidize subscriptions for low-income households.  See Module 6 for more information on country initiatives that provide reduced rates for broadband access services for targeted populations.

Where it is not feasible to provide subsidies for broadband access, or in addition to such subsidies, governments may also consider using community centers to provide low- or no-cost access to broadband services.  Establishing locations where users are able to share broadband access is an important tool to enable broadband adoption and drive demand for otherwise willing and skilled persons who lack the financial means to purchase devices or pay long term (contract) access charges.  Module 6 further addresses how countries are incorporating publicly funded community centers and for-profit Internet cafes into plans to help drive broadband demand, as well as increase access to broadband services and applications.

## 2.5.4 Attractiveness

Even after addressing the issues associated with awareness and affordability, barriers may still exist to greater broadband use. In order to generate demand for broadband, consumers must not only be aware of and able to afford broadband, but they must also see the relevance and attractiveness of it. Many people simply see no need for the Internet or broadband access, or do not use the Internet because of concerns over privacy or data security. Such issues must be addressed for broadband to be fully adopted throughout a country.

Attractiveness is facilitated by ensuring that the market provides sufficient choice and diversity of services, applications and content to appeal to all consumers. Actions to boost broadband demand are generally aimed at both consumers and businesses to encourage them to produce and consume content, services and applications.[153] This section identifies how governments and the private sector can encourage demand for broadband through the promotion of services, applications and content that people and businesses find compelling and valuable and want to use.

### Services to Drive Broadband Demand

Services refer to the basic connectivity function of providing access to the Internet, as well as value-added features that broadband operators include with the broadband subscription and that meet specific quality guidelines. Within the broadband ecosystem, the availability of services is an important factor that can help drive demand. The success of policies that encourage the development of new services will, of course, be affected by the attractiveness and affordability of the service offerings. As further detailed in Module 6, there are a variety of services available that can help drive broadband demand, including:

- **Internet access:** The way that a broadband Internet subscription is provided can impact attractiveness and will depend on the technology as well as regulatory and business considerations. This includes whether the broadband subscription can be purchased on its own or requires a subscription to an underlying transport technology. For example, in the case of digital DSL, a telephone line is required. Subscribers have typically been obligated to pay a monthly rental for the telephone line in addition to the broadband subscription even if they do not use the telephone line for anything else but broadband. This adds to costs and may require an extra bill, discouraging users from taking up the service. Some operators include the telephone line with the broadband subscription so there is no separate bill. In a few countries, the cost of the physical broadband connection is billed separately from Internet access. In other words, the user needs to pay one bill for a broadband connection and another bill to an ISP for Internet access. Other factors to consider are data or usage caps that limit the amount of data that a subscriber can use in a month. Some operators distinguish between domestic and international use by having no cap or a higher cap for traffic to domestic sites, and a low cap for access to sites hosted abroad. One issue with caps is that users often do not understand the relation between volume and their usage needs. Users can easily underestimate how much data they will use, particularly if they access a lot of video services or use peer-to-peer download services (some of which may run in the background). This makes it difficult for them to know which package to select when choosing amongst different data plans. Some operators cap usage through time rather than data volume, such as a monthly subscription of 20 hours.

- **Voice services:** Voice telephony continues to be a popular service, if not the most popular service worldwide. A growing number of broadband operators offer Voice over Broadband (VoB) service, which is a managed service (unlike VoIP, which is generally considered an "over the top" application).[154] VoB provides the same quality as a traditional fixed telephone and

often provides other value-added features such as call waiting, voice mail and speed dialing, as well as the ability for users to monitor these features online via the provider's web site.  The price structure for VoB is often made attractive by including unlimited national calls for a flat rate or even including free national calls with the broadband service subscription.  Since the service works through the broadband modem, users do not need to be connected to the Internet nor do they even need a separate Internet subscription.

- **Video services:** IP-based routing allows video services to be provided over a variety of networks.  This has allowed broadband operators to provide Internet protocol television (IPTV) or video on demand (VoD) services.   These services allow end users to access Internet-only video programming, such as video clip sites or to select a favorite movie or show for viewing on demand.  The ability to provide IPTV and/or VoD can make operators' broadband services more attractive, especially when other features are included such as access to special programming not available elsewhere.  However, there may be a number of regulatory considerations with these video services, such as requiring a specific type of IPTV license or adherence to copyright laws or other content regulations.[155]

- **Bundling multiple services:**  IP-based technology and digitization of information and media allow a single network to offer voice, data and video services in a single bundle, which often reduces the total cost of the service (that is, the bundled prices is less than the cost of buying the same services individually) and the benefit of receiving just one bill.  Bundling should be encouraged due to these benefits, although regulators may want to ensure that consumers maintain the option to select only one service and not be obligated to purchase additional services.  In order to enable service bundling, regulators should ensure that licensing rules permit service providers to offer a variety of services.

- **Government services:**  Aside from the more well-known commercial information and communications services available over the Internet, government services can also serve as a demand driver for broadband.  Generally, such government services include:  1) making government information available online; 2) conducting online transactions with the government; and 3) participating in the political process online.  Although these may not be the main drivers of broadband demand, government services can contribute to the overall usefulness of the Internet and make interacting with the government much easier.

- **Health services:**  E-health involves a variety of services and tools provided by both the public and private sectors, including electronic health records (EHRs) and telemedicine.  Broadband healthcare services and applications have the potential to lower costs and lead to better health outcomes.  For example, broadband capabilities are essential to medical evaluation and other medical applications that use imaging extensively.  High-definition video consultations allow rural patients and immobile patients to be seen by specialists in a timely manner when urgent diagnosis is needed and a specialist is not able to travel to where the patients are located.  Other e-health services and applications include digital patient records; remote monitoring, where caregivers monitor key vital signs from a remote location, such as for diabetes or congestive heart failure patients; and access to medical information materials and advice.[156]  With the explosion of mobile devices in low-income nations and the relative lack of wireline broadband penetration, mobile-health (m-health) is establishing a new frontier in health care in those countries.[157]

- **Financial services.**  Online banking has evolved considerably, with the Internet becoming an integral part of the delivery of banking services around the world.  It is generally recognized that

e-banking services can provide speedier, faster, and more reliable services to customers, and thus also improve relationships with customers.  Although many types of Internet connections have online banking capabilities (for example, some m-banking transactions are conducted with narrowband SMS messages), high-speed connectivity is essential for more advanced e-banking activities.  Delivering financial services to low-income users through e-banking can also offer the potential to dramatically decrease operational costs, improve the quality of financial information, allow for "video chats" with bank representatives and make banking for low-income users more profitable and less risky for mainstream financial institutions.[158]  For these markets in particular, mobile money services that allow users to make payments and remittances, access existing bank accounts, conduct financial transactions, engage in commerce, and transfer balances have proved to be of particular importance, including in Afghanistan, Bangladesh, Kenya, Indonesia, Pakistan, the Philippines, and South Africa.[159]

## Applications to Drive Broadband Demand

Applications are function-specific software programs that use a broadband connection to deliver content to users.  As with services, broadband-enabled applications can spur adoption of broadband access by increasing the value of broadband.  Applications add value to broadband, as they provide tools and services that are tangible and useful for both consumers and businesses.   The range of new applications that has been developed over the last decade is tremendous.   New and innovative applications improve business efficiency and productivity, as well as provide new ways to personally interact through social networking applications.  The dynamic nature of application development is clear in the various "app stores" that have sprung up around the various mobile device platforms, which now have hundreds of thousands of "apps" with downloads that are already into the tens of billions only a few years after their inception. See Module 1 for details on various social media applications, as well as further understanding of their importance in promoting broadband uptake.

Importantly, most of the development for applications has taken place in and been driven by the private sector.  Given the success of such efforts, government action may not be necessary to promote the development of more innovative applications.   However, countries may need to revise their laws and regulations regarding intellectual property and privacy, for example, to protect those who develop and use such applications.  Other content-related issues may also appear in the application development context.

## Content to Drive Broadband Demand

Content is linked to applications and services and generally refers to the information viewed, created and shared.  Useful content is an essential underlying element of broadband adoption.  In particular, the development of local content is important as broadband Internet access becomes more widely available in countries where there are relatively few websites offered in countries' dominant or native language.  Policymakers can play a key role in promoting local content, as well as digital content generally, as outlined below.  For further details on creating compelling and local content, see Module 3 and Module 6.

**Promoting Local Content**. Native English speakers currently account for the majority of Internet users around the world; thus, most web content is in English.[160]  Although English continues to dominate, the number of Internet users in China is quickly rising and is expected to exceed the number of English language users in the next five years.[161]   Despite this shift, a significant obstacle to Internet and broadband use by non-English speakers is the scarcity of content in their own languages.  Policymakers are expected to increase efforts to ensure that local, relevant and interesting content is produced in order to increase the demand for broadband services in their countries.  In addition to direct grants for

the production of local content, governments can support the development of local content and applications in other ways, such as the development of standardized keyboards, character sets and character encoding. This type of indirect intervention would impact on the content available by enabling users to create content in their own languages.[162]  Additionally, translation and standardization of operating systems into local languages can help to facilitate the development of local applications that are relevant and comprehensible to local users.[163]

Governments can also play an important role in developing local content and local applications by directly creating local content and local applications in the form of e-government applications as described above.  As policymakers seek to drive demand and enhance the development of (local) content, several legal and regulatory issues arise, generally around the issues of freedom of expression, content regulation and intellectual property rights.  The laws and rules that regulate content in the offline world have been gradually applied to and adapted for online content, even as the pace of innovation online threatens to perpetually render them obsolete.  Online content can be produced by traditional methods or generated collaboratively by the users themselves—it can be a song played by an Internet radio station, a viral video in an embedded YouTube clip, a blog post, or a news article published by a news website. The creativity that broadband services make possible will increasingly run up against a legal/regulatory regime that was developed in the days of printed books and film cameras—both of which are rapidly being superseded by their digital counterparts (e-readers and digital cameras).

**Policies to promote freedom of expression.** One of the fundamental rights of persons is the right to freedom of opinion and expression, which includes freedom to hold opinions without interference and to seek, receive, and impart information and ideas through any media and regardless of frontiers.[164] Content regulation, including surveillance and monitoring of Internet use, needs to take into account the standards set by international human rights law, and have regard to the unique nature of the Internet. A recent report by the Special Rapporteur on the Promotion and Protection of the Right to Freedom of Opinion and Expression of the United Nations' Human Rights Council notes that any restriction by a state of the right to freedom of expression must meet the strict criteria under international human rights law.[165]   The report concludes that there should be as little restriction as possible to the flow of information via the Internet, except in few, exceptional, and limited circumstances prescribed by international human rights law.  It also stresses that the full guarantee of the right to freedom of expression must be the norm, and any limitation considered as an exception, and that this principle should never be reversed.[166]  With faster speeds, and in particular faster upload speeds, broadband can facilitate collaboration as well as access to information.  As more and more Internet users employ the web, not just to consume but also to share, the Internet can become a virtual town square for citizen participation.  By the same token, restrictions on Internet use, the censorship of certain information or even restrictions on access posed by "net neutrality" concerns can cut off this vital avenue for citizen engagement.  Governments will need to strike a balance between the legitimate need to restrict illegal content and the rights of users to participate freely and lawfully in cyberspace.

**Content Regulation.**  Countries have different social, cultural, and moral traditions.  These traditions generally are enforced by legislation that prohibits the display or dissemination of certain types of content.  Governments have legitimate reasons to regulate content: protection of minors, prevention of vices and national security, to name a few.  There will inevitably be tensions as countries attempt to strike the right balance between the regulation of content on the Internet and the protection of fundamental rights, such as freedom of expression and information, which are strongly enabled by broadband.  The widespread access to the world's information and entertainment sources made possible by broadband-enabled Internet will make such restrictions more difficult to enforce. Rather

than pursuing policies that could be seen as censorship, there are other options that achieve the goal of restricting certain types of content.  For example, the movie and videogame industries, among others, voluntarily rate their content in order to help consumers identify content appropriate for themselves and their families.  The Family Online Safety Institute (FOSI), an international nonprofit organization, administers a program whereby websites rate their content in terms of language, violence, sexual content, etc., in response to a standard questionnaire.[167]  In addition, commercial vendors have developed PC applications that employ keyword-based filtering to allow parents to control the kinds of websites their children can visit.  Similarly, the development of industry codes of practice relating to online content may be another viable alternative to government regulation.  However, a growing number of countries are implementing Internet controls of ever-increasing sophistication, including monitoring and filtering.[168]

**Intellectual Property Rights (IPR).**  Compared to the limited bandwidth networks of the past, broadband's inherent capacity to transmit large amounts of information has made it easier to share all types of copyrighted works, including songs, books, and videos.  And as the software to find, copy and share such works has gotten better and easier to use, the problems associated with the illegal sharing and use of copyrighted works has become a major issue.  IPR refer mainly to the rights of those persons or entities that hold copyrights, patents, or trademarks.  Copyright holders successfully litigated against the first generation of filesharing networks, including services such as Napster that operated based on a centralized index.  Victory in court meant taking down the central index, effectively shutting down the network.  Users soon started sharing files using new peer-to-peer technologies such as BitTorrent, which because of their decentralized nature, are much harder to shut down than first-generation filesharing networks.[169]  Countries have sought to combat such new illegal filesharing applications through various regulatory tools, including so-called graduated response or "three-strike" laws that involve giving two warnings to online copyright infringers, resulting in loss of broadband Internet access with the third infringement, as well as the potential for fines or criminal prosecution.

## 2.6  Financing Broadband Development

In the past 20 years, markets have liberalized, competition has increased and the private sector has been the primary vehicle for financing telecommunications projects, especially in profitable areas.  Nonetheless, in many developing countries, there are still significant barriers to entry and legacy dominant carriers continue to control markets and distort competition.  Thus, the government's primary role has been two-fold: to develop policies that support and encourage private sector investment while also seeking more effective ways to regulate dominant carriers and promote competition.

Today, most countries emphasize competition and a significant role for private sector investment to spur the growth of their broadband markets.  In developed countries, and some developing countries, the majority of the private investment comes from within the country itself.  In the least financially endowed countries, however, private investment may also come from foreign sources.  Governments seeking to promote broadband development in their countries should bear in mind that investors and companies around the world may be looking for opportunities to invest in good projects wherever they are located.  Thus, attracting foreign private investment—through appropriate incentives, a clear regulatory and legal environment, and a good development plan—may be important components for filling out a broadband strategy.

Where governments choose to finance broadband networks, they should avoid replacing private investment or substituting for the normal operation of market mechanisms.  Rather, governments should facilitate and support private sector investment and be capable of developing, promoting and

implementing timely policies based on a thorough understanding of the market.[170]  Thus, an essential element in effectively deploying broadband is the ability to find an appropriate financing model in which government oversight and intervention is focused mainly on funding and financing only those initiatives targeted at actual or expected market failures in the availability of broadband network and driving the early adoption of broadband services.

In addition to private sector investment and direct funding by governments, several other options exist for countries to finance broadband deployment, including government grants or subsidies to both private and public entities and partnerships where private funding is matched by government.  The sections below briefly address the main ways governments can support the financing of broadband development.

## 2.6.1  Government Support to Enhance Private Investment

The 2004 Report of the Task Force on Financial Mechanisms for ICT for Development (ICT4D), notes that the engine of ICT development and finance over the past two decades has been private sector investment, including foreign direct investment (FDI) by an increasingly diverse and competitive array of multinational and regional ICT sector corporations.[171]  Such companies target and provide service to profitable, high revenue customers, neighborhoods, and regions, often to the detriment of those areas that are less commercially viable.  This is the result of the tendency to see profitability and return on investment as drivers for investment in a private investment environment.

In addition to the purely economic decisions involved, private investment also depends heavily on the regulatory climate.  The government's challenge is to put in place the necessary policy measures and regulatory framework to allow and encourage the deployment and financing of broadband networks as widely as possible, and thus ensure that not only high value users receive high quality services, but that the benefits of broadband can be spread throughout all populations and areas.

The OECD, based on a survey of broadband policies in member states, identified particular policy initiatives that may promote broadband investments, including policies to:

- Improve access to passive infrastructure (conduit, poles, and ducts) and to co-ordinate civil works as an effective means to encourage investment.

- Ensure access to rights of way in a fair and non-discriminatory manner.

- Encourage and promote the installation of open-access to passive infrastructure when public works are undertaken.

- Allow municipalities or utilities to enter telecommunication markets.  Where there are concerns about market distortion, policymakers could limit municipal participation to basic investments (e.g. the provision of dark fiber networks under open access rules).

- Provide greater access to spectrum (which is a significant market barrier to wireless broadband provision) and to adopt more market mechanisms to promote more efficient spectrum use.[172]

These policies have been used by numerous countries to spur the build-out of broadband networks.  In Korea (Rep.), for example, thanks to greater market liberalization over the past decade, a number of new service providers entered the telecommunications market and began to fund and deploy fiber-based networks.  Many advanced broadband networks are now available and the country has an impressive number of users.

In Africa, wireless broadband licenses have been granted by governments since 2004, allowing mobile operators to roll out networks capable of supporting high speed data.  Although  uptake was initially

slow, several factors have led to a growing number of African operators boosting investments for 3G or 4G, including: (i) more affordable international and backhaul capacity; (ii) increasing competition in the mobile sector; (iii) greater demand for more advanced services (e.g., through the launch of e-health and e-education projects relying on mobile as well as other technologies); (iv) slower growth in voice subscribers and revenues; and (v) the lack of wireline networks on the continent.[173]

In some cases, private investors may also look to multilateral investment banks to assist in financing, particularly where potential investments are perceived as higher risk, or where difficult liquidity conditions and uncertain economic prospects are seen as additional risk factors.  Such conditions decrease the possibility of solely private financing and/or raise the costs of financing.  In such cases, investment banks have become involved in broadband projects.  The European Investment Bank (EIB), for example, is already lending an average of EUR 2bn each year to support broadband projects.  The EIB develops and finances pilot projects and innovative funding schemes.

## 2.6.2  Fiscal Support to Facilitate Broadband

There will be cases where regulatory reform and private sector investment still do not permit a government to reach its broadband development goals.  In those cases, policymakers may turn to fiscal support to fill broadband development gaps. Fiscal support comprises assistance provided by the government to a company or its customers in the form of cash subsidies, in-kind grants, tax breaks, capital contributions, risk bearing, or other fiscal resources.[174]

### Economic Justification of Fiscal Support

Fiscal resources are limited and face competing demands from many sectors. As a result, policymakers considering providing more direct support for broadband development must carefully analyze the expected costs and benefits of providing that support.   First, a persuasive case must be made that the benefits of supporting broadband development are likely to outweigh the cost to be incurred by all participating private and public sector entities, as seen from the viewpoint of the economy as a whole.  Fiscal support should not be provided for components of the broadband strategy that will leave the economy worse off than without it.  Second, if a component is overall desirable for the economy, it must be determined how much fiscal support should be provided.

Fiscal support often involves the direct use of government money.  Subsidizing investment requires cash outlays up front that will never be recovered.  Subsidizing broadband use may involve payments made over a long period of time, possibly for the lifetime of the strategy.  Investing equity in PPPs involves cash contributions up front that may be recovered in the long run (e.g., as dividends) to the extent that the ventures are commercially successful.  Long-term debt financing comprises cash outlays that may be recovered over the years, provided the beneficiaries do not default on repayment obligations.

Fiscal support that does not involve direct use of government money also has a cost.  Giving investors free use of spectrum for last mile access has an opportunity cost related to the revenues that the government could obtain from the sale of spectrum licenses for profitable business use.  Preferential taxation (e.g., income tax holidays, custom duty exemptions) implies fiscal revenues foregone.  On-lending international development loans and credits reduce funding available from these sources for other initiatives in the same country.[175]  Regulatory risk (e.g., changes in the pricing rules) can be mitigated through government guarantees, which create contingent liabilities.  The government can pick up part of the commercial risk of an uncertain market outlook for new investments by committing to future purchases, which may result in obligations unrelated to actual need.

**Estimating costs and benefits**

In order to determine whether to move ahead with some form of fiscal support for broadband development, the costs and benefits must be determined. The economic costs and benefits of a component of the broadband strategy are valued to reflect real scarcities of goods and services. Financial analysis values costs and benefits at market prices. Both economic and financial analyses compare the situations with and without the component. Sunk costs are not taken into account.

The principles for estimating economic and financial costs and benefits are well known, but applying these principles in practice is subject to assumptions on market and technology development. This can be a challenge, especially when some players (e.g. incumbent operators) have more detailed information and analytical capabilities than others (e.g. government authorities, new entrants). To some extent, this limitation can be overcome by using the calculus of costs and benefits to provide guidance on fiscal support but relying primarily on market mechanisms (e.g. minimum subsidy auctions) to reach the final decisions on support awards.

When costs and benefits can be measured in monetary terms, economic costs and benefits can be derived from financial costs and benefits. Transfers from one part of the economy to another, such as sales taxes or custom duties, are excluded from the cost stream. Prices that are distorted by market interventions, such as unskilled labor, foreign exchange, capital, and the radio spectrum, are adjusted to reflect their real scarcity in the economy. External costs (e.g., business losses resulting from digging up streets to install fiber) should be quantified, to the greatest extent possible.

Benefits can be harder to calculate. Starting from the financial analysis of network and service providers, economic benefits can be estimated by adding consumer and producer surpluses to the revenue streams. For example, U.S. consumers have been increasingly willing to spend more money for fixed broadband connectivity than they are actually paying. This resulted in a consumer surplus of about USD 32 billion in 2008, up 58 percent from about USD 20 billion in 2005. Higher speed is expected to add a further USD six billion to existing customers. The study underestimated the wider economic impact of broadband, as it excluded business users and wireless access.[176]

**Comparing costs and benefits**

The net present value (NPV) of the expected benefits is the discounted monetary value of benefits minus costs over time. For the government, valuing costs and benefits to reflect real scarcities in the economy, an economic NPV>0 means the project would have a positive effect on the country's welfare. For a private company, valuing costs and benefits at market prices, NPV>0 means the project could be commercially viable. This analysis can be applied to the broadband strategy as a whole as well as to each major separable component.

Projects that have negative economic NPV should not be supported. Projects that have positive financial NPV do not need support. Components that have positive economic NPV but negative financial NPV would be good for the economy, but are unlikely to be undertaken as a business. Fiscal support of these components would be justified, up to a maximum support equal to the absolute value of the (negative) financial NPV. This is the amount of support that would make the component just viable commercially. Support above this level would not be justified.

## Types of Fiscal Support

**Private investment should be protected**

Where government does decide on providing some type of fiscal support, the re-creation of monopolies with public support is a fundamental concern to many governments around the world, as is avoiding

contributing to established carriers' dominance and displacing private investment.  The EU supports the construction of broadband infrastructure and Internet take-up through both rural development and structural funds, and has clarified the application of state aid rules on use of public funds for broadband deployment through EC's Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband network ("State Aid Guidelines").[177]  The State Aid Guidelines were specifically drafted to address concerns relating to public support, and contain safeguards to ensure that any broadband infrastructure funded with public money does not favor existing operators, including provisions that a company receiving public monies must provide effective open access to its competitors to allow them to compete in an equal, non-discriminatory way.  Although the State Aid Guidelines focus on the role of public authorities in fostering the deployment of such networks in unprofitable areas (i.e., areas where private operators do not have the commercial incentives to invest), they clearly note that state aid should not replace or "crowd out" private investment.  Instead, public funds should complement private operators' investments and thereby achieve higher and faster broadband coverage.[178] Box 2.18 provides an overview of the EU experience with the State Aid Guidelines.

**Box 2.18.  EU Experience with State Aid for Financing Broadband**

In the context of market reform, good practice in financing universal access projects using public financing other than funds in international jurisdictions includes the practice of setting out rules or guidelines on the provision of public funding for universal service and access.  The EU State Aid Guidelines for funding broadband assist in bringing UAS through the presence of clear rules that:

- Facilitate NGA and broadband investments from public funds in order to bring broadband connectivity to underserved areas.

- Enable the rapid deployment of broadband and especially NGA networks, thus avoiding the creation of a new digital divide.

- Due to the conditions laid down for the granting of state aid (such as open access, open tenders) allow the maintenance of competition, which will in turn contribute to ensuring better and more broadband services.

- Although historically funding decisions could be made on a case by case basis in the EU, in light of the significant level of investments, it has been recognized that a level of certainty is required for all stakeholders, hence the need for the Guidelines.

*Source:  EC/ITU, SADC Toolkit on Universal Access Funding and Universal Service fund Implementation (2011), available at http://www.itu.int/ITU-D/projects/ITU_EC_ACP/hipssa/events/2011/SA2.2.html.*

**Direct Government Intervention**

Market-based investments should be the mainstay for broadband deployment, but some degree of direct government funding may be required to enable and complement the market, particularly in areas that are not considered economically viable by private operators.  The form of this more direct intervention will vary from country to country.  In many countries, subsidies are used to underpin private sector investment.

Some governments have effectively used subsidies and other financial incentives to spur broadband deployment.  Canada, Korea, Germany, Greece, Malaysia, Portugal, Singapore, the United Kingdom and the United States have all announced and are implementing substantial direct government funding for network infrastructure development.  In some countries (e.g., the United States, United Kingdom, Canada, Germany, Portugal and Finland) measures to expand broadband access and to bolster connection speeds have been included in the country's planned economic stimulus packages.[179]  In

2011, the European Commission announced a EUR 9.2 billion program to support investment in broadband networks and pan-European digital services. The plan will be backed by the selling of European "project bonds" under the "Connecting Europe Facility," and is expected to stimulate additional private and public investment of up to EUR 50 billion in broadband network buildout.[180] Most of these plans seek to speed up existing links to build faster wireline and wireless next generation networks. Countries are spending public funding for rolling out high-speed networks to areas that are underserved or unserved by commercial ISPs. In other countries, however, the debate over public financing is not over how much to contribute to broadband efforts, but rather how to cut budgets in line with the economic realities of 2011. In such a context, funding for broadband may assume lesser importance compared to other, more important, social and economic goals. Consequently, the focus on finding private sector-led solutions is likely to increase.

The case of the United Kingdom is instructive. The government had set a goal in 2009 of ensuring 100 percent access to next generation broadband, and had planned to support the roll-out of fiber-based broadband and other next generation technologies via a tax on telephone lines.[181] BT subsequently started initiatives to roll-out fiber broadband to most of the United Kingdom by 2015. However, BT has made clear that on its own, it will not push beyond 66 percent fiber coverage, and that public sector support of some form will be required to go beyond that, be it at a national level via a central government administered funding support mechanism or by regional funds and local partnerships to boost coverage in particular areas.[182] Within this context, BT has announced it plans to roll-out superfast fiber broadband to unprofitable areas with the help of European funding. The European Regional Development Fund's (ERDF) Convergence program is investing GBP 53.5m, or just over 40 percent of the total funding, with BT providing the remaining GBP 78.5 million.[183]

A few governments are pushing the build-out of broadband networks through direct investment by a government-backed company specifically tasked with building new networks. In most, if not all cases, these government-led efforts will deliver only wholesale services that service providers can then use to offer retail services. In April 2009, for example, the Australian government announced that it would commit AUD 43 billion (USD 30 billion) to building a National Broadband Network (NBN) across Australia, with wireline services reaching 93 percent of the population and the other 7 percent to be served by wireless or satellite broadband networks. In March 2011, Qatar announced a similar plan for a fiber-to-the-home network to reach 95 percent of the population by 2015, with a government-backed company focusing on supplying the passive infrastructure for the network.[184] In Africa, a USD 7.7 million contract to build a wireless Internet facility was awarded to Korea Telecom in 2007 by the Rwandan government. This marked the entry of wireless broadband technology in Africa.[185] In the next three years, the Rwandan government is aiming to provide access to high-speed Internet to more than four million Rwandans through the wireless Internet facility and the Kigali Metropolitan Network project.

## Subsidies as an Instrument of Fiscal Support

As detailed in Module 4, subsidies are the most commonly used instrument to support universal broadband development, and are often used to ensure universal access in key sectors, including electricity, water supply and sanitation services.[186] Since such services are generally considered essential to a productive, robust economy and society, subsidies are often used to target certain populations or areas where the costs of supplying the service are not fully recovered from the revenues raised by selling it. Subsidies may be financed by government budgets, user surcharges, international grants, and other sources. A central agency or financial institution, a specialized fund, or other mechanism may be used to collect and distribute the subsidies.

Good subsidy practice entails creating well-designed funding mechanisms that are transparently managed and effectively target the desired beneficiaries.  Such practices include ensuring that all participants—the government, operators and customers—contribute to financing the services.  While the government subsidizes start-up costs, the service providers should also invest their own resources into infrastructure build-out and customers should pay for at least the basic maintenance costs of service.   An increasingly popular way to support the build-out of broadband to unserved and underserved areas using the lowest subsidy possible is by requiring service providers to compete for funds (often referred to as "least-cost subsidies").  The use of a public tender process to award subsidies generally results in lower costs to the government, mobilization of substantial private investment, and enhanced transparency as compared with traditional public sector funding of infrastructure investments.

However, competition among firms for subsidies is likely to succeed only when certain critical factors have been met related to demand, supply and the enabling environment.  On the demand side, competition for subsidies to extend broadband is likely to work well only if users are willing to pay at least as much as is needed to keep the service running after initial investment and start-up.  On the supply side, the main concern is whether there are enough qualified providers competing for the subsidies since the least-cost subsidy model works best when several firms compete for each subsidized project.  An important aspect of creating an enabling environment is to ensure that subsidies are used to narrow gaps between the market and development needs and do not serve as a substitute for the market or to compensate for regulatory distortions of the market.  As such, a transparent, stable and credible legal, regulatory and general business framework is needed for prospective service providers to make reasonable estimates of costs and revenues and assess the risks they are being asked to assume.  The processes for successfully using least-cost subsidies to award funding for universal access broadband projects are addressed further in Module 4.

## Public Private Partnership (PPP) Models

Apart from implementing policies and regulations to ensure competition (between networks or services), the public sector can promote broadband development by sharing financial, technical or operational risks with the private sector.  Indeed, experience has shown that in some cases, purely private sector-led development, or direct government or subsidy funding may not be sufficient to reach certain areas, provide certain services or provide ongoing public funding, even with "smart subsidies."[187]  Within this context, many countries are now adopting approaches that combine public and private sector skills and resources, as well as combining public financing with some form of matching funding from private investors.  This helps to reduce investment risk while also recognizing that market participation is essential to financial sustainability of projects.   PPPs are also increasingly being considered as a solution for ICT development, including for broadband backbones and the supply of transmission bandwidth sufficient to catalyze advanced broadband applications.

In Africa, for example, much attention has been given in recent years to the funding and financing of projects aimed at bringing more affordable broadband connectivity to the continent by means of submarine cables, regional fiber-optic backbones, and satellites.  Such projects have generally been financed through a mixture of public and private sector funding.  Alcatel-Lucent, for example, signed a turnkey contract in 2010 valued at over USD 500 million with Africa Coast to Europe (ACE), a newly formed consortium composed of 20 parties (operators and governments) linking Cape Town in South Africa to Penmarch in France via a submarine cable network.[188]   This new system, with 40 Gbit/s capability, will span over 17,000 km and will deliver broadband communications to and from the African continent and Europe.

In Finland, the main objective of the December 2008 plan for 2009-2015 is to ensure that more than 99 percent of the population in permanent places of residence, as well as businesses and public administration offices, are no further than two km from a 100 Mbit/s fiber-optic or cable network.  The government expects telecommunications operators to increase the rate of coverage to 94 percent by 2015, depending on market conditions, while public finances will be used to extend services to sparsely populated areas where commercial projects may not be viable, bringing coverage to the target of 99 percent.  The plan stipulates that where public financial intervention is required, it should be in the form of public-private partnerships, with federal funding only being allocated to projects deemed not viable for 100 percent private investment.  The plan limits such interventions, providing that the federal subsidy amount cannot exceed one-third of the total project cost, with additional EU and municipal support capped at another one-third, thereby requiring private participants to invest at least one-third of the cost.[189]

Spain has relied greatly on inputs from the private sector through PPPs.[190]  Of the public funds used, EUR 31 million were structural funds and EUR 53 million were in zero-interest public credits.  Operators invested about EUR 280 million.  The funded projects use Asymmetric DSL (ADSL), WiMAX, and satellite technologies depending on geography, roll-out dates and available technologies.  The government set the minimum download speed at 256 kbit/s and prices were capped at a "reasonable fee."

Malaysia's 2006 MyICMS strategy also set out a number of goals for broadband services, as well as strategies to achieve such goals.[191]  The government is funding a fiber optic network under a public-private partnership with Telekom Malaysia that is aimed at connecting about 2.2 million urban households by 2012.  Under the terms of the Agreement, government committed to investing MYR 2.4 billion (USD 700 million) in the project over 10 years, with Telekom Malaysia committing to covering the remaining costs. In 2010 Telekom Malaysia (TM) launched its next-generation high-speed broadband service and included a relaunch of TM's IPTV offering.

## Local efforts, bottom-up networks

Broadband development financing is not limited to national or regional governments, however.  There are also interesting examples of how local efforts have resulted in the financing of bottom-up broadband networks.  The Universal Access and Service Module of the *info*Dev ICT Regulation Toolkit (Module 4), for example, notes that the emergence of municipal broadband networks provides an additional source of financing, from local governments, for ICT service development.[192]  The toolkit highlights the Pirai municipal network in Brazil as a successful initiative that was based on the needs of the municipal authority and included e-government, education and public access, with a range of application support and development activities.  The project established numerous broadband access nodes that allowed all local government offices and most of the public schools, libraries, and general public access points to be connected.  Initially, all financing was provided by the municipal government.  A commercial enterprise was later established, but continues to be funded and supported by the municipality.[193]

Municipalities in some European countries (such as the Netherlands and Italy) have also taken the lead in orchestrating broadband initiatives in their region (see Box 2.19).[194]  A 2010 study argues that this has been due to the fact that incumbent cable and telecommunication carriers have been uncertain about the prospects of NGA networks in certain areas, that there is an increasing demand for broadband services, in particular double- and triple-play services as well as higher network capacity in both urban and rural areas, and that local (and national) governments perceive broadband networks as a means of reducing the digital divide and stimulating economic development of regions.   This, the study claims, has led municipalities to become major investors in NGA networks.[195]  The French government, for

example, has helped local authorities play a greater role in developing broadband infrastructure through the *Caisse des Depots et Consignations* (CDC, a government-owned bank), which provides concessional loans to municipalities for broadband development.[196]

**Box 2.19.  Municipal Broadband Initiatives**

In Italy, Terrecablate Siena is an example of a publicly owned carrier, which participated in the Terrecablate consortium ("Societá Terrecablate Reti e Servizi S.r.l." was created in 2005 and comprised of the Province of Siena, 36 municipalities and three mountain communities of the Province of Siena). The project is funded with public money and aims at maximizing access to connectivity within rural areas.

In the Netherlands, the *Draadloos Groningen* (Wireless Groningen) Foundation signed an agreement in 2009 with Unwired Holding to deploy and manage a citywide wireless broadband network.  The business model used is the "anchor tenant" model whereby the anchor tenants (large organizations within a city) fund the network and use it for their own applications.  The Foundation's members are the municipality of Groningen, the Hanzehogeschool Groningen, the University of Groningen and the University Medical Center.  These four members of the foundation are also the initial anchor tenants.  Each of them are contributing EUR one million over a four-year period, which is aimed at guaranteeing financial support for the network in its start-up phase, and a commitment to use it for as many purposes as possible. Noorderpoort College and the Groningen police have also signed up to use the citywide network. Draadloos Groningen and Unwired Holding will begin selling access to the network to other governmental and commercial organizations, as well as to individuals.

In the United Kingdom, the government is taking a new approach to delivering connectivity in rural and hard-to-reach areas where the market is unlikely to provide service.  Where local authorities have superfast broadband as a development priority, Broadband Delivery UK (BDUK) will work with the local government to coordinate projects and financing.  Such collaboration will be the foundation for the government's USD 859 million investment commitment until 2015.

*Sources: Alberto Nucciarelli, et al., Emerging models of public-private interplay for European broadband access: Evidence from the Netherlands and Italy (2010); Esme Vos, Groningen, Netherlands deploys municipal wireless network, (Apr. 15, 2009), available at http://www.muniwireless.com/2009/04/15/groningen-deploys-muni-wireless-network; Department for Business, Innovation and Skills and Department for Culture, Media and Sport, "Britain's Superfast Broadband Future," (December 2010), available at http://www.culture.gov.uk/images/publications/10-1320-britains-superfast-broadband-future.pdf.*

## Universal Access and Service Funds (UASF) for Broadband

In the past, many countries defined their USFs in a way that gave priority to providing voice telephony (traditionally provided over wireline) services to unserved or underserved regions.  Recently, however, a number of countries have revised their definitions and scope of the funds to include broadband, mobile telephony, or Internet access.  For example, the EU and the United States are adding resources to existing rural development funds or USFs to accommodate broadband.[197]  Other countries are contracting commercial providers to build the network with service obligations through a competitive bidding process (e.g., France, Ireland, Japan and Singapore).  In addition, according to a 2010 World Bank study, the availability of new, lower cost broadband-enabled technologies allows countries to adopt more ambitious UAS policies without necessarily incurring higher costs or continuous subsidies.[198] Countries are increasingly considering turning broadband into a USO and reforming their universal service policies in order to expand broadband access to unserved areas.  According to a 2011 ITU report, over 40 countries now include broadband in their universal service or universal access definitions.[199]

Examples of countries that have revised their USO policies to include broadband are provided in Module 4.

As addressed in Module 3, the financing of UAS has gone through various stages, ranging from cross-subsidies that finance non-profitable areas under a monopolistic scenario to the creation of UASFs financed by operator levies that support projects in more competitive markets.  There is also a range of other solutions between these two points.  Historically, first-generation funding projects have been primarily top-down (e.g., Colombia and Peru), with the fund defining the locations and requirements. However, in the last few years, bottom-up projects have been tried in Chile and other countries.  In Sub-Saharan Africa, the tendency has been towards top-down projects, primarily allocated through competitive processes such as least-cost subsidy bids.

The *info*Dev ICT Regulation Toolkit also illustrates how so-called "second generation" UASFs are today applying their resources to the financing of Internet Points of Presence (POPs) in rural districts, telecenters and cyber cafés, school connectivity and other ICT initiatives.  Uganda is one of the first countries to establish a more comprehensive USF, and many of its latest initiatives are through technology-neutral competitions, which are increasingly being won by mobile operators.  However, there are some legitimate and understandable concerns regarding UASF in many countries around the world, fuelled mostly by a few unfortunate examples of mismanagement and lack of transparency.  Also, there have been concerns raised over the complexity of establishing and managing a UASF.  Negotiating UAS contributions for all operators, which are viewed as equitable and accepted as fair, is not easy.[200]

Policymakers have also found that mechanisms need to be put in place to make funds accessible to a wider range of telecommunications service providers.  Limiting access only to a specific category of licensee or to licensed operators, for example, can create barriers that continue to support existing conditions (i.e., the expansion of wireline networks to provide universal service/access) and discourage the implementation of new technologies to provide service in unserved or underserved areas.  In addition, the development and presentation of project proposals for UASF consideration should not be restricted only to the fund authority or to telecommunications providers, but instead should be open to all entities with an interest in contributing to the fulfillment of universal service/access.  A system where multiple parties can submit project proposals allows all interested parties to contribute to achieving USO objectives.  Having multiple sources for project proposals can provide a more realistic vision of the needs and conditions of the market, such as what type of service is required by localities and which technology is best suited, and are more likely to result in creative and resourceful project solutions.  This has become even more relevant in a broadband context as USO objectives expand to include deployment of a variety of advanced technologies and services that includes fixed line and wireless broadband, multi-service platforms permitting full access to all functions and features of telephony, Internet, data transmission, e-commerce, e-government, multimedia entertainment, and interactive communications.

## Comparing Alternative Instruments

Not all fiscal support instruments are equally effective.  They differ primarily in terms of accuracy, and also regarding transparency, targeting, cost, and sustainability.[201]  Figure 2.18 illustrates which instruments of fiscal support can help overcome each type of obstacles to broadband development (i.e., their effectiveness in addressing specific impediments to broadband development).[202]  For example, subsidizing investment is particularly effective at reducing investors' costs and also can help overcome financial market failures.  Alternatively, subsidizing use of broadband is an effective way to increase revenues by making service affordable to people that otherwise would not buy the service; however, it can also enhance competition among firms to provide the service and reduces commercial risk by

building up demand that otherwise would materialize at some point in the future as incomes rise and costs decline.  The choice of instrument can be further narrowed by considering the transparency of the instruments' cost and their ability to effectively target specified categories of beneficiaries.[203]

**Figure 2.18.  Accuracy of Fiscal Support for Broadband Development***

| Objective | Subsidy of invest-ment | Subsidy use and devices | Rights of way, spectrum | Preferential taxation | Equity Investment | Long-term loans | On-lending international loans | Partial risk guarantees |
|---|---|---|---|---|---|---|---|---|
| Reduce costs | ▓ | | ▓ | ▓ | | | | |
| Increase revenues | | ▓ | | | | | | |
| Facilitate competition | | ▤ | | | | | | |
| Improve business environment | | | | | | | | |
| Address fin. market failures | ▤ | | | | ▓ | ▓ | ▓ | |
| Reduce regul. and political risk | | | | | ▤ | ▤ | ▤ | ▓ |
| Reduce commercial risk | | ▤ | | | | | | |

*Source: Telecommunications Management Group Inc., adapted from Irwin, Timothy, 2003, Public Money for Private Infrastructure, World Bank Working Paper No. 10, The World Bank, Washington, DC.*
*\* The dark shading depicts areas where the instrument is particularly effective, while the light shading illustrates additional effects.*

## Best Practices for Effectively Managing and Reviewing the Flow of Funds

Whether funds flow through a UASF, or other public financing body such as PPPs or municipal-led projects, a number of key principles are applicable to ensure effective management of the flow of funds to projects aimed at achieving universal broadband access, as described in Module 4.

- Effective management:  Transparency, accountability and efficiency are the necessary elements to ensuring that the flow of funds is effectively managed.  Transparency of procedures can be enhanced through a manual or handbook for recipients of public financing that detail rules related to procurement, accounting standards, project selection criteria and other procedures. Accountability seeks to ensure that operations are transparent and generally rely on periodic reporting by service providers, as well as annual independent audits and reports on the UASF, as applicable.  Establishing an efficient management structure involves providing the fund manager with the flexibility and autonomy needed to respond quickly to market realities while ensuring that there is sufficient oversight, evaluation and review.

- Review processes: UAS programs should be reviewed in terms of strategy and management on a regular basis by an independent entity (with relevant expertise in the fields of UAS, project finance, and operational management). Where public funds are used to subsidize broadband deployment, evaluations of UAS projects generally consider a number of elements including whether the specific targets in a UAS or NBP were met; identifying the impact that the projects have had on deployment and uptake of broadband services; whether the financial commitments needed to meet objectives were sufficient or whether additional funding is needed; and strategic options for future development of the UAS program to further meet UAS goals.

## 2.7 Measurement, Monitoring and Evaluation: Checking Progress

### 2.7.1 Why Measure Performance?

A country that adopts a broadband strategy will do so to achieve certain objectives such as increasing the productivity of its economy through greater use of knowledge and accelerating economic growth by increasing the use of broadband applications and services. In relation to the overall development strategy, there will be an interest in ensuring that both government funds and private investment are utilized as efficiently as possible, and that negative effects such as exacerbation of the broadband divide are minimized.
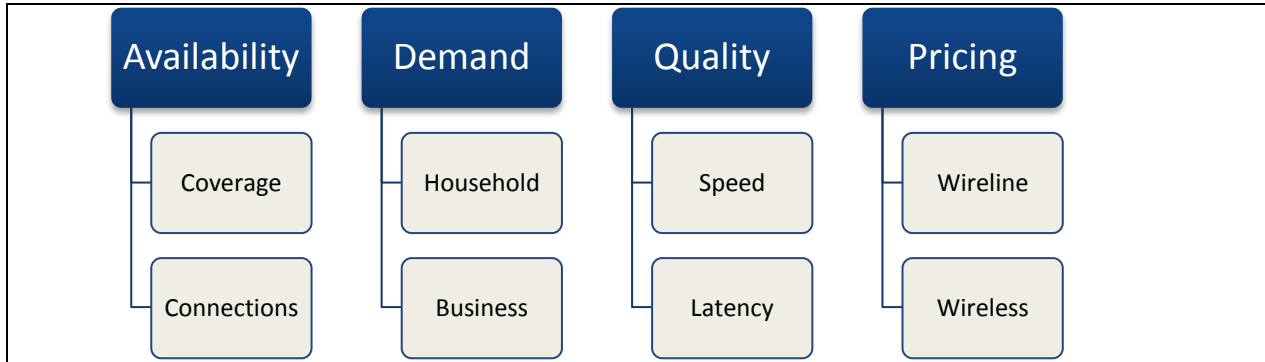
Policymakers seeking to promote broadband development need mechanisms to ensure that their objectives are being achieved and to identify if mid-term corrections and refinements to policies and programs are needed. Broadband indicators are also needed for analysis, for example to examine trends and the link between broadband adoption and social and economic development. They are also important for monitoring license compliance in areas such as coverage and quality. In short, they need to measure progress and identify successes and failures. This is not possible unless regular progress monitoring is conducted. Ideally, the indicators most appropriate for the selected objectives are built into the design of the programs from the beginning, and the necessary resources for data collection and analysis are allocated from the start. When indicators are an afterthought, they tend to be more difficult to collect and use.

The objectives of broadband strategies adopted by different countries will differ. The conditions affecting the fit of the indicators will also differ from country to country. Therefore, the specific indicators appropriate for a particular country, the frequency of data collection and reporting, the geographical unit of analysis, etc. will differ from country to country as well. Consequently, this section provides a range of options rather than a single prescription.

### 2.7.2 What to Measure?

This section identifies fixed and wireless broadband indicators that are likely to be of most interest to policy makers. It focuses on indicators related to users' access to and adoption of broadband, rather than wholesale and backbone markets.[204] The areas covered include availability, demand, quality and pricing (see Figure 2.19). The focus here is on key indicators, but there are additional measurements that could be useful for monitoring and analysis. These might include, for example, monetary-based statistics such as broadband revenues. The *Partnership on Measuring ICTs for Development* (Partnership)[205], a coalition of intergovernmental agencies has produced a methodological manual identifying core ICT statistics including several broadband indicators.[206] This provides a useful list of key broadband indicators based on definitions with international consensus.

**Figure 2.19. Categories of broadband indicators**

| Availability | Demand | Quality | Pricing |
|---|---|---|---|
| Coverage | Household | Speed | Wireline |
| Connections | Business | Latency | Wireless |

*Source: Telecommunications Management Group, Inc.*

## Availability (Supply)

Availability refers to the ability to access wireline and wireless broadband networks and services. Different modes of providing broadband exist; therefore, different indicators of availability are needed for each of the modes.  In the case of wireline systems, availability can be measured by the percentage of households passed.  This is a conventional measure in the cable industry that can be extended to fiber and DSL as well.  The indicator reflects the number of copper (telephone), coaxial (cable television) or fiber optic lines accessible by a premise, regardless of whether users actually subscribe to the broadband service.[207]  It may also be useful to distinguish between the type of technology, such as DSL, cable modem and fiber-to-the-premise (FTTP).  This provides an idea of the relative importance of each to broadband development as well as the degree of intermodal competition between technologies.  It may also be useful to provide a breakdown of subscriptions by speed ranges and geographic area. These considerations are becoming increasingly important as countries seek to deploy minimum speed broadband services to unserved and underserved populations.

In the case of wireless, the obvious indicator of availability is signal coverage.  This can be measured in terms of population or area.  The ITU has developed a definition for wireless broadband coverage in the form of 3G/4G network coverage, though the data are not reported for most countries.[208]  Parallel definitions for fixed wireless, satellite and wireline coverage do not exist within the ITU definitions. However, several countries in the OECD report these data using definitions developed either by national governments or by industry organizations.[209]  They may be adapted by countries wishing to develop comprehensive coverage indicators.

## Adoption (Demand)

While supply side indicators give a general idea of high-speed Internet availability, they do not reflect concrete adoption or usage.  Thus, policymakers need to also find reliable ways to measure how many people and businesses are actually using the networks that have been put in place.  Measuring the uptake/adoption of wireline and wireless technologies, however, is significantly more difficult than measuring the supply.[210]  While coverage measures the theoretical ability to access broadband services, the number of subscribed connections measures actual demand for the service.  Subscriptions should be minimally broken down by wireline and wireless broadband and preferably additional categories to allow for deeper analysis.

Measuring adoption rates is important because a number of countries have begun to use the percentage of households with broadband access as a key metric in their broadband goals (see Table

2.4.  Without appropriate measurement programs, there is no way to judge if these goals are being met. As a result, and also to help them compare their progress to other countries, a growing number of countries are measuring broadband access by households and businesses through surveys typically carried out by the national statistical offices.  These demand side surveys also typically include a number of indicators on use, which can illuminate factors contributing to broadband take-up.

**Table 2.4.  National broadband plans: household targets**

| Country | Plan | Indicator |
|---|---|---|
| Brazil | *Um Plano Nacional Para Banda Larga* | 50 broadband accesses per 100 households |
| Germany | *The Federal Government's Broadband Strategy* | 75 percent of households should have high speed broadband access with transmission rates of at least 50 MB/sec by 2014 |
| Malaysia | *The National Broadband Plan* | By end of 2010, it is expected that the total broadband connection will reach 75 percent penetration rate for household |
| Morocco | *Maroc Numeric* | 1 out of 3 household connected by 2013 |
| South Africa | *Broadband Policy for South Africa* | Household broadband penetration should be at least 15 percent by 2019 |
| United States | *Connecting America: The National Broadband Plan* | 100 million U.S. homes should have … access to actual download speeds of at least 100 Mbps … by 2020. As a milestone, by 2015, 100 million U.S. homes should have affordable access to actual download speeds of 50 Mbps … |

*Source: Telecommunications Management Group, Inc.*

In measuring broadband adoption, it is important to recognize that there are a number of methodological limitations that can make comparisons between countries or with benchmarks difficult or misleading. Determining the number of wireless broadband subscriptions, in particular, presents several methodological challenges.  First, different countries may define wireless broadband according to different speeds.  Second, the line between fixed and mobile broadband is not always clear.  For example, in some countries there is a legal rather than technical restraint on nationwide roaming for some wireless broadband networks.  Even with this restriction, users can move with their mobile handset or data card within a limited area so the distinction between fixed and mobile is not so clear.  A third consideration is that countries approach the use of wireless broadband on laptops via data cards differently than use via mobile handsets.  Some countries only consider the former to be mobile broadband and consequently include it in their overall broadband counts, while smartphone broadband use can go uncounted, which could lead to undercounting of actual broadband use—especially with the advent of 4G technologies.

Another major issue with measuring wireless broadband is that users may have the theoretical ability to access mobile broadband services if they have an appropriate device (and data payment plan), but they may not actually make use of the available services.  Counting this theoretical availability can significantly overstate the take-up of wireless broadband services in a country.  Therefore, it is important to distinguish between active and inactive data subscriptions.  The OECD has defined active wireless subscriptions as access to the Internet in the previous three months or the use of a separate data subscription.[211]  However, even activity is a blurred concept since some countries count access to any high-speed service such as video chat, mobile television, etc. and users may not be accessing the Internet.

Regulators in a number of countries publish broadband subscription data, highlighting trends and making comparisons.  The Turkish Information Communications and Technology Authority, for example, contrasts the availability of different broadband subscriptions with the European Union and also provides a breakdown of speeds over ADSL, the most prevalent wireline broadband technology in the country (Figure 2.20).

**Figure 2.20. Wireline Broadband by Technologies and Speed (ADSL) in Turkey Percent, 2010**
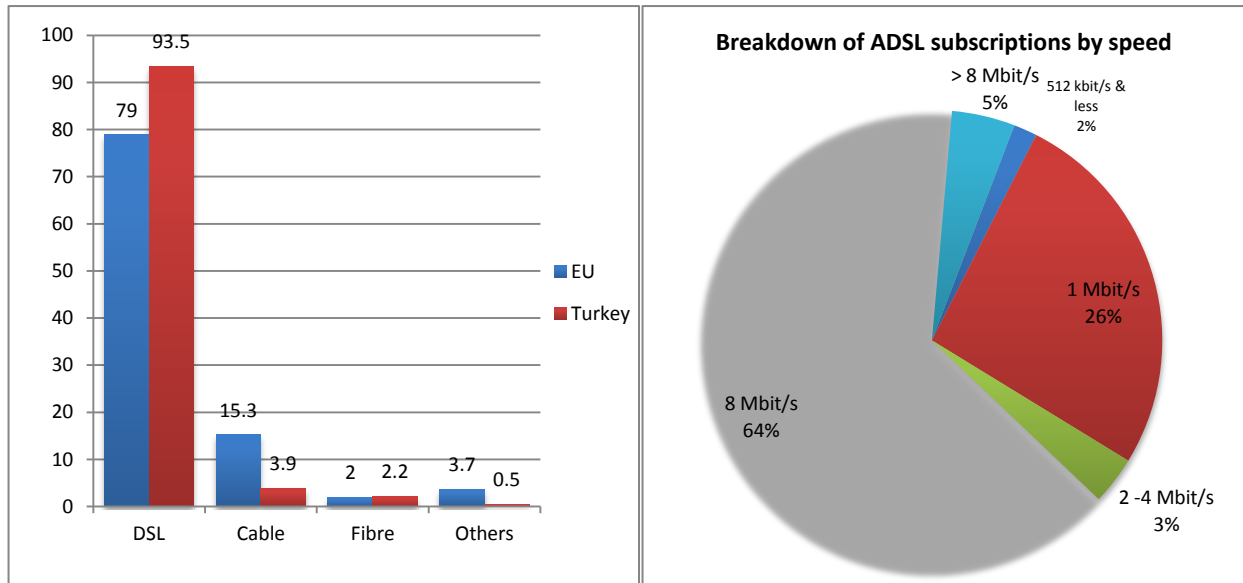


*Note: Data for EU refer to January 2010.*
*Source:* ICTA, *Annual Report 2010*.

## Quality

In order to use or fully utilize certain applications, certain performance parameters must be met by the broadband connection.  Two of the most important are latency (the amount of time it takes for a packet to travel between sender and receiver) and speed, which can be monitored for both fixed and wireless networks.   Other broadband performance metrics include signal quality, availability ("uptime"), complaint ratios and service activation and restoration times.  Technical means exist to measure these aspects at various points in the link between the end user and the server providing the application.  Such information is important to both policymakers—to ensure that the broadband networks and services being supplied are up to industry standards—and to consumers—who can use such information to decide which service will provide them with the highest quality.  Many consumer complaints hinge on differences between advertised and actual speeds.[212]

In Bahrain, for example, the Telecommunications Regulatory Authority publishes quarterly reports measuring average download and upload speeds and DNS and latency times (Figure 2.21).[213]   In the absence of regular monitoring some regulators publish links on their web sites to third party applications for measuring speed and other quality aspects.[214]

**Figure 2.21. Average Download Speed (Two Mbit/s Packages) and Ping Time (Milliseconds), Bahrain, January-March 2011**
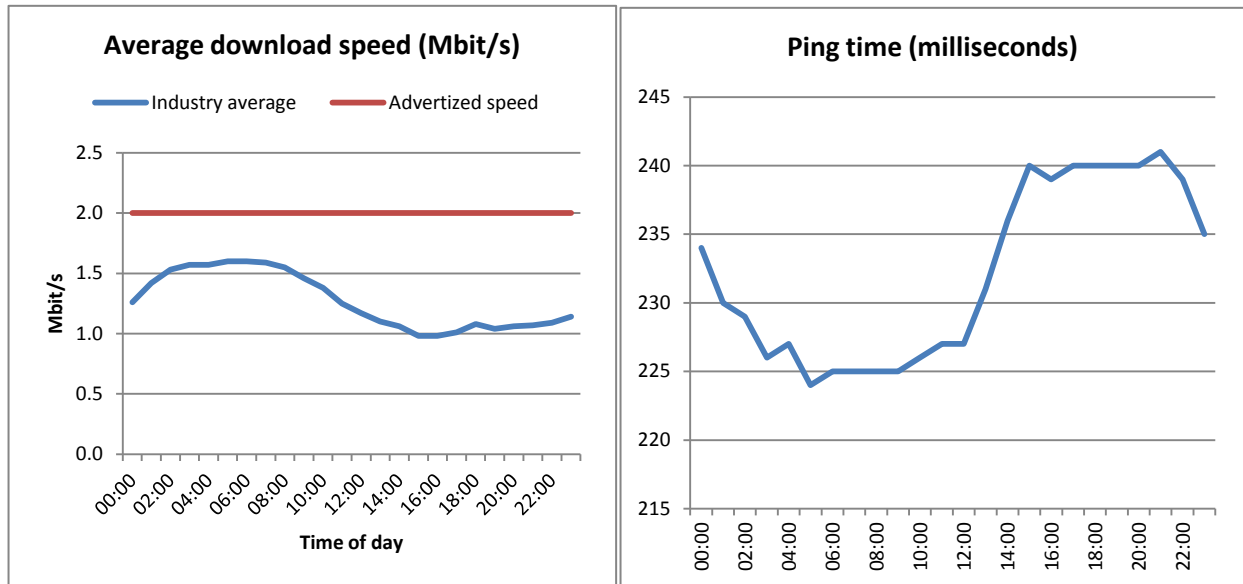


Note: Ping time measures latency by taking the average round trip to servers located in Bahrain, Europe and the United States.
Source: Telecommunications Authority of Bahrain.

Overall quality can also be affected depending on how far apart the user is from the information being accessed. When a user is accessing ICT resources that are provided by their own ISP, service can be quite good since everything is on one network. If the information is located in a server on a different network in a different part of the country, however, there are more links that must be made, and hence more opportunities for quality to degrade. Finally, if a user is trying to access information on a server in a far-off country, quality can suffer further as more variables are introduced into the transmission link. Measuring for each of these cases yields diagnostic information useful for regulators, operators and consumers, and can help to identify weak links in the broadband supply chain. For example, the Info-communications Development Authority of Singapore establishes different latency parameters depending on whether Internet traffic is national or international.[215]

## Pricing

As noted in section 2.2.3, price impacts adoption rates; services (or devices) that are too expensive will not be subscribed to or used and adoption rates will suffer. Thus, governments have an incentive to try to ensure that prices are as affordable as possible and to track whether their efforts to keep costs down are succeeding. In particular, a government that launches a broadband initiative using public resources will want the service to be affordable to the intended beneficiaries. One could argue that prices need not be monitored in the case of purely private supply, where no public resources have been expended. However, when broadband is seen as an essential public utility, or where prices are high due to market failure, governments may want to monitor pricing. Concerns about this issue have prompted several countries, such as India and the United States, to include "affordable" broadband access as a key factor or goal in their broadband initiatives.[216]

Competitive broadband markets typically have multiple tariffs with varying levels of bandwidth, data download caps and discounts. This presents methodological challenges in terms of compiling comparative broadband tariff indicators across technologies. Baskets of monthly services are often used

as a common measure of price trends that factor in caps and speeds.  The key components include the monthly price of broadband service, the corresponding speed and if applicable, the cap and prices for exceeding the cap.  Capped versus unlimited packages pose comparison problems, but can be mitigated somewhat by comparing price per advertised Mbit/s.   Another issue is that some broadband technologies require an underlying subscription to the transport service.  For example in the case of DSL, most operators require a subscription to a fixed telephone line, while some mobile broadband plans require an underlying voice subscription.

Efforts to define pricing models that can fairly and effectively compare prices across countries are ongoing.  The Partnership, for example, has defined a core indicator for wireline broadband prices.  The core fixed broadband tariff indicator is based on entry-level prices for plans providing at least 256 kbit/s download speed.  Mobile broadband pricing is a bit more difficult to compare since prices tend to vary by the volume of data downloaded per month (a "tiered" pricing scheme).  In addition, comparisons can be complicated since some operators do not guarantee advertised speeds and apply various restrictions (capping data or reducing data speeds) or charge additional fees if the user exceeds his/her contracted data limits.

An example comparing wireline and mobile broadband monthly prices for selected economies is shown in Table 2.5.  The example illustrates the various ways of looking at broadband pricing and highlights comparability issues.  One notable aspect is the differences between entry-level prices, speeds and affordability (in terms of price as a percentage of per capita income).  For example, although an entry-level fixed broadband package in Turkey is almost twice as much as in Brazil, the Turkish tariff is a slightly better value since the download speed is twice as fast as in Brazil.  Similarly, although the entry-level price for fixed broadband in Brazil is more than twice that of Vietnam, it is much more affordable in Brazil than Vietnam (although the value of the Vietnamese package is ten times more).

**Table 2.5. Wireline and Mobile Broadband Monthly Prices, Selected Countries, USD, 2011**

|  | Brazil | Kenya | Morocco | Sri Lanka | Turkey | Vietnam |
|---|---|---|---|---|---|---|
| Fixed broadband basket (unlimited) | $16.99 | $39.36 † | $11.86 | $14.18 | $30.10 | $7.93 |
| Speed (Mbit/s) | 0.512 | 0.256 | 1 | 0.512 | 1 | 2.56 |
| $/Mbit/s | $33 | $154 | $12 | $28 | $30 | $3 |
| % GDP per capita | 1.9% | 28.4% | 4.4% | 7.0% | 3.5% | 8.1% |
| Mobile broadband basket (1 GB) | $51.27 | $26.24 | $11.86 | $4.34 | $19.93 | $6.34 |
| Speed (Mbit/s) | 1* | 7.2** | 1.8* | 7.2** | 7.2** | 3.6* |
| $/Mbit/s | $51 |  | $7 | $1 |  | $2 |
| % GDP per capita | 5.7% | 18.9% | 4.4% | 2.1% | 2.3% | 6.5% |
| AAER 2010 LCU/1US$ | 1.7536 | 76.1926 | 8.3507 | 112.796 | 1.5054 | 18,919.10 |
| GDP per capita | $10,816 | $1,662 | $3,249 | $2,435 | $10,399 | $1,174 |
| Fixed broadband basket 1 GB, LCU | 29.8 | 2,999 | 99 | 1,600 | 45.31 | 150,000 |
| Mobile broadband basket 1 GB, LCU | 89.9 | 1999 | 99 | 490 | 30 | 120,000 |

*Note:* LCU=Local currency unit.   AAER=Annual average exchange rate.   * Advertised download speed. ** Theoretical download speed.  †=Includes 30 minutes of on-net calls.

For fixed broadband, least expensive uncapped plan providing download speed of at least 256 kbps. For mobile broadband, least expensive plan offering 1 GB per month of download and download speed of at least 256 kbps.

*Source: Adapted from Telefonica, VIVO (Brazil); Orange, Safricom (Kenya); Maroc Telecom (Morocco); SLT, Dialog (Sri Lanka); TTNET, Turkcell (Turkey); VNN, MobiFone (Vietnam).*

Table 2.6 summarizes some of the important broadband indicators used by national and international organizations to track broadband availability and adoption.

**Table 2.6. Broadband Indicators**

| Code | Indicator | Description |
|---|---|---|
| **Infrastructure and access** | | |
| A4 | Fixed (wired) broadband Internet subscriptions per 100 inhabitants | *Fixed broadband Internet subscriptions* refer to entities (e.g. businesses, individuals) subscribing to paid high-speed access to the public Internet (a TCP/IP connection). High-speed access is defined as being at least 256 kbit/s, in one or both directions. Fixed broadband Internet includes cable modem, DSL, fiber and other fixed broadband technology (such as satellite broadband Internet, Ethernet LANs, fixed wireless access, Wireless Local Area Network and WiMAX). Subscribers to data communications access (including the Internet) via mobile cellular networks are excluded. |
| A5 | Mobile broadband subscriptions per 100 inhabitants | *Mobile broadband subscriptions* are subscriptions to mobile cellular networks with access to data communications (e.g. the Internet) at broadband speeds (defined as greater than or equal to 256 kbit/s in one or both directions) such as WCDMA, HSDPA, CDMA2000 1xEV-DO, WiMAX (IEEE 802.16e) and LTE. |
| A8 | Fixed broadband Internet access tariffs per month | Fixed broadband Internet access tariffs represent the least expensive broadband entry plan converted to US$ for a minimum 256 kbit/s connection. Monthly charges do not include installation fees nor modem rentals. Affordability measure can be derived using the tariff as a percentage of monthly *per capita* income |
| **Access to and use of ICT by households and individuals** | | |
| HH7 | Proportion of individuals who used the Internet in the last 12 months | The proportion of individuals who used the Internet is calculated by dividing the number of in-scope individuals who used the Internet (from any location) in the last 12 months by the total number of in-scope individuals. |
| HH11 | Proportion of households with access to the Internet by type of access (Narrowband, Fixed broadband, Mobile broadband) | This indicator is generally calculated as the proportion of in-scope households with Internet access that use each type of access service, for instance, the proportion of households with Internet access that use a fixed broadband service as their means of access. However, it may also be useful to compare with the total population, for instance, the proportion of all households with mobile broadband. |
| | **Use of ICT by businesses** | |
| B9 | Proportion of businesses using the Internet by type of access (Narrowband, Fixed broadband, Mobile broadband) | This indicator is generally calculated as the proportion of in-scope Internet-using businesses that use each type of access service, for instance, the proportion of Internet-using businesses that use a fixed broadband service as their means of access. However, it may also be useful to compare with the total population, for instance, the proportion of all businesses with mobile broadband. |
| **NON-CORE** | | |
| | Wireline broadband coverage (% of | Percentage of households passed by a wired line capable of |

| Code | Indicator | Description |
|---|---|---|
| | households) | providing broadband access at download speeds of at least 256 kbit/s. |
| | Mobile broadband coverage (% of population) | The percent of total population that are covered by a broadband mobile wireless network offering download speeds of at least 256 kbit/s. This indicator measures the percentage of inhabitants that are within range of a mobile broadband network signal, irrespective of whether or not they are subscribers. |
| | Percentage of localities with a public broadband Internet facility | A locality refers to populated areas such as cities, towns and villages. A public broadband Internet facility refers to a location providing Internet access to the general public— either for free or by payment—over a broadband connection to the Internet. |
| | Fixed (wired) broadband by speed | Wireline broadband Internet subscriptions broken down by ranges of advertised downstream speeds. |
| | Average download / upload speeds | Average download / upload speeds from speed measurement surveys |
| | Mobile broadband Internet access tariffs per month | Least expensive mobile broadband tariff per month (advertized speed at least 256 kbit/s) with at least 1 GB download |

*Note:* Core refers to fundamental indicators identified by the Partnership on Measuring ICT for Development.
*Source:* Partnership on Measuring ICT for Development: *Core ICT Indicators*, ITU: *Definitions of World Telecommunication/ICT Indicators* and TMG, Inc.

## 2.7.3  How to Measure?

An effective policy evaluation plan will specify not just the elements to be measured, but also how the data should be collected to ensure its integrity and validity.  Government agencies responsible for broadband policy should consult internationally comparable indicators and identify those most suitable for monitoring and evaluation.  Based on their mandate to regulate and monitor the sector, best practice suggests that national regulatory agencies should gather data (numbers of subscriptions, for example) directly from operators.  Ideally, the regulator should consult and cooperate with national statistical agencies that have the technical skills to produce demand side statistics through household and enterprise surveys that may ask about broadband possession or use of different ICT services within households and businesses (or by individuals).  Broadband operators play a key role, both as providers and consumers of the data.

The entities best positioned to provide supply-side data are the network builders and owners.  It is common for provisions mandating the reporting of data to the government or the regulatory agency to be included in statutes governing the industry or in licenses or concession contracts.  Irrespective of legal provisions, the principal challenge will be to ensure the regular and timely reporting of the required indicators based on adherence to agreed-upon standard definitions and procedures.

Most governments do not monitor their country's broadband development in a vacuum.  They typically need data from other countries to put their nation's high-speed market evolution in perspective and benchmark it with other countries.  Brazil for instance compared its broadband penetration and forecast evolution to Argentina, Chile, China, Mexico and Turkey (Figure 2.22).

**Figure 2.22. Broadband Access per 100 Households in Brazil, China, Mexico, Turkey and Chile, 2000-2014 (est.)**
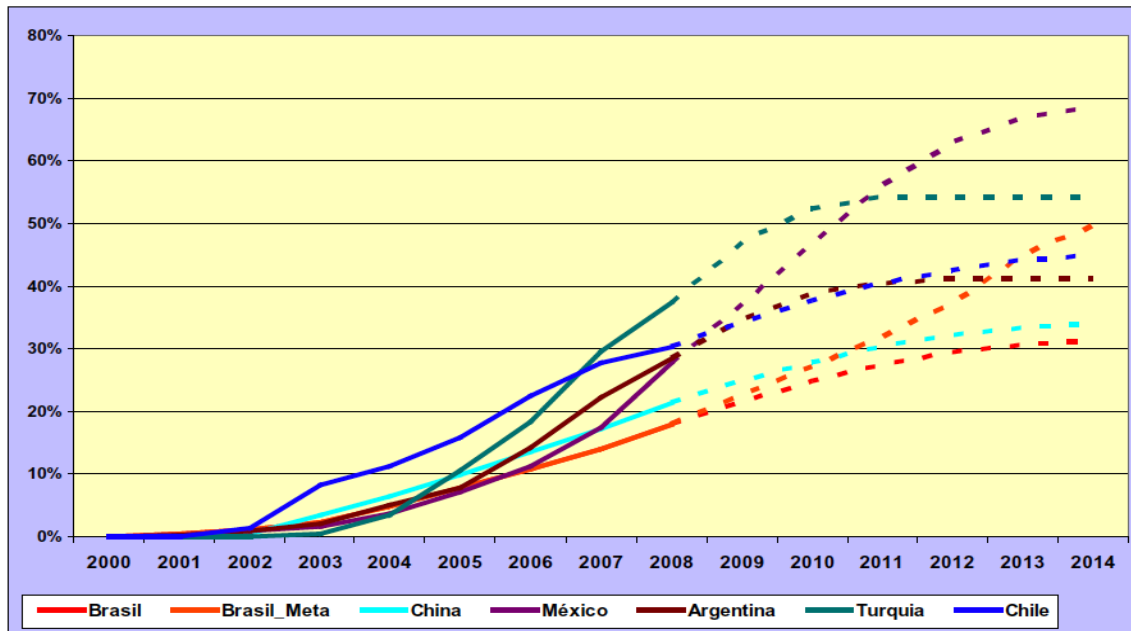


*Source: Ministry of Communications (Brazil), Um Plano Nacional para Banda Larga - O Brasil em Alta Velocidade (2009).*

There are a number of international sources that harmonize and disseminate statistics for different countries.  The ITU has been the traditional repository of supply-side data on telecommunications and now on ICTs, and also collects some demand-side data.  Similarly, the OECD collects and disseminates a number of broadband indicators for its member countries as does EUROSTAT, the statistical arm of the European Union.  All these organizations make the data available online (Table 2.7).  The Economic and Social Commission for Latin America and the Caribbean (ECLAC) also recently launched a broadband indicator site for its members.[217]  In addition, several private sector entities publish broadband statistics on mobile broadband subscriptions[218] as well as average download speeds and other quality metrics.[219]

**Table 2.7. Sources of Official Broadband Statistics**

| Organization | Site | Note | Link |
|---|---|---|---|
| ITU | ICT Data and Statistics Division | Worldwide scope.  Fixed and mobile broadband subscriptions; fixed broadband tariffs. | http://www.itu.int/ITU-D/ict/statistics/ |
| EUROSTAT | Information Society | European Union members and sometimes other countries. Household and enterprise broadband penetration. | http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/introduction |
| OECD | Broadband Portal | OECD member data. Includes broadband indicators covering penetration, usage, coverage prices, services and speeds. | http://www.oecd.org/document/54/0,3746,en_2649_33703_38690102_1_1_1_1,00.html |

*Source: Telecommunications Management Group, Inc.*

### 2.7.4  How can measurement data be used?

Collecting data is a crucial step in informing broadband development policy, but its real importance lies in how that data is then used to fine tune policies and strategies.  All stakeholders must have access to, and be confident in, the data so that they can use it to inform their investment and policy/regulatory decisions.  All projects and initiatives involve judgments and trade-offs made in conditions of imperfect information, so transparent, reliable feedback is essential.  Not only does transparency enhance accountability, it also allows better information to flow through to decision makers, allowing them to improve policies and implementation through mid-course corrections.  Transparency is particularly important when public funds, loans, credits or other (financial) incentives are involved.

Public and stakeholder participation in policy formulation and implementation is critical for the long-term success of broadband development initiatives.  Thus, for governments considering how to effectively build and refine their policies and strategies, getting the collected data into the hands of those stakeholders is critical.  How can the data be made available?  First, the data must be produced using proper procedures, standard definitions and in a timely manner, as discussed in section 2.7.2.  Second, the data must be made widely available in formats that allow further analysis.

A number of governments have made it a priority to make information available for use by the public, operators and academics.  The government of the Republic of Korea, for example, has won wide recognition as an ICT development success story.  There is a profusion of information made available by the Korean government, both through Statistics Korea,[220] the national statistics office, and the Korea Communications Commission,[221] the national regulatory agency.  Officials responsible for measuring broadband development progress not only collect comprehensive data, they are also at the cutting-edge of discussions on the definition of indicators, the methodologies for their measurement, and interpretation.[222]  The United States FCC has developed a broadband coverage map, which is available online, that shows where (wired) broadband networks are available in the country.[223]  Germany has a similar mapping function that shows broadband speeds available across the country,[224] and has also created an infrastructure "atlas" that shows the passive infrastructure (from telecommunications, electricity, water and gas line providers) that could be used to help further buildout broadband networks.[225]  Such efforts can help identify those areas where broadband development still lags and those resources that could be used to help close the broadband development gap.

# Endnotes

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[3] In a technical sense, public goods are non-rivalrous (i.e., one person's use does not diminish another person's ability to use it) and non-excludable (people cannot be stopped from using it). Examples include free over-the-air radio and television and national defense. However, some argue that broadband is not a pure public good as broadband access is excludable as demonstrated by the unevenness of broadband deployment, even within the same country. Some may also argue that broadband is not a public good since it is also rivalrous—one person's use can diminish another's use if the network is congested. Robert Atkinson, *Network Policy and Economic*, Paper Presented at the 2010 Telecommunications Policy Research Conference (TPRC) (Oct. 2010), *available at* www.itif.org/files/2010-network-policy.pdf.

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respondents is less than 100 because, for purposes of comparison, not all factors addressed in the study are included in this figure.

[15] The experiences of the countries surveyed in the World Bank's report, *Building Broadband: Strategies and Policies for the Developing World*, for example, may provide good approaches that could be adapted for use in many countries.  Yongsoo Kim, Tim Kelly, and Siddhartha Raja, *Building Broadband: Strategies and Policies for the Developing World,* World Bank, (June 2010), *available at* http://www.infodev.org/en/Publication.1045.html.

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[63] Yongsoo Kim, *et al*., *Building Broadband: Strategies and Policies for the Developing World* (June 2010).

[64] Telecompaper, *KDN cuts internet rates by 90 percent* (Aug. 5, 2009), *available at* www.telecompaper.com/news/kenya-data-networks-cuts-internet-rates-by-90-percent.

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[66] World Bank, *The World Bank Guarantees: Leveraging Private Finance for Emerging Markets* (2002).

[67] Telecommunications Regulatory Authority, *Fixed Broadband Analysis Report 01 Oct 2010–31 Dec 2010* (2011), *available at* www.tra.org.bh/en/pdf/FixedBroadbandAnalysisReportQ42010.pdf.

[68] FCC, Broadband.gov, *About the Consumer Broadband Test (Beta)*, *available at* www.broadband.gov/qualitytest/about/.

[69] Robert Crandall, Jeffrey Eisenbach and Robert Litan, *Vertical Separation of Telecommunications Networks: Evidence from Five Countries*, Federal Communications Law Journal, pp. 494-95 (June 2010).

[70] *info*Dev, *Structural Separation Explained and Applied*, ICT Regulation Toolkit, *available at* http://www.ictregulationtoolkit.org/en/PracticeN ote.3149.html.

[71] *info*Dev, *Structural Separation Explained and Applied*, ICT Regulation Toolkit.

[72] Local loop unbundling (ULL) is the obligation imposed to the incumbent operator to provide access to the local loop or last mile of its network (i.e., the connecting network between the termination point of the subscriber premises and the main distribution framework of equivalent facility of the incumbent's fixed network). LLU obligations can be full or shared. Full LLU allows the use of the full frequency spectrum of fixed network. Shared LLU only authorize access to the non-voice frequencies of the fixed network.

[73] Kent Bressie, *Eight Myths about Undersea Cables*, Presented at the SubOptic2010 Conference (2010), *available at* www.wiltshiregrannis.com/siteFiles/News/0D12892E4C32D99099222C3A323EE38C.pdf?CFID=9388181&CFTOKEN=68748222.

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[75] Janet Hernandez, Daniel Leza and Kari Ballot-Lena, *ICT Regulation in the Digital Economy*, GSR-10 Discussion Paper (Nov. 2010), *available at* http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR10/documents/GSR10-paper3.pdf.

[76] *See* TRAI, *International Telecommunication Access to Essential Facilities at Cable Landing Stations Regulations* (June 7, 2007).

[77] CRC, Resolution No. 2065 (Feb. 27, 2009).

[78] Mark Williams, *Broadband for Africa:  Policy for Promoting the Development of Backbone Networks*, GICT, World Bank, p. 42 (Aug. 2008).

[79] *info*Dev/ITU, ICT Regulation Toolkit, *Backbone Network Enhancements* at www.ictregulationtoolkit.org/en/Section.3188.html (last visited January 27, 2011).

[80] Mark D. Williams, the International Bank for Reconstruction and Development/The World Bank, Broadband for Africa:  Developing Backbone Communications Networks, 2010.

[81] Mark Williams, World Bank, *Broadband for Africa: Policy for Promoting the Development of Backbone Networks* at 8 (August 2008).

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[83] OECD (Organisation for Economic Co-operation and Development), *Internet Traffic Exchange: Market Developments and Measurement of Growth*, (2006).

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[85] OECD, *Broadband Growth and Policies in OECD Countries,* (2008).

[86] Broadband Infraco, http://www.infraco.co.za/SitePages/Home.aspx.

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[89] TRAI, *Recommendations on Infrastructure Sharing*, pp. 19-20 (April 2007), *available at* http://www.ictregulationtoolkit.org/en/Publication.3632.html.

[90] B. Wook Kwon, OECD, *Public Rights of Way for Fibre Deployment to the Home*, (2008).

[91] Janet Hernandez, Daniel Leza and Kari Ballot-Lena, Telecommunications Management Group, Inc., *ICT Regulation in the Digital Economy*, GSR Discussion Paper, at 4 (2010).

[92] See Next Generation Connectivity: A review of broadband Internet transitions and policy from around the world, The Berkman Center for Internet and Society at Harvard University (February 2010) at http://cyber.law.harvard.edu/publications/2010/Next_Generation_Connectivity (last visited January 27, 2011) and Dr. Tracy Cohen and Russell Southwood, Extending Open Access to National Fibre Backbones in Developing Countries, GSR08: Six Degrees of Sharing, Discussion Paper (November 2008) at www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR08/papers.html (last visited January 27, 2011).

[93] See ITU/infoDev, ICT Regulation Toolkit, Module 6.6.5: Competition and Sharing at www.ictregulationtoolkit.org/en/Section.3486.html (last visited January 27, 2011).

[94] The most recent rules can be accessed at the ARCEP website, available at http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1[uid]=1350&tx_gsactualite_pi1[annee]=&tx_gsactualite_pi1[theme]=&tx_gsactualite_pi1[motscle]=&tx_gsactualite_pi1[backID]=26&cHash=01032942d9 (last visited February 7, 2011).

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[103] OECD, *Broadband Growth and Policies in OECD Countries,* (2008).

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[109] National Telecommunications and Information Administration, *NTIA Fact Sheet on Spectrum Plan and Timetable, Fast Track Evaluation*, available at http://www.ntia.doc.gov/reports/2010/SpectrumFactSheet_11152010.pdf (last visited January 27, 2011).

[110] OECD, *Broadband Growth and Policies in OECD Countries,* (2008).

[111] John Cox, *Verizon confirms details of U.S. LTE deployment,* available at http://www.networkworld.com/news/2009/021809-mwc-verizon.html (last visited January 27, 2011).

[112] Sweden: PTS, The 800 MHz auction is closed - three bidders won licenses (Mar. 4, 2011) available at http://www.pts.se/en-gb/News/Press-releases/2011/Press-release/

[113] France: ARCEP, 4G Spectrum Allocation: ARCEP publishes the results of the allocation procedure for 4G mobile licences in the 800 MHz band (the digital dividend) (Dec. 22, 2011) at http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1[uid]=1470&tx_gsactualite_pi1[backID]=1&cHash=80abfa005c.

[114] Switzerland: ComCom, Continuation of the mobile spectrum tender (July 19, 2011) at http://www.comcom.admin.ch/aktuell/00429/00457/00560/index.html?lang=en&msg-id=40253; UK: Ofcom, Second consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6 GHz spectrum and related issues (Jan. 12, 2012) at http://stakeholders.ofcom.org.uk/consultations/award-800mhz-2.6ghz/.

[115] Article 2, §7 of the Annex to Resolution 454 of December 2006 on the Conditions of Usage of the 800 MHz, 900 MHz, 1800 MHz and 1900/2100 MHz.

[116] Article 11, §1 of Resolution N. 544 of August 2010 on the Conditions of Usage of the 2500-2690 MHz band and Article 4, §2 of Resolution N. 537 of February 2010 on the Conditions of Usagage of the 3500 MHz band.

[117] European Commission, *14th Report on the Implementation of the Telecommunications Regulatory Package 2008* (2009).

[118] OECD, *Broadband Growth and Policies in OECD Countries,* (2008).

[119] For example, the various specific mobile allocations, such as land mobile, have now given way to simply "mobile."

[120] Further, the provision of data or even voice over traditional or alternative wireless networks was not a major disruption. However, the trend around the world has been for regulators to see the provision of video services over wireless networks as a problem. The introduction of mobile television and video broadcasting over "telecommunications" networks, for example, has led to significant hand wringing among many regulators. The primary cause for this is the stricter control governments seek over media and broadcasting than telecommunications. Even many countries that have adopted multiple play-friendly regulations are still maintaining older distinctions.

[121] The European Parliament and the Council of the European Union, *Directive 2009/114/EC of the European Parliament And Of The Council of amending Council Directive 87/372/EEC on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community*, (September 16, 2009).

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tualite_pi1[theme]=&tx_gsactualite_pi1[motscle]=&tx_gsactualite_pi1[backID]=26&cHash=a4d915cd36 , (last visited January 28, 2011).

[123] Operators can upgrade CDMA2000 networks in the 800 MHz band to datacentric CDMA2000 EV-DO networks. This has happened in 28 countries (for example, Brazil, Cameroon, Indonesia, and Morocco) to date. Further, even the GSM evolution to 3G, WCDMA, is now available in the 900 MHz band. Australia, Finland, France, and the United Kingdom have plans to deploy (or have already deployed) WCDMA in this band.

[124] For an in-depth study of spectrum management and reform in developing countries, see Bjorn Wellenius and I. Neto, World Bank Policy Research Working Paper, *Managing the Radio Spectrum: Framework for Reform in Developing Countries*, (2008).

[125] FCC, *Wireless Auctions: Information Page*, available at http://wireless.fcc.gov/auctions/default.htm?job=auction_factsheet&id=73 (last visited January 27, 2011).

[126] Ofcom, *Choice, Competition, Innovation: Delivering the Benefits of the Digital Dividend*, available at http://www.ofcom.org.uk/media/news/2007/12/nr_20071213a (last visited January 27, 2011).

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[128] For example, the U.S. Federal Communication Commission's Part 15 rules on how "intentional, unintentional, or incidental radiator may be operated without an individual license" states: "Emanations from the device shall be suppressed as much as practicable, but in no case shall the emanations exceed the levels specified in these rules... Parties responsible for equipment compliance should note that the limits specified in this Part will not prevent harmful interference under all circumstances." As such, manufacturers and users of devices using the unlicensed spectrum have a responsibility to reduce their harmful emissions as much as possible and minimize the possibility of interference with other devices. On the other hand, users of the devices have no right to be protected from harmful interference from another device.   See http://www.fcc.gov/oet/info/rules/ (last visited January 27, 2011).

[129] For an in-depth study of spectrum management and reform in developing countries, see Bjon Wellenius and I. Neto, World Bank Policy Research Working Paper, *Managing the Radio Spectrum: Framework for Reform in Developing Countries*, (2008).

[130]National IT and Telecom Agency, Public consultation over draft 800 MHz auction documents (Nov. 17, 2011) at http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/800-mhz/public-consultation-over-draft-800-mhz-auction-documents.

[131] Cisco, *Visual Networking Index Global IP Traffic Forecast 2010-2015* (June 2011), *available at* http://www.cisco.com/en/US/netsol/ns827/networking_solutions_sub_solution.html#~forecast.

[132] *Id.*

[133] Communications Commission of Kenya (CCK), *Quarterly Sector Statistics Report 1st Quarter July-Sept 2010/2011* (Jan. 2011).

[134] Based on the Pew Research Center's survey,  almost half of the non-Internet adult users surveyed in the United States indicated that they did not use the Internet because they did not find it relevant (they are not interested, consider it a waste of time, are too busy, or do not feel it is something they want or need).  Pew Internet & American Life Project, *Home Broadband 2010 – Trends in broadband adoption* (Aug. 2010), *available at* http://www.pewinternet.org/Reports/2010/Home-Broadband-2010/Part-1/Most-non-internet-users-have-limited-exposure-to-online-life.aspx.

[135] Some examples of civil society organizations involved in making Internet and especially broadband services more available, accessible and attractive include Tribal Digital Village, working among Native American reservations in the United States (see http://www.sctdv.net), and CUWiN (Champaign-Urbana Community Wireless Network), developing community-based wireless mesh technologies in various communities in the United States, West Africa, and South Africa (see http://www.cuwin.net).

[136] Janice Alane Hauge and James E. Prieger, *Demand-Side Programs to Stimulate Adoption of Broadband: What Works?* (Oct. 14, 2009), *available at* http://ssrn.com/abstract=1492342.

[137] Edwin San Román, *Bringing broadband access to rural areas: a step by step approach for regulators, policy makers and universal access program administrators: The experience of the Dominican Republic*, International Telecommunication Union, *Global Symposium for Regulators*, Beirut, Lebanon (2009).

[138] Educational Testing Service, *Digital Transformation: A Framework for ICT Literacy* (2002), *available at* http://www.ets.org/research/policy_research_reports/ict-report.

[139] Treaty of Lisbon, Consolidated versions of The Treaty on European Union and The Treaty on the Functioning of the European Union, Charter of Fundamental Rights of the European Union, articles 16 and 8, respectively, *available at* http://europa.eu/lisbon_treaty/full_text/index_en.htm. *See also* the European Convention on Human Rights, adopted by states member of The Council of Europe, at article 8.

[140] The central piece of legislation relating to data protection in the European Union is Directive 95/46/EC, on the protection of individuals with regard to the processing of personal data and on the free movement of such data. In addition, Directive 2002/58/EC, concerning the processing of personal data and the protection of privacy in the electronic communications sector ("e-Privacy Directive"), regulates areas which were not sufficiently covered by Directive 95/46/EC, such as confidentiality, billing and traffic data, rules on spam, etc. This Directive was subsequently amended by Directive 2009/136/EC of 25 November 2009 to, among other things, enhance privacy and data protection of Internet users.

[141] *See* FTC, *Solutions for Data Protection and Global Trade*, Remarks of FTC Commissioner Mozelle W. Thompson before the EU Committee of AMCHAM (Dec 1998), *available at* http://www.ftc.gov/speeches/thompson/speech123.shtm.

[142] *See* European Commission, *Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions: a comprehensive approach on personal data protection in the European Union* (Nov. 2010), *available at* http://ec.europa.eu/justice/news/consulting_public/0006/com_2010_609_en.pdf . *See also* U.S. Federal Trade Commission, *Protecting Consumer Privacy in an Era of rapid Change*, Preliminary FTC Staff Report, p. 28 (Dec. 2010).

[143] A data controller is a person (natural or legal) who alone or jointly with others determines the purposes and means of the processing of personal data.

[144] Department of Commerce Economics and Statistics Administration (ESA) and National Telecommunications and Information Administration (NTIA), *Exploring the Digital Nation: Home Broadband Internet Adoption in the United States* (Nov. 2010), *available at* http://www.esa.doc.gov/sites/default/files/reports/documents/report.pdf; Janice Alane Hauge and James E. Prieger, *Demand-Side Programs to Stimulate Adoption of Broadband: What Works?* (Oct. 14, 2009), *available at* http://ssrn.com/abstract=1492342.

[145] For example, according to the Digital Britain Report, at 33, in the UK, 30% of those without Internet service said that the main reason was cost or lack of computer ownership.

[146] Ovum, *Emerging markets paying three times more than rest of the world for broadband* (Sept. 20, 2010), *available at* http://about.datamonitor.com/media/archives/4775.

[147] Ministerio de Tecnologías de la Información y las Comunicaciones, *Ecosistema Digital » Servicios, available at* http://201.234.78.242/vivedigital/ecosistema_2_servicios.php.

[148] European Commission, *Connecting Europe at High Speed: National Broadband Strategies* (2004).

[149] T. Kelly, V. Gray, and M. Minges, ITU, *Broadband Korea: Internet Case Study* (2003).

[150] For a further example, see the global non-profit organization One Economy Corporation, at: http://www.one-economy.com/who-we-are. International locations include Turkey, Jordan, Israel, Cameroon, Kenya, Nigeria, Rwanda, South Africa, and Mexico.

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[151] See www.connectmk.com (last visited January 27, 2011).

[152] ITU, *The World in 2011 — ICT Facts and Figures* (2011) *available at* http://www.itu.int/ITU-D/ict/facts/2011/material/ICTFactsFigures2011.pdf.

[153] Daniela Battisti, *Broadband Policies, Focus on the Italian Government Action Plan*, OECD, *available at* www.oecd.org/dataoecd/35/45/1936957.ppt.

[154] "Voice over Broadband" (VoB) is a managed service using IP that provides the same quality as a traditional wireline telephone as well as providing users with their own number and a ringing telephone. In addition, VoB often provides other value-added features such as call waiting, voice mail, and speed dialing, as well as the ability for users to monitor these features online via the provider's web site.

[155] *See* BT, *BT Vision*, *available at* http://www.productsandservices.bt.com/consumerProducts/displayCategory.do;JSESSIONID_ecommerce=WWG1Nf2LyzDZSCd20Z7Kwc8MqZQMj4ZFbcrChsfrTGbw2MRYPvv2!-229543251?categoryId=CON-TV-I.

[156] Maintaining the security and privacy of patient health information and records is critical. More information on safeguards that have been developed can be found at: United States http://www.hhs.gov/ocr/privacy/, Canada http://www.ipc.on.ca/english/Home-Page/, United Nations http://www.hon.ch/home1.html.

[157] telecomAfrica, *mHealth – Pushing Frontiers of Health Care in Developing Countries* (Feb. 16, 2011), *available at* http://telecomafrica.org/?p=780.

[158] Charles Waterfield, *Virtual Conference on Electronic Banking for the Poor*, *available at* www.gdrc.org/icm/040412%20Ebanking%20Conference.doc.

[159] Hernandez, *et al., ICT Regulation in the Digital Economy*, GSR Discussion Paper, Telecommunications Management Group, Inc., p. 106 (2010).

[160] Daniel Pimienta, Daniel Prado and Álvaro Blanco, *Twelve years of measuring linguistic diversity in the Internet: balance and perspectives*, United Nations Educational, Scientific and Cultural Organization,, p. 35 (2009). This study compares the presence on the Internet of English with European languages. For every 100 pages in English on the Internet in 2007, there were eight in Spanish, 10 in French, six in Italian, three in Portuguese, and 13 in German.

[161] Alex Wilhelm, *Chinese: The New Dominant Language of the Internet*, The Next Web (Dec. 21, 2010), *available at* http://thenextweb.com/asia/2010/12/21/chinese-the-new-dominant-language-of-the-internet-infographic/.

[162] For example, there is no standardized keyboard layout for Pashto, an Indo-Iranian language spoken by about 25 million people in Afghanistan, India, Iran, Pakistan, Tajikistan, the UAE and the UK. There is a standard for Pashto text encoding, so some progress is seen. However, there is no standard interface terminology translation in Pashto, which makes achieving digital literacy more challenging. Samad Hussain, Nadir Durrani, and Sana Gul, *Pan-Localization, Survey of Language Computing in Asia* (2005), *available at* http://www.panl10n.net/english/outputs/Survey/Pashto.pdf.

[163] Sri Lanka's ICT Agency has a Local Languages Initiative to enable ICT in languages such as Sinhala or Tamil (http://www.icta.lk/en/programmes/pli-development/68-projects/557-local-languages-initiative-lli.html).

[164] See Article 19 of the Universal Declaration of Human Rights and Article 19(3) of the International Covenant on Civil and Political Rights.

[165] Any limitation to the right to freedom of expression must pass the following three-part, cumulative test: a) It must be provided by law, which is clear and accessible to everyone (principles of predictability and transparency); and (b) It must pursue one of the purposes set out in article 19, paragraph 3, of the International Covenant on Civil and Political Rights, namely (i) to protect the rights or reputations of others, or (ii) to protect national security or of public order, or of public health or morals (principle of legitimacy); and (c) It must be proven as necessary and the least restrictive means required to achieve the purported aim (principles of necessity and proportionality). *See* United Nations, Human Rights Council, *Report of the Special Rapporteur on the promotion and protection of the*

*right to freedom of opinion and expression*, p. 8 (May 2011) *available at*
http://www2.ohchr.org/english/bodies/hrcouncil/docs/17session/A.HRC.17.27_en.pdf.

[166] *Id*. at p. 19.

[167] FOSI, *ICRA Tools*, available at http://www.fosi.org/icra/.

[168] *See, e.g.,* OpenNet Initiative's research at http://opennet.net/research/regions/asia.  ISP filtering is also a key component of the Australian Government's cyber-safety plan; *see* http://www.dbcde.gov.au/funding_and_programs/cybersafety_plan/internet_service_provider_isp_filtering.

[169] Ben Sisario, *U.S. Shuts Down Web Sites in Piracy Crackdown*, New York Times (Nov. 26, 2010), *available at* http://www.nytimes.com/2010/11/27/technology/27torrent.html.

[170] Yongsoo Kim, *et al.*, *Building Broadband: Strategies and Policies for the Developing World,* p. 56 (June 2010).

[171] Task Force on Financial Mechanisms for ICT for Development, *A review of trends and an analysis of gaps and promising practices*, p. 22 (Dec. 2004).

[172] OECD, *Broadband Growth and Policies in OECD Countries* (2008).

[173] Oxford Analytica, *Connecting Africa: Continent-wide mobile broadband rollout intensifies* (July 2010), *available at* http://www.forbes.com/2010/07/28/africa-mobile-broadband-business-oxford-analytica.html.

[174] Timothy Irwin, *Public Money for Private Infrastructure,* World Bank Working Paper No. 10 (2003).

[175] International development organizations, such as the World Bank and regional development banks, typically have an overall funding envelope for a particular country at a given time which involves tradeoffs among competing eligible initiatives.

[176] Mark Dutz, Jonathan Orzag, and Robert Willig, *The substantial consumer benefits of broadband connectivity for US households* (2009), available at http://internetinnovation.org.

[177] European Commission, *Communication from the Commission:  Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband network,* (Sep. 30, 2009), *available at*  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2009:235:0007:0025:EN:PDF.

[178] European Commission, *Communication from the Commission:  Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband network,* (Sep. 30, 2009).

[179] Christine Qiang, *Broadband Infrastructure Investment in Stimulus Packages: Relevance for Developing Countries*, World Bank, p. 1 (2009).

[180] European Commission, "Connecting Europe Facility: Commission adopts plan for €50 billion boost to European networks," Press Release, October 19, 2011, available at: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/1200&format=HTML&aged=0&language=EN&guiLanguage=en.

[181] Department for Business Innovation and Skills, *Digital Britain*, Final Report (2009), *available at* http://webarchive.nationalarchives.gov.uk/+/http://www.culture.gov.uk/images/publications/digitalbritain-finalreport-jun09.pdf

[182] Natasha Lomas, BT: Fibre broadband coming to two-thirds of UK by 2015, silicon.com (May 13, 2010), available at www.silicon.com/technology/networks/2010/05/13/bt-fibre-broadband-coming-to-two-thirds-of-uk-by-2015-39745802/.

[183] Paul France, BT brings fibre to first Cornwall homes, cable.co.uk (Mar. 28, 2011), available at www.cable.co.uk/news/bt-brings-fibre-broadband-to-first-cornwall-homes-800478200/.

[184] Zaywa, *Qatar's Government Establishes Q.NBN to Accelerate Rollout of Nationwide Broadband Fiber to the Home (FTTH) Network, available at*

https://www.zawya.com/Story.cfm/sidZAWYA20110327102507/Q.NBN%20To%20Build%20Qatar%20National%20Broadband%20Network .

[185] Michael Malakata, *Rwanda's mobile broadband is Africa's first*, Computerworld (Dec. 2009), *available at* http://news.idg.no/cw/art.cfm?id=D6F3D422-1A64-67EA-E4FF70C29D8BDB9D.

[186] The discussion of subsidies draws, including *verbatim* without quotes, from *Björn Wellenius, Vivien Foster and Christina Malmberg Calvo, Private Provision of Rural Infrastructure Services: Competing for Subsidies, World Bank Policy Research Working Paper No. 3365 (2004)*.  The examples are taken from the individual references noted.

[187] *info*Dev, *ICT Regulation Toolkit, Module 4:  Universal Access and Service, Section 5.4.1 Public Private Partnerships, available at*http://www.ictregulationtoolkit.org/en/Section.3288.html

[188] The consortium is headed by France Telecom-Orange, and includes:  Baharicom Development Company; Benin Telecoms; Cable Consortium of Liberia; Orange Cameroun; Companhia Santomense de Telecomunicacoes; Cote d'Ivoire Telecom Expresso Telecom Group; Gambia Telecommunications Company; International Mauritania Telecom; Office Congolais des Postes et Telecommunication; Orange Guinea; Orange Mali; Orange Niger; PT Comunicacoes; the Republic of Equatorial Guinea; the Gabonese Republic; Sierra Leone Cable; Societe des Telecommunications de Guinee; and Sonatel.Alcatel Lucent, News Release on ACE Cable (June 2010), *available at* http://www.prnewswire.com/news-releases/20-operators-team-with-alcatel-lucent-to-bring-fast-lower-cost-broadband-connectivity-in-africa-with-a-new-17000-km-submarine-system-95852004.html

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[192] *info*Dev *ICT Regulation Toolkit, Module 4:  Universal Access and Service, Section 5.4.2*, *available at* http://www.ictregulationtoolkit.org/en/Section.3289.html

[193] *Id.*

[194] , *available at* http://cms.tm.tue.nl/Ecis/Files/papers/wp2010/wp1003.pdf.

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[200] Sofie Maddens, *Trends in Universal Access and Service Policies*, GSR-09 Background Paper, Beirut, Lebanon (November 10, 2009), *available at* http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR09/papers.html.

[201] Irwin 2003*, op. cit.*

[202] Some instruments can actually compound the obstacles.  For example, granting tax holidays or custom duty exemptions weakens the business climate by discriminating among economic activities and increasing the cost of tax administration and compliance.

[203] Irwin 2003, *op. cit.*

[204] Although the deployment of national backbones are important goals of some broadband plans, the indicators to measure developments in these areas have not been identified or defined by the international statistical community and the data are not widely available. Nevertheless, perusal of plans from some countries can help to identify relevant indicators. For example India's proposed broadband plan calls for the construction of a national fiber optic backbone throughout the country. This might be measured by indicators such as the number of localities served by the national fiber optic backbone and kilometers of fiber backbone in the network. See: "India's national broadband policy to be sent for Cabinet approval shortly." *TeleGeography CommsUpdate*. 31 March, 2011. http://www.telegeography.com/products/commsupdate/articles/2011/03/31/indias-national-broadband-policy-to-be-sent-for-cabinet-approval-shortly/

[205] The Partnership aims to develop further different initiatives regarding the availability and measurement of ICT indicators at the regional and international levels. It provides an open framework for developing a coherent and structured approach to advancing the development of ICT indicators globally, and in particular in developing countries. Partners include EUROSTAT, ITU, OECD, UNCTAD, UNESCO Institute for Statistics, the UN Regional Commissions (UNECLAC, UNESCWA, UNESCAP, and UNECA), United Nations Department of Economic and Social Affairs (UNDESA), and the World Bank. See: http://www.itu.int/ITU-D/ict/partnership/index.html

[206] See: Partnership on Measuring ICT for Development. 2010. *Core ICT Indicators*. http://new.unctad.org/upload/docs/ICT_CORE-2010.pdf . In addition, the ITU has identified and defined other broadband-related statistics. See: ITU. 2010. *Definitions of World Telecommunication/ICT Indicators*. http://www.itu.int/ITU-D/ict/handbook.html

[207] For more on issues relating to measuring broadband coverage, see OECD Committee for Information, Computer and Communication Policy, *Indicators of broadband coverage*. DSTI/ICCP/CISP(2009)3/FINAL (Dec. 10, 2009), *available at* http://www.oecd.org/dataoecd/41/39/44381795.pdf.

[208] ITU, *Definitions of world telecommunication/ICT indicators,* ITU code 271G (Mar. 10, 2010).

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[210] Subscription data, for example, are not precisely comparable across countries because household sizes can vary. In addition, there will be significant duplication if fixed and wireless broadband subscriptions are simply aggregated for an overall access figure, since some users may have a fixed and a wireless connection, or even more than one wireless connection (e.g., a phone and a data modem for a computer).

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[213] Telecommunications Regulatory Authority, *Broadband Analysis Report* (Apr. 2011), *available at* http://www.tra.org.bh/en/marketQuality.asp.

[214] For example, the FCC in the United States has a consumer broadband webpage where tests can be run to test speed, latency and jitter. See http://www.broadband.gov/qualitytest/about/.

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