Building broadband: Strategies and policies for the developing world

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Contents

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The authors retain sole responsibility for any residual errors.

Executive summary

A growing number of countries are seeking to spur broadband development. This report offers policymakers and regulators an analysis of approaches that leading countries have taken in expanding their broadband markets, with a focus on the Republic of Korea. In addition, case studies cover Finland, France, Japan, Sweden, the United Kingdom, and the United States. The analysis suggests policies and regulations that developing countries could consider to support the growth of broadband.

The state of broadband. By late 2009 the number of broadband subscriptions—both wireline and wireless—had crossed 1 billion globally. Most of these connections are in the developed world, with the developing world lagging significantly.

	Broadband subscribers (million)	***Market penetration (per 100 inhabitants)***
East Asia & Pacific	381.4	17.8
Eastern Europe & Central Asia	49.2	12.4
European Union (EU-27)	294.1	60.5
Latin America & Caribbean	52.4	9.2
Middle East & North Africa	27.8	7.6
North America	210.9	62.5
South Asia	9.1	0.6
Sub-Saharan Africa	15.6	1.9
World	1040.6	15.6

Table: Global broadband subscriptions (wireline and wireless), September 2009[1]

Redefining broadband. This report proposes that broadband be defined beyond the traditional notion of a specific type of network connectivity or minimum transmission speed. Rather, it proposes that broadband be viewed as an "ecosystem" that includes its networks, the services that the networks carry, the applications they deliver, and users. Each of these components has been transformed by technological, business, and market developments.

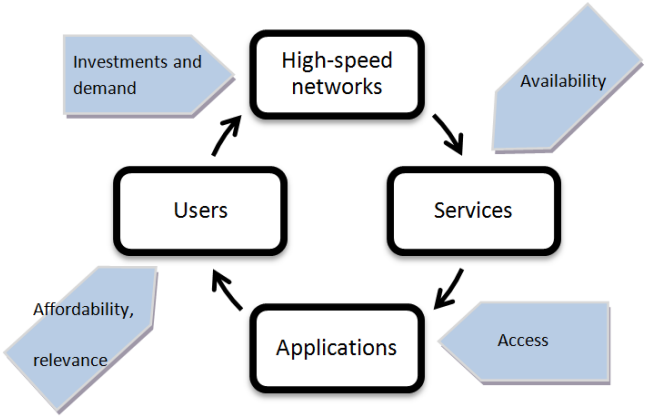

Figure: The broadband ecosystem

Defining broadband to include both the supply and demand sides of the market also leads to a rethinking of approaches to spur broadband access and use. It is critical to create an enabling environment for supply-side growth in terms of access to networks and services—but is also important to facilitate demand for and adoption of broadband.

Strategies and policies. Countries' approaches to broadband often include strategies that lead to the formulation of policies and regulations. These strategies evolve with markets and focus on building the supply of, and demand for, broadband. They create the base for policy implementation in the initial stage, creating the strategic framework and institutions that implement strategies through policies and regulations.

To derive a list of these policies and regulations, this report focuses on the Republic of Korea—which is not only one of the most successful broadband markets, but has also deployed a wide range of polices and regulations. Policies and programs for broadband market development can be split into three components that overlap but also follow a logical sequence: promotion, oversight, and universalization.

	Early stage: Promote	***Mass market: Oversee***	***Universal service: Universalize***
Goal	*Focus on promotional policies as a pump-primer to spread broadband networks*	*Facilitate competition through consistent, facilitating regulation*	*Universalize broadband service as the market grows*
Networks	• Develop an enabling environment through policies and regulation that promote investment and market entry • Reduce administrative burdens and provide incentives and subsidies for R&D, pilots, and network rollout • Develop cyber-building certification systems • Allocate and assign spectrum for wireless broadband services	• Consider infrastructure sharing, including unbundling of the local loop • Reallocate spectrum to expand available bandwidth	• Undertake deployment of open access to broadband networks in rural or remote areas, using public/private partnerships, as appropriate • Coordinate access to rights-of-way
Services	• Provide broadband networks to schools, government agencies, etc (government as an anchor tenant) • Standardize and monitor service quality	• Create an enabling environment for intra- and intermodal competition • Ensure non-discriminatory access for service, application, and content providers	• Consider expanding universal service obligation to include broadband
Applications	• Promote government-led demand aggregation • Government agencies as early adopters and innovators • Provide e-government and e-learning applications • Promote creation of digital content • Develop local content and hardware sector	• Support secure, private, reliable e-commerce transactions • Introduce intellectual property protections	• Develop advanced e-government programs • Offer grants to community champions and broadband demand aggregators
Users	• Provide low-cost computers and other user devices, such as in education • Deliver digital literacy programs	• Promote ethics on information use	• Expand universal service programs to underserved communities • Construct community access centers • Provide subsidies for poor households to buy user devices (such as computers)

Broadband building blocks. This report proposes three building blocks that countries may wish to consider as they attempt to develop their broadband markets. These building blocks are not the only tools available for growth, nor are they applicable to all countries. Rather, they represent emerging good practices that countries can study and adapt to their own goals, circumstances, and resources.

- ***Be visionary yet flexible***. Most of the countries surveyed have, early in the growth of their broadband markets, developed national broadband strategies that laid out their visions and service goals. These served as frameworks in which policies and regulations were developed to implement the strategies though public-private partnerships. But such strategies were not static: they adapted to evolving markets and accommodated newer technologies. By 2009 all the countries surveyed had, or were developing, a national broadband strategy.
- ***Use competition to promote market growth***. The more successful countries in the survey used collaborative approaches between the public and private sectors to promote and later universalize broadband services. In some cases, public investments aimed at specific gaps or triggered larger private investments. Further, every country surveyed relied on competition to expand the broadband market. Some focused on facility competition, while others focused on service competition. The more successful countries generally also benefited from inter-modal competition, notably between digital subscriber line (DSL), cable modem, and third-generation (3G) wireless technologies. Each country tried to create level playing fields and competitive markets to ensure fast private sector–led growth of broadband services.
- ***Facilitate demand***. The successful countries in the survey developed and implemented demand facilitation policies in the initial stages of market development to raise broadband awareness among users, make services more affordable, and expand networks and services to the widest population in the shortest time possible. Other countries have used public funds for more than network rollout, and have supported research, manufacturing promotion, content development, user awareness, ICT skill development and digital literacy programs.

Application to developing countries. Countries across the developing world are looking to increase access to, and use of, broadband. In particular, broadband is seen as a general purpose technology that stimulates growth in the wider economy and creates new business opportunities. Given varying political and economic circumstances, however, it is impossible to provide universal solutions. Therefore, the findings of this report will have different implications for different countries.

This report develops a long list of policies and programs framed within a strategic framework that allows specific solutions tailored to countries' circumstances. The building blocks identified are useful everywhere because they focus on improving incentives and the climate for private investment—a policy that even highly resource constrained countries should be able to follow. Further, the report finds that policies and programs implemented fall into three stages—promotion when the market was incipient, oversight as competition begins to drive growth, and universalization as the market matures. This report provides emerging best practices to support broadband market growth at each stage.

Developing countries could also use the experiences of the surveyed countries to find ways to leverage even limited resources for maximum impact and develop programs based on demand and market evolution. To help countries in these efforts, an upcoming broadband strategies toolkit, being developed by the GICT Department, will provide more detail, and a wider range of case studies, on how to convert the broad strategic and policy ideas in this report to practical instruments used in policymaking, regulation, and implementation of broadband network development.[2]

Chapter 1. The status and importance of broadband

Countries around the world are looking to spur the growth of broadband access and use as the next stage in the development of telecommunications networks and services. Using a variety of networks and devices—from mobile handsets to desktop computers—broadband offers high-speed data transmission, enables multimedia communication, improves access to information, and supports high-quality Internet connectivity. In addition, by exploiting wireless technology for high-speed Internet connections, broadband can cement gains from the significantly global expansion in access to telecommunications provided by mobile telephones.

The status of broadband connectivity

There are more than 1 billion broadband subscriptions globally. In September 2009, there were over 465 million fixed broadband subscribers—nearly three times the number in December 2004.[3] There were also more than 575 million wireless high-speed data subscriptions—almost 20 times as many as in December 2004.[4] Pyramid Research forecasts that by 2013 the number of broadband subscriptions (both wireline and wireless) will exceed 3 billion as today's narrowband networks are upgraded to broadband.[5] Some countries, such as Singapore, already have a combined fixed and mobile broadband penetration rate in excess of 100 per 100 inhabitants.

But broadband is spread unevenly. For example, North American and European Union countries together contain about half of global subscribers—while South Asia and Sub-Saharan Africa contain less than 3 percent (Table 1).

	Broadband subscribers (million)	***Market penetration (per 100 inhabitants)***
East Asia & Pacific	381.4	17.8
Eastern Europe & Central Asia	49.2	12.4
European Union (EU-27)	294.1	60.5
Latin America & Caribbean	52.4	9.2
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North America	210.9	62.5
South Asia	9.1	0.6
Sub-Saharan Africa	15.6	1.9
World	1040.6	15.6

Table 1: Global broadband market penetration, September 2009[6,]

There is significant scope for broadband networks to grow. Worldwide, less than a quarter of fixed telephone lines have been upgraded to digital subscriber line (DSL) broadband connections (just under a half if other fixed line technologies are included, and third generation cellular (3G) connections account for just over one-fifth of wireless telephone subscriptions. Again, regional discrepancies are significant (Table 2). In North America, conversion of fixed-lines is more advanced while in the European Union and most developing regions, it is the conversion of mobile subscriptions to broadband which is taking the lead.

Data for cable broadband—broadband services provided over cable television (TV) networks—also suggest wide variation among countries. In Bulgaria, cable broadband subscribers account for 62 percent of all broadband subscribers, while in neighboring Turkey that share is one percent. In the United States, half of broadband subscriptions are via cable TV networks, while in the United Kingdom it is about a quarter.[7]

Region	***3G/Total wireless[8]***	***DSL/Total mainlines[9]***
East Asia & Pacific	18.3%	15.1%
Eastern Europe & Central Asia	10.1%	4.8%
European Union (EU-27)	44.3%	29.1%
Latin America & Caribbean	20.2%	4.0%
Middle East & North Africa	8.9%	6.2%
North America	21.0%	37.9%
South Asia	12.3%	0.2%
Sub-Saharan Africa	7.9%	4.6%
World	21.5%	12.8%

Table 2: Broadband connections relative to voice telecommunications connections (percent), December 2008

Broadband growth is similarly uneven. Between 2005 and 2008 Eastern Europe added 19.5 million fixed broadband subscribers, raising market penetration in the region to 7.5 percent. During that period African countries added 2.4 million fixed broadband subscribers, bringing market penetration to 0.36 percent.[10]

Moreover, anticipated investments indicate that gaps in broadband access, at least for fixed networks, will continue to widen. An earlier study by the World Bank found a potential "next generation network gap" between countries that already had higher broadband penetration and those that did not.[11] The significant investments being planned through government stimulus packages are also generally higher among existing broadband leaders.[12] And broadband services are much more expensive in low- and middle-income countries than in high-income ones (which is not the case for mobile communications).[13] All these factors suggest that the broadband digital divide may not narrow anytime soon.

Why has broadband become a policy issue?

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,[14] and it can contribute to social and cultural development.

Yet the new digital divides do not just separate the mostly high-income countries that are broadband leaders from the mostly middle- and low-income countries that are broadband laggards. Those divides also work within countries and communities, separating those who can and do use broadband from those who cannot or do not.

Countries, communities, corporations, and individuals that lack easy access to broadband may miss economic and social opportunities. Broadband cities attract more services firms and so create more jobs than their narrowband counterparts.[15] 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.

Economic impact

The World Bank has found that in low- and middle-income countries every 10 percentage point increase in broadband penetration accelerates economic growth by 1.38 percentage points—more than in high-income countries and more than for other telecommunications services (Figure 1).[16] In a similar study, McKinsey & Company estimates that "a 10 percent increase in broadband household penetration delivers a boost to a country's GDP that ranges from 0.1 percent to 1.4 percent."[17] Booz & Company found that "10 percent higher broadband penetration in a specific year is correlated to 1.5 percent greater labor productivity growth over the following five years." Booz also suggests that "countries in the top tier of broadband penetration have exhibited 2 percent higher GDP growth than countries in the bottom tier."[18] These studies are the latest in the already extensive work estimating broadband's economic impact.[19]

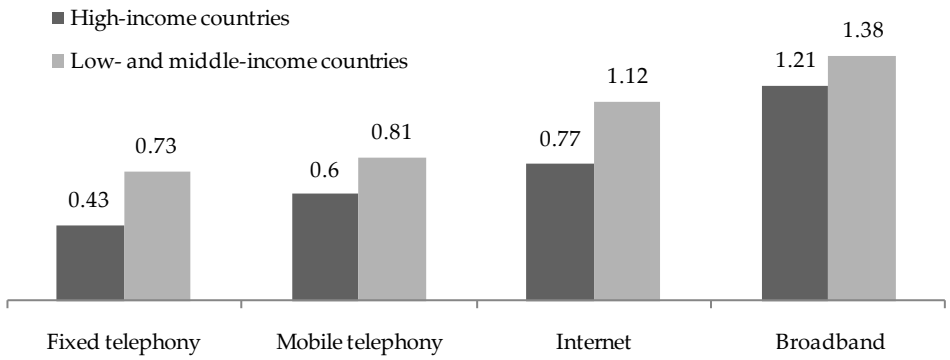


Figure 1: Growth impact of telecommunications
(GDP percentage point increase due to 10 percentage-point increase in penetration)

Developing other elements of the broadband ecosystem also provides economic benefits. For example, the growth of Internet-related services and applications has created jobs and led to the creation of new businesses. For example, in November 2009 Google had a market capitalization of $168 billion and employed 19,000 people in 20 countries.[20] China's leading Internet search engine, Baidu.com, has a market capitalization of more than $14 billion and over 6,000 employees, and in 2008 had revenues of $460 million.[21]

Developers have also been extremely active in creating applications for various handsets. Annual sales of applications for Apple's iPhone exceed $2.4 billion, as well as stimulating additional hardware sales.[22] Thus broadband creates significant economic opportunities for users, service providers, application developers, and network operators alike. McKinsey estimates that "bringing broadband penetration levels in emerging markets to today's Western European levels could potentially add US$300–420 billion in GDP and generate 10–14 million jobs."[23]

Social impact

Broadband also has social benefits, connecting consumers, businesses, and governments and facilitating social interaction.[24] It delivers information to individuals and businesses, supports good governance, and strengthens social capital.

Widespread access to information sources supports economic activity and good governance. Broadband allows companies to explore new business opportunities, reach customers, and obtain information about market prices. Better access to information makes markets work more efficiently[25] and raises producer incomes.[26] Information about the performance of governments and politicians makes governments more accountable[27] and improves public services.[28]

Finally, broadband networks are increasingly used to deliver public services: financial services, health care, electronic voting, and electronic land registration are all examples of services that were once delivered manually but are now being automated and delivered over broadband networks, often substituting for personal travel or physical movement of goods.

In a 2006 report the Pew Research Center's Internet & American Life Project found that, "the internet and email play an important role in maintaining these dispersed social networks. Rather than conflicting with people's community ties, we find that the internet fits seamlessly with in-person and phone encounters." The Pew study, conducted in 2004, found that Internet users are more likely to receive help on a range of key issues, with 85 percent of users receiving help compared with 72 percent of non-users. The issues included looking for information about a medical condition, making a financial decision, and seeking a new job.[29] Broadband supports these social ties. A 2009 report by Pew found that many people consider broadband an important part of their lives (Figure 2).

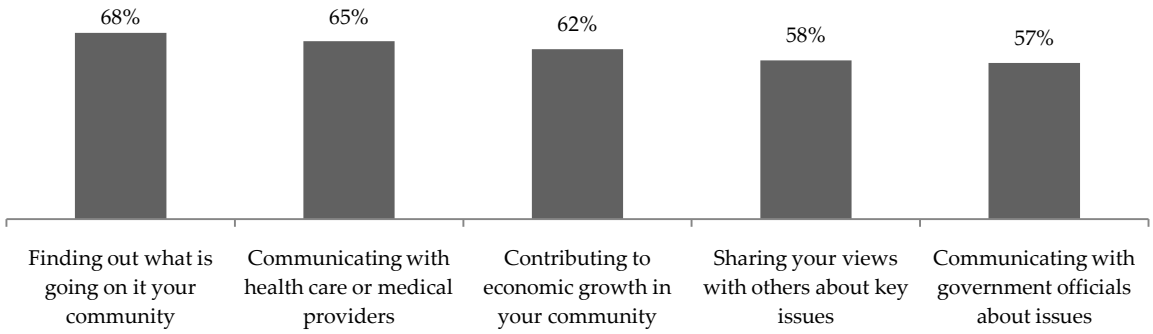


Figure 2: Broadband activities cited as important by users (percent)[30]

The policy response

Recognizing the widening broadband divide and the risk of some groups missing the economic and social benefits of broadband access and use, policymakers in a growing number of countries are looking to promote it. Even some countries with well-developed markets are looking to universalize broadband. As noted, some are promoting broadband as part of larger macroeconomic stimulus programs.

But policymakers are also realizing that success in broadband is harder to achieve than with mobile telephony, the spread of which was driven by huge consumer demand and falling ownership costs. Broadband has both supply and demand considerations. For instance, while the usefulness of a telephone is obvious even to illiterate or poor individuals, the same can be rarely said of broadband—especially if the opportunity to try it is quashed by cost considerations. Access requires owning a computer or smartphone and having a connection, making ownership relatively costly (even with falling prices for hardware and subscriptions). Using broadband requires also some level of digital literacy. Consequently, broadband access and use remain incipient in the developing world.

This report's contents

The rest of this report has seven chapters. Chapter 2 proposes rethinking how the term broadband is used given recent developments in networks, services and applications, and users. The report draws on academic and technical sources to reconceptualize broadband as an ecosystem.

Chapter 3 provides detailed analysis of broadband market development in the Republic of Korea. The country represents emerging best practice in approaching broadband as an ecosystem and has been highly successful in spurring rapid growth of broadband. Furthermore, Korea has a wide variety of broadband policies and programs, and its rich experience may be useful for other countries.

Chapter 4 summarizes approaches used by other countries to develop successful broadband markets. The analysis—based on surveys of Finland, France, Japan, Sweden, the United Kingdom, and the United States—identifies a range of approaches for building broadband access and use.

The next two chapters analyze how various countries have built broadband ecosystems. Chapter 5 discusses how governments (and the public sector as a whole) have evolved in supporting the growth of broadband markets. The chapter discusses how governments are defining national broadband strategies, promoting efficient markets and equitable access, and facilitating demand. Chapter 6 lists the policies and programs that the surveyed countries have used to expand broadband access and use.

Chapter 7 closes by offering building blocks for governments to consider as they develop broadband policies and programs.

Limitations and an important caveat

Because this report provides concepts and principles derived from studies of Korea and other high-income countries, there are some limits to its scope.[31] The report stays away from prescriptions because there is great diversity in market status across countries. The report does not provide details on how policies or regulations should be developed—countries will have to prepare these based on their own circumstances, resources, and goals.[32]

Further, this report focuses on the development of the broadband *access* market—that is, the retail and not wholesale market for broadband. Though the report addresses domestic and international backbone connectivity given its importance for broadband market development, the focus remains on the links between users and providers of broadband services—the so-called last mile of broadband networks. It is important to understand that high-quality and low-cost international connectivity is essential for domestic broadband development, else high take-up of broadband will face a major bottleneck. For detailed examinations of backbone policies and programs, see earlier work by the World Bank,[33] and the contents of the upcoming broadband strategies toolkit.

This report also comes with an important caveat. At no point is the intention to create a backdoor for government entry into service provision, a move that could undo two decades of reforms and progress in the information and communication technology (ICT) sector. Rather, a balance should be struck between public programs that extend the reach and adoption of broadband services and private operations of the infrastructure and services. This report is not intended to suggest substitutions for market mechanisms, but rather to recommend policies that facilitate market provision of broadband services. It looks for new ways for governments to improve access to broadband services supplied by the private sector.

As Qiang notes, before making public investments in broadband, "governments should first look at regulatory tools that might be able to increase entry and competition, and hence maximize what the market can deliver on its own." Furthermore, to maintain a level playing field for competition even with public investments, governments should minimize the risk of choosing winners. Hence, when governments intervene, subsidized networks should be open access—meaning that network providers offer capacity or access to all market participants in a nondiscriminatory way.[34] Such rules, such as the European Commission's State Aid Rules, should be well understood and implemented in a transparent manner.[35]

In cases where governments are trying to promote growth of underdeveloped markets, arrangements should ensure that public investments are crowded in and occur only when no private investments are expected for a significant period. Furthermore, governments can still encourage private investments in such cases without direct subsidies. For example, developing passive infrastructure—ducting, towers, cable conduits, and opening rights of way—significantly cuts costs and creates minimal market distortions.[36]

Future efforts

This report is the first stage of a larger project. With support from the Republic of Korea's Trust Fund on Information and Communication for Development (IC4D), *info*Dev and the World Bank's Global ICT Department will be developing a toolkit for broadband strategies. This toolkit will be a rich source of information, regulatory and licensing documents, and practical examples related to policymaking, regulation, and implementation of broadband network development. The toolkit will also include detailed case studies for a number of countries, including those surveyed in this report.[37]

Chapter 2. Rethinking broadband as an ecosystem

This chapter reconceptualizes broadband in light of recent trends in information and communication technology (ICT). Traditionally, broadband is defined as a high-speed communications network that connects users at data transfer speeds above some minimum such as 256 kilobits per second (kbit/s or kbps). But this definition leads to an incomplete conceptualization of broadband. More than just a network, broadband is an "ecosystem" comprising various elements that depend on high-speed connectivity to interact in different ways.

The broadband ecosystem

This report conceptualizes broadband as an interconnected, multilayered ecosystem of high-capacity communications networks, services, applications, and users. This ecosystem—for the retail or access segment—is represented in Figure 3.

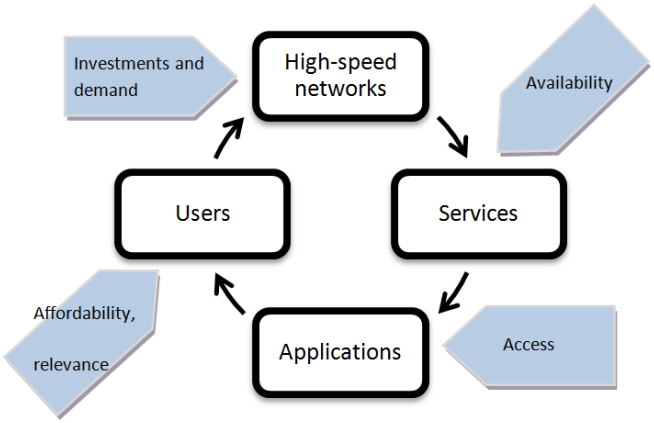


Figure 3: The broadband ecosystem

The ecosystem includes the networks that support high-speed data communication and the services these networks provide. It also includes the applications provided by these services and the users who are increasingly creating applications and content. Investments—by public or private investors and agencies—and user demand expand the reach of high-speed networks. These networks increase the availability of high-quality services to both users and application providers. Applications access these services to reach users, who respond to the affordability of the services and relevance of the applications. Users then grow in number and sophistication, demanding and driving greater investments in networks, creating the virtuous circle for broadband.

The importance of the ecosystem

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

A broader conceptual framework helps because it causes a rethinking of the areas of focus for broadband policies and strategies. It suggests that to expand the ecosystem, governments will have to design various policies and programs focused on different components of the ecosystem. Countries might overlook the "demand facilitation" aspect of broadband strategies if they consider only the supply of broadband connectivity. For instance, not considering users and applications—the demand side—could lead to an incomplete policy or strategy.

There are various inter-dependencies among the components of the broadband ecosystem, and hence a holistic approach to broadband has produced better results. These interdependencies link the various components in multiple

ways. Investments in high-speed networks improve the quality of service and promote the creation of even more complex or bandwidth-intensive applications. Similarly, the availability of various applications attracts more users by increasing the value of broadband and supports wider investments in networks and quality of services. Wide spread access to services has also allowed users to create their own content, again driving the demand for high quality services that can do more than simply 'download' content, but also allow sharing among users. The following explores these developments.

As the countries surveyed in this report shows, building a high-speed telecommunications network is only the necessary first step in developing a broadband system. A range of policies and programs are needed to promote and universalize the use of this network by supporting the development of services and applications, encouraging users to go online and taking steps towards wider inclusiveness.

Consequently, viewing broadband as an ecosystem fits with the growing recognition that government strategies need to develop "pull" measures focused on building demand. Such pull measures can promote digital literacy, establish an enabling environment (including an appropriate legal framework), and foster the development of applications (including local content).

This chapter details this conceptual framework and these components in the context of current technological and business trends. It introduces the four elements of the broadband ecosystem—networks, services, applications, and users—and describes recent trends affecting each.

Networks

Broadband connectivity is expanding globally. The number of fixed broadband subscribers reached 465 million by September 2009, up from 286 million in December 2006. Of these, 128 million are from Brazil, Russia, India and China (known as the BRIC countries); double the subscriber base of 2006.[38] The number of wireless broadband networks has also expanded. In September 2009 there were more than 570 million high-speed subscriptions over mobile networks—people using third generation (3G) or more advanced systems.[39] In mid-2009 there were some 343 wireless broadband networks (based on technologies such as WiMAX).[40]

Traditional definitions of broadband networks focus on the provision of high-speed data connectivity above a minimum bandwidth. But this minimum varies across agencies and countries, and evolves over time.

From a technical perspective, for instance, Recommendation I.113 of the International Telecommunication Union Standardization Sector defines broadband as a "transmission capacity that is faster than primary rate Integrated Services Digital Network (ISDN) at 1.5 or 2.0 Megabits per second (Mbit/s)."[41] But more recent definitions are based on recognition of how broadband services are advertised. The Partnership for Measuring ICT for Development, a consortium of international organizations and agencies, has adopted the definition used by the Organisation for Economic Co-operation and Development (OECD), International Telecommunication Union, and United Nations Conference on Trade and Development—a network capable of speeds of "at least 256 kbit/s, in one or both directions."[42]

There are also wide variations across countries. The Canadian Radio-television and Telecommunications Commission defines high-speed Internet service as having data speeds at or above 128 kbit/s, while broadband service involves data speeds at or above 1.5 Mbit/s.[43] The US Federal Communications Commission recently upgraded its definition of broadband from 200 kbit/s to 800 kbit/s as part of its ongoing development of a national broadband strategy.[44] The Digital Britain plan seeks to deliver universal broadband services at 2 Mbit/s by 2012.[45] In February 2009 Korea unveiled plans in to build a broadband network that allows data uploads and downloads of 1 gigabit per second (Gbit/s) by 2013.[46]

Box A: Truth in labeling for broadband speeds

World over, broadband service providers advertize bandwidths that are often higher than the bandwidths actually experienced by the user. Reports from a range of sources suggest that advertized bandwidths are typically higher than actual bandwidths. For instance, a report from the UK's Ofcom found that only 20 percent of customers live close enough to a telephone exchange (3.2 kilometers) to receive 8 Mbit/s from an advertised 8 Mbit/s connection.

There is a range of reasons for variations between advertized and actual bandwidth. In addition to technical reasons such as the technology used and distance from network nodes such as exchanges, actual bandwidth also depends on 'contention,' that is how many users simultaneously share bandwidth.

This issue has emerged as users demand more bandwidth for their applications and services. And some governments have begun to respond. The Czech government has asked that service providers offer actual achieved bandwidth that is, over the long term, not less than 80 percent of the advertised bandwidth. This has also become a topic of discussion as the United States prepares its first national broadband strategy, due for publication in February 2010. In its recommendations to member countries, the OECD advises, "Governments should discourage harmful business conduct and practices such as misleading advertising."

Source: OECD, Broadband Growth and Policies in OECD Countries, 2008

Even within countries, definitions of broadband networks have been evolving. In July 2009, India's telecommunications regulator suggested that the government redefine broadband as connectivity of 2 Mbit/s or faster, up from the 256 kbit/s defined in the Broadband Policy of 2004.[47] There are also growing concerns about truth in labeling of broadband service speeds (**Box A**).

Internet connectivity speeds are increasing worldwide. In early 2009 Akamai, a major Internet content manager, suggested that there is a global shift away from narrowband to broadband connectivity. Globally, average Internet connection speeds (for users who pass through the company's servers) rose 29 percent in 2008 to about 1.7 Mbit/s. And in the first quarter of 2009 one-fifth of Internet connections were faster than 5 Mbit/s—a nearly 30 percent increase over the first quarter of 2008.[48]

Developments in technologies and business models are enabling networks to reach more people at lower costs. In the developed world, fiber optic networks are moving closer to users, reaching their neighborhoods, offices, and homes. Simultaneously, in the developing world the spread of high-speed wireless networks promises to gain momentum over the next few years. Indeed, wireless broadband is already more prevalent than wireline broadband (Table 3). In Sub-Saharan Africa, subscriptions using wireless broadband are more than eight times wireline, suggesting the potential for wireless broadband in areas where traditional wireline infrastructure might be absent.

Region	***Wireless broadband***	***Wireline broadband***
East Asia & Pacific	9.7	8.1
Eastern Europe & Central Asia	5.3	7.1
European Union (EU-27)	36.5	24.0
Latin America & Caribbean	3.4	5.7
Middle East & North Africa	5.1	2.5
North America	34.0	28.5
South Asia	0.1	0.5
Sub-Saharan Africa	1.7	0.2
World	8.6	7.0

Table 3: The penetration of wireless and wireline broadband subscriptions (per 100 inhabitants)

This report does not recommend a minimum connectivity standard for broadband as that is a moving target. Rather, it proposes that countries consider their policy and strategic goals, along with the services and applications

envisaged, and then define broadband network capabilities to match that vision. They should ensure that networks can realize the fastest connectivity possible for the largest number of users. Indeed, setting a minimum standard could be counterproductive because network operators could meet the standard yet it could prove insufficient for future applications. Connectivity standards should balance ambition with a realistic assessment of supply and demand factors. Thorough consultations with service providers, users, and other stakeholders will ensure transparency and relevance when setting such standards.

Services

Operators begin offering services once physical networks are in place. In the past, different services—video, audio, data—were offered. But convergence has eroded the boundaries between these segments. Increasingly all are being carried as Internet protocol (IP) data packets.[49] There is growing momentum for a shift to IP-based broadband networking based on so-called next generation networks. For example, broadband-enabled telephone networks allow subscribers to watch television broadcasts (using IPTV) or stream video over the Internet (say, through video repository Websites such as YouTube). But this distinction is merely semantic: in the converged era, it is impossible to distinguish between the text around a YouTube video and the video itself (and the audio). All of it uses the data service.

Consequently, broadband service is focused on providing high-speed data connectivity over these networks. Once broadband data networks are in place, they can carry all kinds of services providing voice (such as Skype or similar IP-based telephony services), video (through IPTV or Web-based applications such as Hulu), and data.

There are different aspects to consider. One is the connectivity speed: the higher the speed, the greater the functionality. There are numerous estimates of bandwidth requirements for various types of digital content. For instance, the OECD suggests that bandwidth requirements for online games, video on demand, and videoconferencing range from 2 to 14 Mbit/s.[50] Booz & Company suggests that first generation broadband offer 512 kbit/s to 2 Mbit/s—enough for rich media, social networking, and videoconferencing. But for more advanced uses, such as next generation TV and tele-learning, the company estimates bandwidth requirements at more than 20 Mbit/s.[51] To be truly useful, broadband services should offer users the highest bandwidth possible at the lowest price. Such data services should also be of high quality.

Another important dimension of broadband service quality is latency—the time taken for data to reach from source to destination—which is critical for real-time applications such as voice telephony, Internet video broadcasting, and gaming, all of which are drivers for broadband adoption. The higher the quality of the broadband service in the face of increasing demand, the better prepared the economy is to use tomorrow's applications and benefit from broadband-enabled innovation.[52]

Demand for bandwidth is increasing and will continue to grow. Between 2002 and 2008 demand for international submarine cable bandwidth grew 54 percent a year. And supply is rising to meet this demand: more submarine cables will be built between 2009 and 2011 than between 1999-2001, at the height of the telecommunications boom.[53] Capacity will grow even faster because technologies are able to squeeze more data into the same bandwidth. Between 2000 and 2009 the number of Internet users has quadrupled, reaching 1.5 billion.[54] The growth of dynamic, collaborative Web 2.0 applications depends on the ability of users to interact (see next section), but also has implications for network development. For instance, in the past users could get by with slower uploads, but now they demand high-speed connectivity that enables two-way multimedia applications. In economies such as Korea and Hong Kong, China, the monthly Internet traffic has already crossed 20 Gbit/s per capita, and growth rates continue to be more than 50 percent per year (Figure 4).[55] Indeed, some worry that a deluge of bandwidth-hungry applications will overwhelm the Internet.[56]

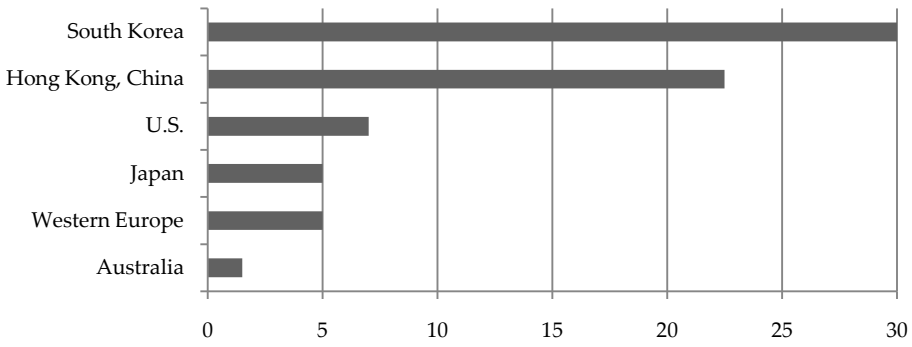


Figure 4: Monthly Internet traffic per capita (Gbit/s)[57]

At the same time, prices for bandwidth will continue to fall. International connectivity continuously gets cheaper, and retail broadband subscribers pay less now than before. In Ireland the price of an ADSL connection for a business user fell 74 percent between 2005 and 2008. In Turkey the drop was 57 percent; in Peru, 17 percent.[58]

Applications

Applications are function-specific software that uses the data stream to deliver content to users. Indeed, applications—often called apps—are becoming the centerpiece of the broadband ecosystem.

Traditionally, software applications were hosted on the user's computer. But with the increasing ability and convenience of hosting and accessing software on the Internet and other private networks, it is becoming more common to find applications hosted in the "cloud," a representation of the Internet and other networks. Broadband connectivity allows users to link to these clouds. This allows users to use multiple devices to access the same services or information while keeping the costs of software and data distribution very low.[59] Indeed, cloud computing has been in vogue for some time, with applications such as Webmail or more recently online office applications (such as the Google Documents suite) being widely used. Capable and reliable broadband connections allow users to rely on the cloud to hold and share applications and the data created using them. This, in turn, helps reduce the need for computing power on user devices, lowering costs and simplifying design.

Another major development in recent years has involved Web 2.0 applications. These applications allow users to interact with each other, with their governments, and with businesses like never before. Web 2.0 applications—including Web-based communities, hosted services, Web applications, social networking sites, photo and video sharing sites, wikis, blogs, mash-ups, and folksonomies—are interoperable, user-centered, and collaborative.[60] Unlike the "traditional Web," they allow users to generate, distribute, and share content in real time.

Social networking, which allows people to publish content and communicate, has grown exponentially in popularity. One of the most popular sites, Facebook, has more than 200 million active users.[61] The company's stock market valuation is now higher than that of well-known media companies such as the Washington Post Company or New York Times Company.[62] These developments are challenging older business models, with advertisers increasingly moving to social networking sites and slashing their print budgets. Newspapers are feeling such changes through sharply falling advertising and circulation revenues.[63]

Applications are increasingly used to deliver media and content to users. In 2007 data revenue accounted for about a quarter of total revenue for mobile telecommunications companies worldwide, and by 2012 is expected to account for a third. The global market for mobile telephone "infotainment" was $35 billion in 2008.[64] An April 2009 survey by the Pew Research Center's Internet & American Life Project found that the number of online adults who use video sharing sites and applications almost doubled from 2006, taking to two-thirds the share of adult Internet users who have watched video on these sites.[65]

Finally, electronic government (e-government) applications have significant utility in enticing users to become more digitally literate. E-government covers an entire range of tools and applications that transform government processes and modes of interacting with businesses and citizens.[66] As the OECD notes, "The public sector has a major role as a producer and user of digital content and applications"—including for education, health, culture, and economic activities such as agriculture and manufacturing. Governments can also induce businesses and individuals to use broadband if they create online tax forms, and can use the Internet to disseminate trade information or promote sectors of the economy.[67]

Users

Users are the fourth part of the broadband system. Broadband users have substantially different opportunities than dial-up users, with the ability to consume, create, and share multimedia content in a variety of formats using a growing range of powerful devices to consume, create, and share content. **Box B** describes three trends in user devices that promise to alter the terrain of the computing and communications industries, bringing them closer to converging.

Broadband devices also allow mobility. There has been steady growth in the number of mobile wireless broadband networks. In March 2009 more than 165 wireless networks (based on the IEEE 802.16e mobile standard such as WiMAX) had been planned or deployed. The number of subscribers on High-Speed Packet Access (HSPA) networks, which connect users at up to 14 Mbit/s, has almost quintupled, reaching 160 million in 2009.[68] In the developing world broadband will likely be predominantly a wireless phenomenon; mobile WiMAX networks already serve 21 low- and middle-income countries.[69]

Similarly, an April 2009 survey by the Pew Research Center's Internet & American Life Project found that 56 percent of adult Americans have accessed the Internet wirelessly, such as while using a laptop, mobile device, game console, or MP3 player. The most common way people get online using a wireless network is with a laptop: 39 percent of US adults have done this.

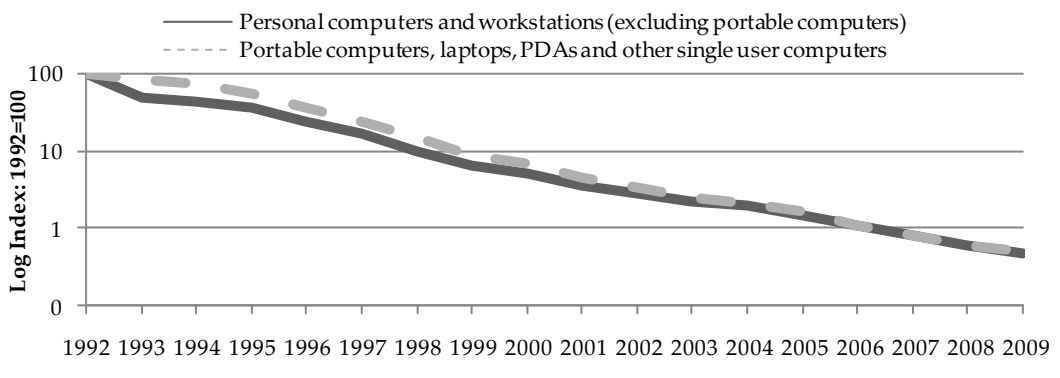
Users find broadband useful for a range of reasons. Broadband services improve business users' connectivity, significantly strengthening business performance. One study of 1,200 companies in six Latin American countries showed that broadband deployment was associated with "considerable improvements in business organization, including speed and timing of business and process reengineering, process automation, data processing, and diffusion of information within organizations."[70] It is not surprising that early adopters of broadband include businesses in the service industries. A 2009 survey by the Pew Research Center's Internet & American Life Project found that 55 percent of U.S. broadband users consider having the service at home very important, while 84 percent see it as being somewhat or very important.[71]

Broadband users are also creating new content and consuming new media. For example, the share of US adult Internet users who have a profile on an online social network site has more than quadrupled in the past four years—from 8 percent in 2005 to 35 percent now, according to the Pew Internet & American Life Project's December 2008 tracking survey.

Twitter, an application that allows users to broadcast short text messages, allows cross-platform communication and has an estimated 6 million users.[72] Formed in 2006, it is already a powerful organizing and political tool across the world.[73] And other Websites such as YouTube, which estimates suggest contains more than 100 million videos, not only host user-created content, but are also developed by users—as distinct from media corporations that have dominated the market for decades. Estimates suggest that YouTube crossed a billion video views *per day* in mid-2008. As *Forbes* magazine notes, the site is likely the "biggest television station on the planet."[74]

Box B: Three trends in user devices

Three trends in user devices have implications for broadband. First, traditional computers such as desktops and laptops are becoming cheaper. A computer capable of multimedia functions and Internet connectivity is much cheaper today, with prices dropping over 90 percent over the last decade. Indeed, producer price indices for the computer manufacturing industry have plummeted since 1992 (see box figure).



Box figure: Prices of computer hardware in the United States, log scale 1992–2009

Second, mobile telephones are becoming smarter. Popular smartphones include handsets powered by Windows or Linux derivatives. They both host applications and allow users to connect to applications over wireless connections. A survey of business technology professionals found that more than a third of smartphone users "occasionally or frequently leave their laptops at home in favor of their smartphones." In 2009 smartphone sales will likely account for 13 percent of global phone sales. Smartphone sales grew by 27 percent in 2008 but growth is expected to slow to 9 percent in 2009.

A third development is the netbook—inexpensive portable computers that support simple applications and Internet connectivity. Netbooks are increasingly being bundled with mobile broadband connectivity. In the United States telecommunications service provider Sprint has bundled a netbook for $1 for subscribers who sign a two-year mobile broadband service contract.

Pyramid Research predicts that netbooks will accelerate mobile broadband adoption among low-income customers, estimating that mobile broadband subscriptions will rise by 25 percent after services go below $20 a month and include ultralow-price netbooks. A growing demand for netbooks has led microprocessor maker Intel to see rapidly increasing sales of its Atom microprocessor, designed for the netbook market. More recently, mobile handset maker Nokia announced the release of its own netbook, the Booklet 3G.

Sources: U.S. Bureau of Labor Statistics; Information Week Oct 2008, Your next computer; Budde Global - Mobile - Handset Market 10/06/2009; *http://news.cnet.com/8301-1035_3-10280886-94.html*; Pyramid Research, Mobile broadband for the masses: The case for bundled netbooks, May 2009, p. 8; *http://www.marketwatch.com/story/intel-margins-soar-as-manufacturing-might-kicks-in-2009-10-13*; *http://conversations.nokia.com/2009/08/24/nokia-booklet-3g-mini-laptop-unveiled/*

Indeed, there is much interest in user-created content. The OECD defines user-created content as content that is made publicly available on the Internet, reflects a certain amount of creative effort, and is created outside professional routines and practices. The OECD predicts that the popularity of user-created content will likely continue to grow, with new drivers furthering its creation and use. Specifically, users will use mobile devices to watch and create user-created content, with higher uplink data transmission speeds and other consumer devices allowing easier content upload.[75] All of which means that the demand for mobile broadband capable of video capture and sharing will only grow.

Chapter 3. Broadband market development in the Republic of Korea

The Republic of Korea is a classic example of a country that has pulled itself up by its bootstraps. Mired in abject poverty in the mid-1950s, it became a booming economy based on heavy industry and manufacturing in the 1970s and 1980s, then a pioneer of the information society in the 1990s and 2000s. During the past decade it has emerged from the East Asian financial crisis and moved from being a middle- to high-income country. It also has considerably raised its investment in information and communication technology (ICT), as both a cause and consequence of broader economic growth.

Korea's exceptional success in developing broadband, and ICT generally, reflects a unique mix of highly competitive private-led markets and government leadership, use, support, and regulation. This is not the traditional model of other high-income countries, and comprises a unique balance between cooperation and governance. It is important to understand how and why this model worked, reflecting Korea's particular cultural, political, and institutional context. The government has intervened in many ways in the market, but it did so in a focused and strategic manner. The government's actions were critically important to trigger or guide private sector development and tie them to the government's sector objectives and particular country conditions.

Broadband growth in Korea has been extremely impressive. Indeed, the country has seen a significant transformation, from less than 1 Internet user per 100 inhabitants in 1995 to one of the world's most highly penetrated broadband markets. The 1998 introduction of high-speed Internet services by provider Thrunet was among the world's first commercial launches of broadband. By June 2009 fixed broadband penetration was 32 percent, and market penetration of 3G services was 77 subscribers per 100 inhabitants[76].

This chapter begins by explaining why Korea's experience suggests emerging best practices for growing broadband markets. It then profiles the country, describes its broadband market, and outlines the approaches it took to market development.[77]

Why Korea?

There is significant value in analyzing Korea's experiences because:

- The government followed a holistic approach to developing the broadband ecosystem.
- The country has experienced rapid growth in its broadband market and, until recently, had outperformed other high-income countries.
- Broader social and economic features make Korea relevant to low- and middle-income countries.

A holistic approach to developing the broadband ecosystem

Korea's government has taken great interest in and played a significant role in developing broadband. The impressive scale of government interventions provides a wealth of policy lessons for other countries.

Korea also shows how an integrated, holistic approach to developing broadband—viewing it as more than simply a network or improved communications service—was critical to the program's success. The state developed a vision of the information society and raised awareness among citizens and businesses. Strategic development frameworks have set broad policy goals and directed the creation of supply- and demand-side policies, such as lowering market entry barriers and spurring demand. Efforts have included public investment in broadband infrastructure and incentives for private investment, initiatives to aggregate and expand demand for broadband services, policies to promote universal access to broadband, and support for industrial and competition policies.

Thus Korea's approach included strategies, policies, and programs to develop the four components of the broadband ecosystem described in Chapter 2 (networks, services, applications, and users). Competition policies helped expand broadband networks and improve services, while the public and private sectors developed applications ranging from games to educational software that helped build relevance and demand for broadband. Users were targeted by digital literacy campaigns, competition improved affordability, and applications development increased the value of

broadband. The relationship between some of the approaches used to build Korea's broadband ecosystem is shown in Figure 5.

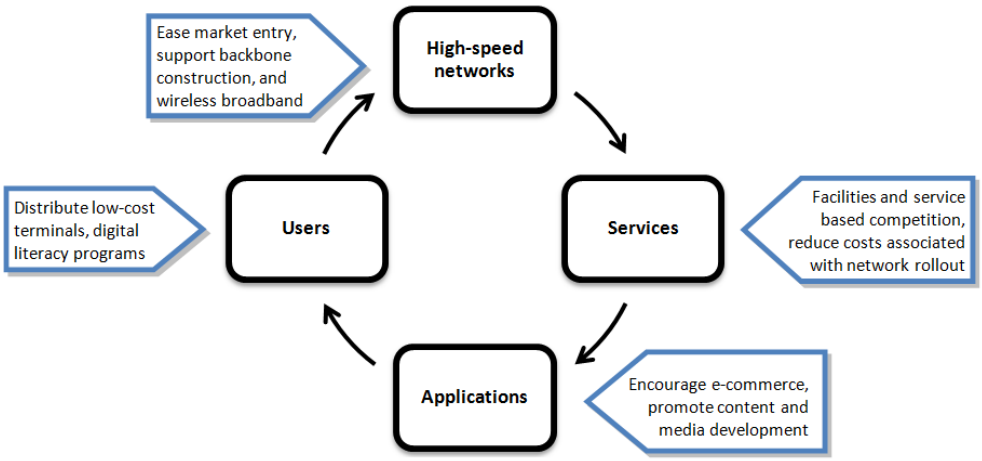


Figure 5: Korea's approach to developing the broadband ecosystem

Broadband networks and services grew quickly due to intense facilities- and services-based competition. Indeed, most supply-side policies have aimed at expanding the private sector's role in helping achieve the government's goals for infrastructure rollout and service and application development. In 1998 the country's largest cable TV network, ThruNet, introduced broadband services. Other providers entered the market by leasing cable infrastructure. In 1999 multiple operators launched ADSL services and quickly gained market share. Between 2000 and 2002 Korea experienced one of the world's most rapid expansions in broadband penetration, with the number of subscribers jumping 200 percent and household penetration rising from 27 percent to 69 percent. Fiber (optic) to the home (FTTH) deployments picked up in the mid-2000s. By late 2005 operators began focusing on advanced next generation access networks. This rollout was extensive, and by the end of 2008 the number of fiber-based subscribers was 6.6 million, giving FTTH 43 percent of the country's broadband connections.

Demand facilitation has also been a key part of Korea's approach. In the early stages the main services driving the adoption of broadband were online stock trading, education services, and games. As uptake increased, there was a move toward more interactive services such as shopping, email, and participation in cyber communities, and today focus on music downloads and gaming. E-government, e-commerce, and e-learning are also important drivers of high broadband adoption in Korea. ICT plays a significant role in education in Korea. EDUNET, one of the country's online educational services, was introduced in 1996. By 2008 it had 5.8 million members. The government has also taken steps to increase the global competitiveness of domestic digital content makers.

Rapid growth: Defying the S-curve

Korea's early, holistic approach to broadband quickly made it a leader in wireline and wireless broadband. Since broadband services were launched in 1998, Korea has outperformed most countries in broadband deployment and use. By 2000 its broadband penetration rate was the highest in the world, and remained so until 2006. It still has the highest household penetration of broadband[78] and scores highest in measures of broadband quality.[79] In 2009 market penetration for fixed broadband services was 32 per 100 inhabitants.[80]

Consequently, in the early stages of its development Korea's broadband market experienced rapid expansion in supply and demand, allowing it to defy the "S-curve" associated with the diffusion of technologies and innovations,[81] which applies to most ICT goods and services.[82] In other words, it has grown at a much faster rate than expected in the early years of development, thus that are relatively high penetration rate was reached quite quickly. In the early years of broadband development, Korea's trajectory was quite different from that of other leading broadband economies (Figure 6). Strong competition between access technologies was accompanied by falling prices and rising service speeds, with subscribers benefiting from some of the world's lowest connection charges.

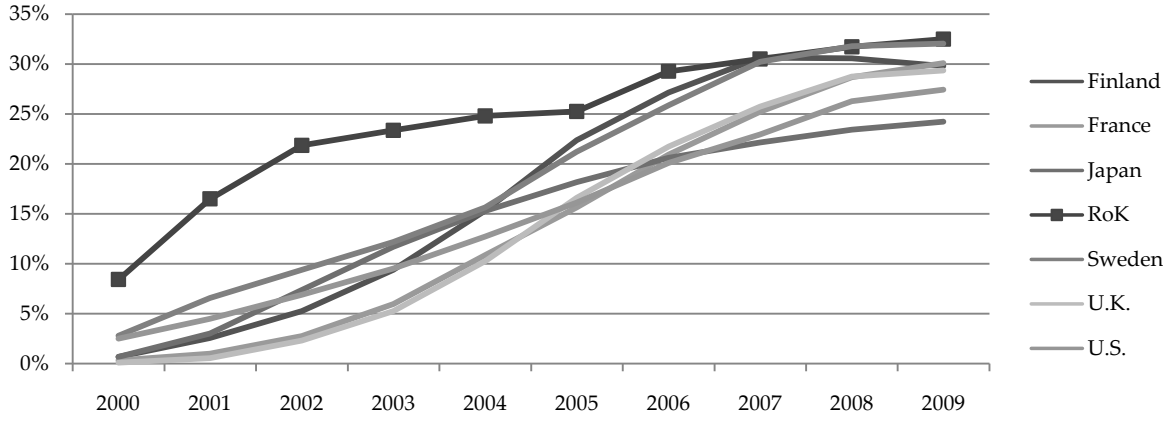


Figure 6: Penetration of wireline broadband services in various countries, 2000–09 (percentage of population)[83]

Mobile broadband has also been successful in Korea, though some networks lag in adoption. This makes the Korean case useful for the many developing countries that will likely see broadband diffuse over wireless instead of wireline networks. In Korea mobile broadband took off in late 2000 following the award of 3G licenses (Figure 7).

In 2002 more advanced CDMA2000 Evolution Data Optimized (EV-DO) services began targeting enterprise customers and early adopters. EV-DO services currently have a 30 percent share of the mobile market. In 2006 KT (Korea Telecom) and SKT (South Korea Telecom) launched WiBro services (the Korean equivalent of WiMAX). But contrary to government predictions of 5 million subscribers within three years of launch, WiBro had just 0.2 million subscribers in February 2009, with service coverage limited to metropolitan Seoul. On the other hand, W-CDMA (Wideband Code Division Multiple Access) services were launched commercially in 2003, and in 2006 HSDPA[84] technologies were launched for the first time in the world in Korea. Uptake of both has been far more extensive, with a combined subscriber base of almost 21 million in 2009.

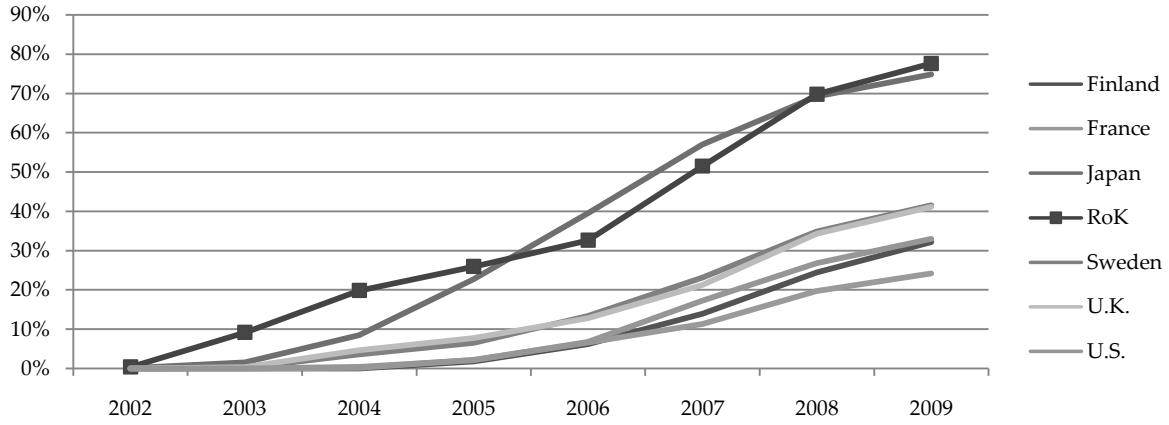


Figure 7: Share of 3G subscriptions in wireless market in various countries, 2002–09[85]

Broader social and economic features

Other social and economic features also make Korea a useful case study for broadband development. First, the country used ICT as a motor for both social and economic development, especially in education and e-government. Thus it suggests emerging best practice for other countries—especially those with few natural resources other than the skills of their people.

Second, Korea initiated liberalization early. Even among high-income countries, it is one of the few that have succeeded in developing viable competitors to the incumbent fixed line telecommunications provider. Although low- and middle-income countries may not find it viable to attract additional fixed line operators, this approach may be possible in markets such as fixed broadband access.

Third, Korea used infrastructure investment as a route out of economic crisis. The Asian financial crisis of 1997–98 has many parallels with today's global financial crisis, and Korea's response might hold useful lessons. Fourth, Korea's recent experience with IPTV—a market that was only liberalized in March 2009—offers promise for developing countries because it provides operators with multiple revenue streams (voice, video, data) to justify infrastructure investment.

Finally, although unique in many geographic and demographic respects, Korea is similar to many developing countries in that it is highly urbanized. The market benefited from rapid penetration of broadband, especially in corporate-owned housing apartment blocks. But the lesson is broader—that governments should look for quick wins that might help broadband market growth.

Country profile

The Republic of Korea, with a landmass of just over 100,000 square kilometers, is on the southern part of the Korean Peninsula in East Asia. In 2008 its population was just under 50 million, making it very densely populated. It is a member of the OECD, United Nations, World Trade Organization, and G-20, among other multilateral groups.

In 2007 Korea's gross national income (GNI) per capita was $21,210, making it a high-income country (Figure 8). ICT has accounted for a large part of the country's growth in recent years, contributing more than 40 percent of the increase in GNI per capita in 2003, for instance. Between 1960 and 1990 Korea was the world's second fastest-growing economy.

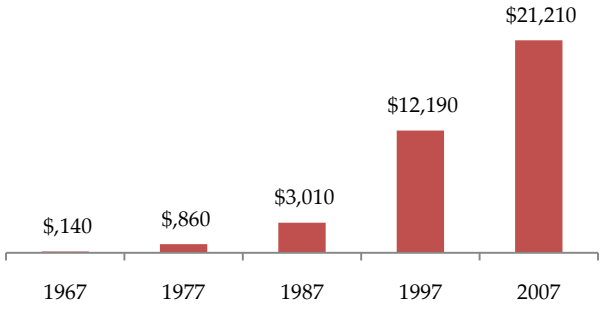


Figure 8: Korea's GNI per capita, 1957–2007[86]

Korea has had democratic government since 1987 and, according to the United Nations Development Programme (UNDP), ranks 26th of 182 economies on the human development index[87]. More pertinent to this study, the International Telecommunication Union (ITU) and United Nations Conference on Trade and Development (UNCTAD) ranked Korea first in their most recent digital opportunity index, a measure of preparedness for the information society.[88]

Korea also ranks second on the information society index,[89] sixth on the e-government readiness index,[90] and seventh on the World Economic Forum's global competitiveness index.[91] In addition, it is among the top-ranked countries on the World Bank's ICT Performance Measures—scoring in the top 10 percent on the three composite measures of access, affordability, and applications.[92]

Broadband market

This section describes the history and development of Korea's broadband market. It first looks at the penetration rates and rapid uptake of fixed and mobile broadband, then provides an overview of the market players.

Fixed broadband

In June 2009 there were 16 million fixed broadband subscribers in Korea, equating to a household penetration rate of 94 percent —one of the highest in the world. Currently, some 122 players provide fixed broadband services, including 8 fixed telecom operators and 114 local operators and cable TV operators. Korea's fixed broadband market has evolved in four stages:

- *Early stage, 1998–99*: broadband services were first commercialized.
- *Growth stage, 2000–02*: number of subscribers and household penetration rate increased dramatically.
- *Market maturity, 2003–05*: growth of broadband adoption slowed and signs of market saturation emerged.
- *Move to fiber (convergence), 2005 onward*: broadband operators have been rolling out advanced next generation access networks.

Developments in the fixed market are shown in Figure 9.

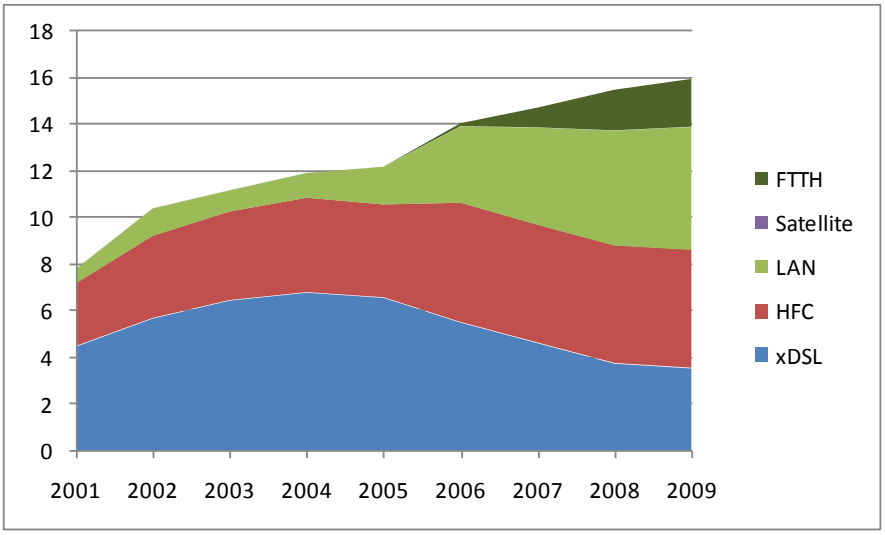


Figure 9: Korea's fixed broadband market by access technology, 2001–09,[93] in millions of subscribers

Note: FTTH = Fiber-to-the-home; LAN = Local Area Networks (e.g. within businesses or apartments); HFC = Hybrid fiber-coaxial; xDSL = various Digital Subscriber Line technologies.

As in many other countries, the initial development of Korea's fixed broadband market was closely linked to cable TV. ThruNet led the market until 1999, and in the late 1990s other Internet providers—such as Dreamline, SKT, and Onse—entered the market by leasing cable infrastructure. Overall, however, cable modem operators failed to capture much of the subscriber base.

In April 1999 Hanaro entered the broadband market. Hanaro Telecom (now SK Broadband) was formed in September 1997 in order to introduce competition into the local telephone market. However it soon moved into high-speed Internet provision, launching Internet access services in Seoul, Busan, Incheon and Ulsan in April 1999. By the end of December 2002, the company had deployed fiber-optic networks covering 100 cities. Hanaro provided services using both ADSL and cable modem access. This threatened to undercut the strategy and revenue of the incumbent KT, which at the time were based around ISDN (integrated services digital network) and premium rate leased line services to business users. But KT responded rapidly, entering the ADSL market in June 1999. It acquired 800,000 ADSL customers in less than a year, quickly becoming the market leader.

The rollout and adoption that Korea's broadband market achieved in its early stage are one of the telecommunication world's great success stories. One question it raises is why the broadband market, initially promoted using cable infrastructure, was subsequently so dominated by ADSL service providers in the late 1990s. The answer lies in three features of the Korean market:

- The ability of DSL providers to install DSLAMs (Digital Subscriber Line Access Modules) in high-rise dwellings, bypassing the incumbent's telecom exchanges. The ability for competitive DSL providers to link DSLAMs with the incumbents network is one of the important outcomes of the policy on unbundling the local loop (ULL);
- Building owners regarding broadband infrastructure as necessary to increasing the attractiveness and value of their properties.
- The regulatory burden imposed on cable TV operators, preventing the emergence of national providers that could compete with telecommunications companies.

As noted, between 2000 and 2002 Korea experienced one of the world's fastest increases in broadband penetration, with the number of subscribers increasing by 200 percent and the household penetration rate increasing from 27 percent to 69 percent. Growth in subscribers was accompanied by the introduction of new value-added services such as VDSL (very high bit rate digital subscriber line) and bundled WLAN (wireless local area network) services.

But by the mid-2000s it was evident that Korea's massive achievements in global broadband leadership had not translated into industry stability. In 2003 the third and fourth biggest players, Thrunet and Onse, went into receivership. Hanaro, the second largest player, was also suffering serious financial difficulties, and was later acquired by SK Telecom This market instability was more than simply a reflection of the broadband lifecycle. Rather, it resulted from the interaction of two complex issues:

- The government's role in creating a highly competitive market with limited regulation.
- The operators' business models—which, in a fiercely competitive market, focused on acquiring more subscribers through low prices and aggressive marketing without service differentiation.

By late 2005, as operators were recovering from their financial crises, the focus turned to rolling out advanced next generation access networks. This rollout was extensive, and by the end of 2008 there were 6.6 million fiber-based subscribers, giving FTTH (fiber to the home) 43 percent of the country's broadband connections. The evolution of fixed broadband market shares is shown in Figure 10.

Broadband standards and technologies sorted themselves out primarily through the market rather than by the authorities. Nevertheless, the government, through agencies such as ETRI and KISDI, has played an important role in standards-making agencies such as ITU, complementing the work of the private sector.

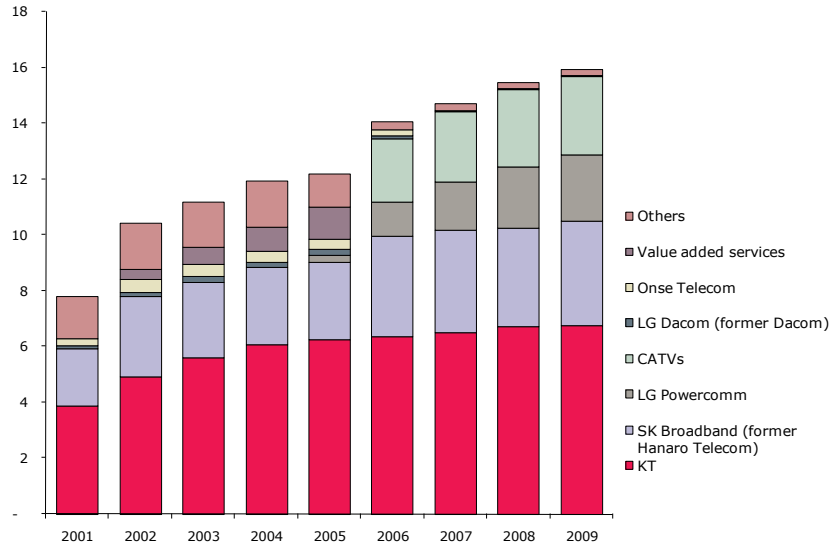


Figure 10: Evolution of fixed broadband market shares of operators, 2001-09, in millions

Mobile broadband

Korea's mobile broadband market is well established, providing 97 percent coverage to a subscriber base of 47 million subscribers in June 2009, or nearly three times as many fixed broadband subscribers.

Korea's wireless broadband market has evolved rapidly, with operators introducing a number of standards and technologies. The first mobile data services introduced in Korea were narrowband Internet services in 1999. The move to provide mobile broadband services took off in late 2000 following the award of 3G CDMA2000 licenses. In 2002 CDMA EV-DO services were launched, targeting enterprise customers and early adopters. Initially these services were not marketed aggressively, in part due to concerns about network congestion and in part due to worries about low demand. But more aggressive marketing strategies were implemented, and EV-DO now accounts for 30 percent of the mobile market.

In the early 2000s WLAN services were introduced. This was followed by the launch of W-CDMA services by SKT and KT. They were formally launched on the opening night of the FIFA World Cup in June 2002 and commercially launched in December 2003. This was followed in June 2006 by the launch of WiBro (the Korean equivalent of WiMAX) by KT and SKT. Also in September 2006, HSDPA technologies were launched for the first time in the world in Korea.[94] As noted, WiBro subscribers in Korea have fallen short of government predictions, but uptake of W-CDMA and HSDPA has been far more extensive.

Contrary to Government predictions of 5 million subscribers three years from launch, the number of WiBro subscribers in Korea had reached only 0.2 million as of February 2009, with service coverage limited to the metropolitan area of Seoul. However, the uptake of W-CDMA and HSDPA has been far more extensive with a combined subscriber base of almost 21 million in 2009.

In retrospect, it appears that the Korean government's attempts to promote WiBro in anticipation of market demand for WIMAX-like services, ahead of the global standardization process, may have backfired. It has suffered by comparison with other mobile broadband services, especially in pricing comparisons. It is likely that only bundled tariffs with fixed broadband will have a substantial impact on the uptake of WiBro because both HSDPA and Wi-Fi provide similar capabilities to WiBro. Additionally, WiBro is unlikely to compete with fixed broadband due to the large difference in access speeds. Currently in Korea the access speed for fixed broadband is up to 100Mbit/s, while WiBro is only 2 Mbit/s.

Applications, services, and content

The rapid growth of demand, driven both by the market and government use, played a key role in accelerating broadband development in the early stages of its market development, the key services that drove the take-up of broadband in Korea were online trading of shares, Internet-based school education, and online interactive games. As take-up increased, there was a move away from purely 'passive' uses of the internet such as data searching towards more interactive services such as shopping, email, and participation in cyber communities, and today the most popular broadband services are music downloads and gaming. But information acquisition remains a close second, just ahead of email and instant messaging.

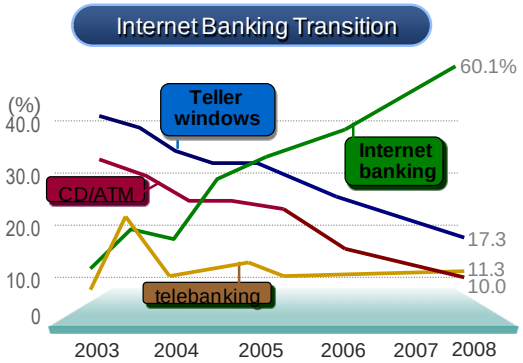
Online gaming is a huge industry in Korea, with sales of $8.3 billion in 2007. The country's high broadband penetration rates and widening coverage have also enabled the distribution of video services over the Internet. With growing convergence between communications and broadcasting services, subscriptions to new services such as IPTV are steadily increasing.

E-government, e-commerce, and e-learning applications are also important drivers of the high broadband adoption pursued by the Korean government. For example, all procurement producers are handled online through the Korea Online E-procurement System (KONEPS), introduced by the central procurement agency for access by all public organizations, including the central and local governments and public organizations.

Since its introduction in 2001, KONEPS has become one of the world's largest e-commerce markets, with total transactions of $34 billion in 2007, when 92 percent of all bidding was done electronically. ICT also plays a significant role in education: EDUNET, introduced in 1996, had 5.8 million members by September 2008.

Although Korea has traditionally focused more on its hardware than its software industry, the government has taken steps to increase the global competitiveness of domestic digital content makers. Homegrown content has developed more strongly in Korea than in other parts of Asia and, as of 2006, its value exceeded US$3.4 billion, with online games and entertainment services being the key contributors. The mobile content industry, valued at US$588 million in 2006, is led by music, ringtones, and mobile games.

Banking provides a good example of the rise of the Internet, with online transactions accounting for 60 percent of the total by 2008—at the expense of both physical infrastructure (such as bank branches and ATMs) and telebanking (Figure 11a). Korea is also unusual relative to other Internet markets in that local firms dominate the content market, as exemplified by the search market. Here the top two companies (Naver and Daum) are local, while the international market leaders – Google and Yahoo – have a combined market share of just 11.4 percent (Figure 11b).



(a) The transition toward Internet banking[95]

Search Properties by Query Volume

	Portal	Searches(MM)	MS(%)
1	Naver (www.naver.com)	2,135	61.9
2	Daum (www.daum.net)	680	19.7
3	Google (www.google.co.kr)	251	7.3
4	Yahoo (www.yahoo.co.kr)	140	4.1
5	Nate (www.nate.com)	132	3.8
6	eBay (www.auction.co.kr)	24	0.7
7	Paran (www.paran.com)	21	0.6

(b) The dominance of local firms in the search market[96]

Figure 11: Banking trends and search engine patterns in Korea

Developing the broadband ecosystem

Numerous policy developments and initiatives brought Korea's broadband market to where it is today. Table 4 summarizes the strategies, policies, and regulations that Korea has used to develop its broadband ecosystem.

The Korean Government's approach to promoting ICT in general and the broadband market in particular has been to formulate strategic development frameworks through the use consecutive 'master plans' which run over a number of years. Through each framework, the Government has outlined broad policy objectives, and has laid out a number of supporting policies, including for example:

- plans for public investment in broadband infrastructure and incentives for private investment;
- initiatives to aggregate and expand demand for broadband services through for example e-Government services and the promotion of e-commerce and digital literacy;
- policies to promote universal access to broadband; and
- various supporting industrial policies such as R&D promotion and incentives to revitalize venture capital markets.

At the end of each master plan, achievements have been assessed and the objectives and goals revised to establish updated plans for the following years. Using these master plans and supporting policies, the Government has often sought to promote specific market sectors by first providing an initial impetus through strategic public investments and initiatives and then encouraging this impetus to evolve into larger investments and actions in the private sector.

In addition to providing frameworks for market development, the Government's role has also extended to the implementation of competition policies and the provision of regulation deemed appropriate and proportionate to foster long-term sustainable growth in the broadband market.

	Promotion	***Oversight***	***Universalization***
Ecosystem definition and strategy	• First National Informatization Promotion Plan • Cyber Korea 21 • u-Korea Master Plan • IT839 Strategy, including Broadband convergence Network (BcN)	• Framework Act on Telecommunications • Telecommunications Business Act • Fair Trading Act	• First and Second Master Plans for Closing the Digital Divide • e-Korea Vision 2006 • Broadband IT Korea Vision 2007
Networks	• Korea Information Infrastructure: early focus on backbone • Broadband technological standards • Cyber building certification • Promotion of technology standardization • Ultra Broadband convergence Network (UBcN)	• Government ownership of KT until 2002	• Korea Information Infrastructure: later focus on rural connectivity • Low-interest loans for network rollout in rural areas
Services	• Broadband as a value added service • Quality monitoring system and service level agreements	• Broadband as a facilities-based service • Network access regulations • ISP peering regulation • Local loop unbundling (LLU) • Significant Market Power regulation (*ex ante* pricing and service restrictions) • Bundling regulation • Number portability for VOIP	• Subsidized services for poor citizens

	Promotion	***Oversight***	***Universalization***
Applications	• Content promotion frameworks • Informatization promotion funds • Industrial initiatives such as tax reductions for emerging Internet sectors, R&D and technology transfer promotion, and promotion of information technology in traditional industries • Promotion of demand for broadband services through e-government, e-commerce, and e-learning initiatives	• Intellectual property rights protection • Strengthening of cyber trust and security systems (such as antivirus software promotion)	• Promotion of applications accessible to people with disabilities
Users	• Subsidies for computer purchases by low-income households • 10 million people Internet education program	• Information use ethics	• Free Internet access centers in remote areas • Broadband access in all schools

Table 4: Strategies, policies, and regulations used to develop Korea's broadband ecosystem

The strategic framework: Informatization plans and funding

The Korean government's approach to promoting ICT in general and the broadband market in particular has involved formulating strategic development frameworks based on informatization master plans that run over a number of years. In each framework the government outlines broad policy goals and defines supporting supply- and demand-side policies, such as:

- Plans for public investment in broadband infrastructure and incentives for private investment.
- Initiatives to aggregate and expand demand for broadband services.
- Policies to promote universal access to broadband.
- Supporting industrial policies.

Since 1996 the government has established a number of master plans to develop an information society:

- 1996–2000: First National Informatization Promotion Plan
- 1999–2002: Cyber Korea 21
- 2002–06: e-Korea Vision 2006
- 2003–07: Broadband IT Korea Vision 2007
- 2006–15: u-Korea Master Plan (phase 1, 2006–10; phase 2, 2011–15)

In addition, the government created an Informatization Promotion Fund to finance projects that foster the use of information. The fund includes contributions from both the government and the private sector, through spectrum licensing fees, revenue-based contributions from operators, and earnings from the operation of the fund, including loans. Between 1993 and 2002 the total value of the Informatization Promotion Fund was $7.8 billion, almost half of which came from the private sector. The rest came from the government budget (39 percent) and sources such as spectrum auctions (15 percent). Money from the fund is used to support ICT-related R&D, develop and encourage standardization in the ICT industry, train ICT human resources, promote broadband network rollout, and promote e-government.

Supply-side policy

Through its informatization master plans, Korea has promoted supply-side broadband policies that can be categorized as:

- Infrastructure and application development policies.
- Content promotion policies.
- Industrial policies
- Regulation and competition policies.

Infrastructure and application development policies

Korea has implemented three key groups of broadband infrastructure policies since the mid-1990s (Table 5).

Year	***Initiative***	***Speed***	***Underlying technologies***
1995–2005 1995–97 1998–2000 2001–05	Korea Information Infrastructure Phase 1 Phase 2 Phase 3	2 Mbit/s	ATM, ADSL, cable modem
2004–10 2004–05 2006–07 2008–10	IT839 Strategy and Broadband convergence Network (BcN) Phase 1 Phase 2 Phase 3	50–100 Mbit/s	VDSL, FTTB, FTTH, WiBro, W-CDMA, HSDPA
2009–13	Ultra Broadband convergence Network (UBcN)	100 Mbit–1 Gbit/s	FTTH, WiBro, W-CDMA, HSDPA

Table 5: Korea's broadband infrastructure development policies

The government invested more than $900 million in the Korea Information Infrastructure project. The project is an excellent example of the government's integrated, ecosystem-oriented approach to broadband. It was initiated in 1995 and included construction of a national high-speed public backbone, development of ICT applications, and promotion of R&D and IT-related pilot projects. The project fostered public-private partnerships, supported network rollout through certification programs, and established an information promotion fund that encouraged private firms to make long-term investments. Moreover, the government revised the project in response to market changes.[97]

Similarly, the IT839 Strategy aimed to develop ICT services, infrastructure projects, and new or upgraded devices between 2004 and 2010. The effort includes creating the Broadband Convergence Network (BcN), which would integrate wireline and wireless systems and the telecom and broadcasting sectors, allowing companies and consumers to send voice, text, images, and video through the same transmission lines. The IT839 program could cost the government and private industry $70 billion by 2010. As one analysis explained, "What distinguishes Korea's effort [from other countries] is the intense cooperation between the IT industry and the government."[98]

Hence, much of the funding for Korea's broadband infrastructure projects has come from the private sector rather than the public sector. Whilst the Government invested more than US$900 million in the KII project, this is a small proportion compared to the total investment in KII of US$33 billion overall and represents just 8 percent of the Government's total IT budget between 1998 and 2003. By comparison, public sector investment in e-Government development comprised 20 percent of the IT budget during this period. Similarly, the government's budget for the BcN was just $62 million—most of the foreseen investment was expected from the private sector.

It is important to understand the "seed funding" role that Government investment has played in the overall level of investment in the Korean broadband market. Overall, Government funding to broadband ecosystem development from 1995 to 2005 amounted to less than US$1 billion out of a total of US$32.5 billion, and that it was higher as a percentage in the early phases, reducing as the private sector took over (Table 6). This trend continues with the more

advanced Ultra Broadband convergence Network (UBcN); much of the investment for this project will come primarily from the private sector, with $27.8 billion in private funding and $1.1 billion in public.

	1995-1997	*1998-2000*	*2001-2005*	*Total*
Main objective	Construct backbone network	Broaden access	Upgrade the backbone and access networks	
Government funding (US$ million)	173	262	371	806
Total investment (public+private, US$ million)	1'982	6'964	23'581	32'527
Share of public investment in total (%)	8.73%	3.76%	1.57%	2.48%

Table 6: The evolution of public and private sector investments in broadband in the Republic of Korea, 1995-2005

One particular mechanism for government intervention has been the Informatization Promotion Fund, which was introduced in 1993. The principle, as clarified in the Informatization Promotion Act, specifies that the Government set aside a fund to finance projects fostering information use. Until the establishment of the KCC in 2008, the fund was jointly managed and administered by the MIC and the IITA, with evaluation of the use of funds undertaken by a Fund Management Council. The fund is now managed by the Ministry of Knowledge Economy.

The primary objective of the fund is to ensure that profits from the ICT industry remain in the ICT industry. Money from the fund is used to support ICT-related R&D, to develop and diffuse standardization in ICT industry, to train ICT human resources, to promote broadband network rollout and to promote e-Government. The Informatization Promotion Fund includes contributions from both the Government and the private sector, through spectrum licensing fees[99], revenue-based contributions from operators[100] and earnings from the operation of the fund, including loans. Between 1993 and 2002, the total value of the Informatization Promotion Fund was US$7.8 billion.

Content promotion policies

Initiatives to develop the broadband market in Korea have included a number of content promotion plans and support (Table 7). However, in general terms Korea's domestic content and programming industry has been less successful than the hardware sector, with the notable exception of gaming. The major reason for this is the relatively linguistic isolation of the Korean market, whose language is not widely spoken outside the country. One side product of this is the success of domestic search services by comparison with international, English-language ones.

Year	***Initiative***
Framework plans and supporting policies	
1992	Information use promotion plan
1998	Multimedia content industry promotion plan
1999–2002	IP and ISP promotion plans
2000	Digital content industry promotion plan
2001	Digital content technologies developed in collaboration with the Ministry of Culture
2001	Internet broadcasting industry promotion plan
2002	Digital Multimedia Content Investment Partnership
2003–08	First and second basic plans for online digital content industry advancement
Supporting legislation and bodies	
1993	Korea Database Promotion Center created
1997	Korea Multimedia Content Promotion Centre created
1998	Korea Software Industry Promotion Agency (KIPA) created
2000	Software Industry Promotion Act
2000	Management of Digital Content Act
2002	Online Digital Contents Industry Advancement Act

Table 7: Content promotion plans in Korea

As Korea's content sector has grown, so have the goals of the government's content promotion plans (Figure 12).

Figure 12: Evolving goals of content promotion policies in Korea[101]

Convergence is a current theme for the future development of the communications content industry, including digital content. The advanced platform integration that Korea has achieved is partly the result of the new possibilities enabled by digital content. Distribution channels for content are diversifying into Web TV, DMB (Digital Multimedia Broadcasting), WiBro, and IPTV, and the Korean government has recognized the importance of shifting the focus from platform to content to boost demand for content and increase competition among media.

Industrial policies

Supply-side broadband initiatives have also included a large number of supporting industrial policies such as policies to encourage R&D in ICT, incentives for joint international research, tax and rent reductions for emerging Internet sectors, deregulation for high technology startups, promotion of overseas IT market penetration, promotion of greater IT use in traditional industries such as agriculture and fisheries, and measures to facilitate standardization. In addition to providing frameworks and supporting initiatives for market development, the government's supply-side role has extended to implementing competition policies and regulatory frameworks.

Regulation and competition policies

Korea's broadband regulations were shaped by the liberalization policies adopted starting in the 1980s, which included licensing Dacom and Hanaro as competitors to fixed line incumbent KT in domestic and international markets (Table 8).

Year	***Regulation***
1997–	Broadband designated as a value added service
2000	Quality monitoring extended to broadband
2000–01	3G licenses granted
2002	Service level agreements introduced for broadband
2002	Network access regulations imposed
2002	KT privatization completed
2002	Local loop unbundling (LLU) introduced
2004	Network access regulations extended to fiber
2005	ISP peering regulation introduced
2005	Rights granted to provide WiBro services
2005	Pricing regulation introduced
2005	Broadband recategorized as facilities-based service
2007	Roadmap issued for telecom regulation
2007–08	Bundling regulation eased
2008	Number portability introduced for VOIP
2008	Regulations removed on handset subsidies

Table 8: Korea's regulations for broadband

Mirroring the evolution of the broadband market, there have been three phases in the evolution of broadband sector's regulatory environment:

- Light regulation to promote competition in the early, growth, and market maturity stages of broadband, through 2005.
- Increased regulation from 2005–07, in response to the growing dominance of KT and operators' financial crisis.

- A return to lighter regulation in some areas as the market has matured, since 2007.

The light regulatory approach adopted by the Ministry of Information and Communication (the former Korean Telecoms Ministry) in the late 1990s created an environment for facilities-based competition to take off. Between 1997 and 2005 entry barriers to the broadband market were kept low by categorizing broadband as value added services, with all types of broadband access technology permitted. The government also actively fostered competition for services in the early stages of the market through performance monitoring schemes, announcements of connection speeds, and the introduction of service level agreements for broadband services.

As the broadband market developed and KT's dominance continued to grow, MIC adopted a heavier regulatory stance in 2005, introducing price regulation and reclassifying broadband as facilities-based services. But the regulatory environment has recently eased—for example, with bundling regulations eased and regulation of mobile handset subsidies fully removed.

Demand-side policies

On the demand side, the government's broadband initiatives have included:

- Aggregating demand for broadband among public bodies to provide an established initial market for services.
- Promoting e-commerce as a way to facilitate widespread adoption of broadband by businesses.
- Providing key public services online and encouraging the development of applications such as e-learning to promote widespread public use of broadband.
- Implementing digital literacy initiatives to narrow the digital divide and ensure maximum participation in the broadband market.

After the initial rollout of broadband networks, e-government policies focused on developing and promoting public services such as G4C (for example, home tax services), G2B (an e-procurement service for businesses contracting with the government), and G2G (a service connecting the financial systems of government bodies).

In the early 2000s e-government policies started shifting toward enhancing e-government services and increasing public and business participation, implemented through the e-Government roadmap that encompassed 31 separate policies. This can be seen as the result of attempts by the government to diversify and develop policies adapted to niche markets rather than as a result of a lack of direction.

The government has also implemented initiatives to promote e-commerce, e-working, and e-learning. These have included reform of various laws and regulations to encourage e-commerce, promotion of e-working through fewer restrictions on working time and physical workspace, introduction of ICT infrastructure and Internet in all schools, and creation of online education programs.

One of the Korean government's main goals since the rollout of broadband infrastructure has been promoting ICT use by improving digital literacy and access to ICT. Policies have included subsidies for computers, loans to build high-speed rural Internet networks, and online education programs targeted at previously unreached groups such as homemakers, the elderly, and the disabled.

Evaluating Korea's approach

In terms of the effectiveness of each policy group, research suggests that the Government's holistic approach to broadband development have been particularly successful. Within five years of the introduction of broadband, there were more than 11 million fixed-line broadband subscribers and penetration rates exceeded 70 percent of households.

Korea's broadband promotion was characterized by:

- rapid expansion on both the supply and demand sides in the early stages of the Korean broadband market's development;

- growth in internet usage that was not limited to typical early adopters such as the young and the college educated; and
- rapid expansion in the trade of ICT and broadband related goods.

A number of factors drove the successful promotion of broadband in Korea, including:

- the Government's long-term strategic planning;
- the success of the KII initiative and Cyber Korea 21;
- liberalization of the telecoms market and the creation of a highly competitive environment; and
- Demand-side drivers including low broadband pricing.

The Government's regulatory policies have also been successful, particularly in terms of increasing competition in the broadband market.

Chapter 4. Experiences of other broadband leaders

In addition to the Republic of Korea, this report surveys six other countries to identify different approaches to developing broadband markets. These six countries—Finland, France, Japan, Sweden, the United Kingdom, and the United States—are all global leaders in broadband access and use. Significant portions of their populations subscribe to wireline broadband, and they are major markets for 3G and other advanced wireless broadband services. In addition, they represent a range of political arrangements and approaches to economic and telecommunications development. And in response to the economic crises of the late 2000s, some have initiated broadband stimulus plans. This chapter summarizes the various approaches to developing the broadband ecosystem in these countries. It concludes with an analysis of the common elements seen in these approaches.[102]

Finland

Finland's approach to broadband has involved significant reliance on market forces, augmented by public support. The government has defined broadband as a "legal right" for citizens, that is, defining it as part of the universal service obligation. As from June 2010, when the law comes into force, each Finnish citizen can expect to have a connection of a minimum of 1 Mbit/s available. Finland aims to cover 99 percent of residences with 100 Mbit/s connectivity by 2015. In June 2009, 30 out of every 100 inhabitants had broadband access, and 34 percent had 3G services. Finland has a population of about 5 million people, with 63 percent living in urban areas. It also has among the world's highest GDP per capita, at $51,062 in 2008 (Source: World Development Indicators).

Finland's support for broadband development relies primarily on market forces, augmented by significant public sector intervention when necessary.[103] The Finnish approach strives for a public-private partnership, often focused at the local level, instead of centralized planning undertaken by a national carrier or government agency. Federal funding flows only to projects deemed not viable for 100 percent private investment.[104] But even for such instances of market failure, the federal subsidy amount cannot exceed one-third, with additional EU and municipal support capped at another one-third—thereby requiring private participants to invest at least one-third of the cost.[105]

Finland's telecommunications industry has relied on market competition to drive growth. This has been possible because the nation never had a single national service provider that qualified for political and economic safeguards, including insulation from market entry.[106] The market is more competitive and fragmented than others in Europe.

The Finnish government expects mobile broadband to play a significant role in realizing the short- and longer-term access goals articulated in the 2008 national broadband strategy.[107] Penetration of wireless telephony reached 50 percent in 1998, prompting an early and precipitous decline in fixed wireline subscriptions. Interestingly, the latest data also suggests that DSL connections are now in decline, as a result of mobile broadband substitution. Today, Finland has a robust mobile telecommunications market, with TeliaSonera Finland, Elisa, and DNA offering attractive prices for services, including mobile broadband.[108] Moreover, the presence of a major wireless manufacturer, Nokia, contributes to ICT employment and broad appreciation for the personal and social benefits accruing from widespread adoption of wireless and broadband services. Finland's ICT sector includes about 6,000 firms and accounts for 10 percent of GDP.[109]

The government anticipates fixed WiMAX broadband service serving 5 percent of Finnish households by 2015 with connection rates of 5–40 Mbit/s, mobile WiMAX serving 60 percent with rates of 5–100+ Mbit/s, and conventional wireless serving 93 percent with rates of 5–100+ Mbit/s. The government expects to achieve its goals with a funding mechanism that involves private investment, federal subsidies, and funding from local governments and the European Union.

The government expects 99 percent all permanent residences to have access, within two kilometers, to an optical fiber or cable TV network delivering 100 Mbit/s bit rate connections.[110] This will push the universalization of broadband. The government expects to achieve its goals with a funding mechanism that combines private sector investment, federal subsidies, and funding from local governments and the European Union. The government expects that for 95 percent of the population, market conditions will support the evolution of such access.

France

France pursues broadband deployment by balancing a longstanding concept of public service with the need to promote telecommunications privatization and open access, in line with EU directives. The government frames broadband development in the context of providing equal treatment to all citizens and ensuring service accessibility, affordability, and continuity. In practice this means that the French government considers it necessary and appropriate to intervene when the market fails to achieve social goals, such as universal service. In June 2009 fixed broadband penetration was 30 percent and 3G market penetration was 23 percent. France has a population of about 62 million people, with 77 percent in urban areas. In 2008 GDP per capita was $45,981.

France recognized the importance of information access early.[111] The government launched the Minitel videotex service in 1982, offering information and e-commerce services well before Internet-based options became available.[112] The government continues its efforts to expand access to broadband by including it in universal service programs and promoting the deployment of next generation networks.

Growth in the broadband market was aided by regulations on facilities-based competition that promoted local loop unbundling (LLU). Initial efforts to mandate unbundling met with resistance from incumbent France Telecom, but sped up following strong regulatory interventions on unbundling. Since 2003 accelerated unbundling has led to rapid expansion in broadband service provision and subscription. Now the government has begun encouraging municipalities and dominant service providers to open passive infrastructure such as ducts and conduits to competitors, ensuring lower-cost deployment of new fiber optic networks. Although the prices for ducts, as mandated by the regulatory, ARCEP, are quite low, France Telecom claims not to have any maps showing their location, and this is causing a bottleneck to competitive market entry.

The French government envisioned that market forces would take the lead in broadband development. After it became clear that this approach was insufficient, the government gave local authorities a greater role in developing broadband infrastructure. The Caisse des Dépôts et Consignations (CDC, a government-owned bank) provided concessional loans to municipalities for broadband development. Though municipalities could establish broadband infrastructure, they could not provide services until 2003—and even then only if there were no other available providers.[113]

The Digital France 2012 plan proposes widespread and affordable access to broadband.[114] The plan has three main components: ensuring ubiquitous Internet access, completing conversion to digital television, and narrowing the digital divide. The government estimates that up to 2 million French citizens cannot participate in the information society for lack of access to affordable broadband connectivity. The government has set a goal of providing access to 100 percent of the population by 2012. To achieve that goal, the government will augment networks by setting monthly access costs at a maximum of 35 Euros for at least 512 kbit/s connection speeds. The French government has also announced a new plan ("Grand Emprunt") worth some EUR 4.5 billion (US$6 billion) through a loan program for high-tech companies, with some of that going to new broadband.[115]

France's wireless broadband market offers an increasingly competitive alternative to fixed services thanks to readily available 3G access throughout much of the nation. There are currently 8 million 3G customers (a 59.1 per cent increase compared to Q107 having a 17.1 percent penetration). The government could stimulate more competition in 3G services with the award of a fourth license in late 2009. Telecommunications equipment manufacturer Ericsson conducted tests of the next generation wireless technology, LTE[116], in late 2008.[117]

Japan

Japan's broadband market has benefited from consistent, effective government stewardship. Japanese residents enjoy the world's fastest broadband services at some of the lowest rates.[118] This is partly because of the nation's strategy to support widespread fiber optic cable deployment, including the replacement of copper-based digital subscriber line technology and compulsory shared access[119] to fiber lines.[120] In June 2009 fixed broadband penetration was 24 percent, while the market penetration of 3G services was 76 percent. Japan leads the world in fiber optic subscriptions, with more than half the market served by fiber optic networks. Surprisingly, despite having some of the world's fastest speeds and lowest prices for broadband, its penetration rate is still below the OECD

average. Japan has a population of about 128 million people, with 66 percent in urban areas. In 2008 GDP per capita was $38,443.

Japan has regularly refined its ICT strategies. The government developed ICT strategies in tandem with liberalization and privitzation initiatives that reshaped the industry and f ostered competitive alternatives to the incumbent carrier NTT.[121] In the span of six years since the start of the decade, the Japanese government has generated six significant strategic documents addressing ICT development. The focus on ICT is supported by the presence of a large domestic high-technology industry that includes firms such as Canon, Mitsubishi, Nintendo, Panasonic, Sony and Toshiba.

The country's leadership is committed to developing advanced ICT. In 2000 the government set a national goal of "creating a society based on highly advanced telecommunications networks, [reducing] gaps in opportunities to access information and communications technology, and the ability to use such technology."[122] The government has also considered broadband development in the larger context of promoting digital literacy.[123]

To achieve its goal of ubquitous access to ICT, the Japanese government has established policies designed to facilitate complete national access to high-speed Internet services by 2010.[124] The government combines regulatory policies promoting competition and cooperation, additional spectrum for wireless broadband services, and subsidization of terestrial and satellite broadband backbone networks with an emphasis on reaching unserved rural locations. Japan will likely achieve near ubquitous broadband access by 2010 thanks to its mix of facilities-based competition and government involvement.[125]

Competition is supported by low-cost access to incumbent carrier facilities. In recent years the Japanese government has significantly deregulated price and tariff regulations where facilities-based competition exists, while maintaining line sharing and interconnection requirements, unbundling facilities at rates favorable to market entrants, and establishing dispute resolution procedures. In addition, Japan continues to fund a universal service program that subsidizes basic services and supports fiber optic deployment by municipal governments. The entry of cable TV networks into the broadband market also helped spur the initial growth of broadband.

Finally, Japan is a leader in wireless broadband. It demonstrates emerging good practice in its wireless broadband network services marketplace in such key features as bit rate,[126] price,[127] and features.[128] In February 2009 there were 107 million mobile subscribers in Japan, resulting in a penetration rate of 83 percent.[129] Some 92 million mobile handset users have Internet access—a 72 percent penetration rate. Critically, incumbent and market entrants did not incur any spectrum auction debt when securing licenses to provide wireless services. This allowed the maximization of infrastructure investments. However, the beauty contest method of allocating spectrum has had the negative effect of limiting market entry, especially from foreign investors, and this may have limited innovation in the marketplace. The Japanese government now aims to bolster broadband capacity, performance, and competition by licensing new Broadband Wireless Access (BWA) systems in the 2.545–2.625 GHz band. KDDI will provide WiMAX and Willcom Next Generation Personal Handiphone Service, offering download speeds of 20–30 Mbit/s and upload speeds of 10 Mbit/s.

Sweden

Sweden has been successful in promoting broadband despite having one of the world's lowest population densities. Government policies have increased access to hardware and led citizens to consider ICT an integral part of their lives. In June 2009 fixed broadband penetration was 32 percent and market penetration of 3G services was 42 percent. Sweden has a population of 9 million people, 85 percent of them in urban areas. In 2008 GDP per capita was $52,057.

The government has augmented market forces with significant public investment, particularly in rural areas. Broadband development build on Sweden's strengths in engineering and innovation, cooperation between government and business, adult education, telecommunications deregulation, early installation of broadband networks for universities, and initiatives to promote access to personal computers. The country now has nearly ubiquitous access, even for residents above the Arctic Circle.

National strategies use both supply- and demand-side policies. In addition to funding, the government created policies that require grantees to operate open networks. Such non-discriminatory access might come more readily from municipal governments, many of which own and operate local networks. On the demand side, Swedes have shown interest in ICT, supporting the diffusion of broadband.[130] The government supported this by distributing free or subsidized computers.

The major role played by powerful municipal governments has also increased broadband access. At an early stage the government required public utilities to build fiber optic networks, rather than wait for market-driven investments. Municipalities received federal grants and favorable tax treatment to construct fiber optic networks. This early development of a backbone fiber optic network did not prevent later market entry by commercial ventures.

Sweden also has a robust wireless broadband market thanks to early planning and allocation of frequencies and licenses. In 2008 mobile broadband accounted for 80 percent of the country's 3.7 million broadband subscriptions.[131] Traffic for mobile data services jumped 526 percent between 2007 and 2008.[132] The government licensed regional and national wireless broadband operators in 2005.

The government aims to make broadband available to all households, businesses, and public entities by 2010. The 2007 broadband strategy promotes market competition for broadband services with downstream speeds of at least 2 Mbit/s.[133] The strategy is a blend of grants, regulatory refinements, and changes in industry structure. The Post and Telecommunications Agency, which regulates the industry, will invest €864 million in broadband infrastructure, half of which will come from EU sources.[134] Grant recipients will have to install networks that meet the bit stream minimum and operate the networks in an open and non-discriminatory manner.

United Kingdom

The United Kingdom has developed broadband through a national strategy, but investment in the fiber optic network—crucial to success—has arguably been insufficient. This may be due to unreasonable expectations for private investment.[135] As a result, the government is reexamining regulation and considering public-private partnerships to develop infrastructure and enable facilities-based competition. As of June 2009 fixed broadband penetration was 29 percent and market penetration of 3G services was 41 percent. The United Kingdom has a population of 61 million people, with 90 percent in urban areas. In 2008 GDP per capita was $43,088.

Broadband market development in the UK was spurred by a combination of vigorous facilities- and service-based competition. In 2002, broadband subscriptions over cable TV networks led DSL, although the ubiquity of telephone networks has led DSL to capture much of the market today. However, the presence of multiple broadband wireless providers, aggressive cable TV network operators, and recent FTTH deployments promise continued facilities-based competition. Service-based competition in the form of local loop unbundling also spurred robust market entry and competition. BT, the incumbent carrier, faces facilities-based competition from about 30 ventures, many of which entered the market to take advantage of low rates on local loop unbundling for network services provided by BT.[136] BT's structural separation into wholesale and retail ventures also stimulated competition.[137] The market has become so competitive that regulator Ofcom is considering the full deregulation of basic wireline telephone services.[138]

Ofcom recognizes that regulation must support private investment and promote competition wherever there are potential barriers to it.[139] Ofcom recognizes that regulatory intervention can affect private investment decisions by affecting the nature and type of competition, the potential for cost efficiencies or reductions, and opportunities for service and infrastructure providers to increase revenues—whether from new services or new commercial relationships.

Accordingly, the government is rethinking its broadband strategy to support next generation infrastructure investment, as outlined in the *Digital Britain* report (**Box C**). One major proposal is to impose a universal broadband service obligation on carriers, with a minimum speed of 2 Mbit/s. About 10 percent of the nation's residents lack such access. The installation of such networks would be financed by requiring carriers to impose a £0.50 monthly surcharge on fixed line telephone service that will underwrite an independent Next Generation Fund, available to carriers seeking to operate high-speed broadband to un-served localities.

Box C: Digital Britain

In 2009 the UK government sought to expedite broadband development, recognizing its potential in helping the country recover from a severe economic downturn. The *Digital Britain,* report seeks to:

- Complementing and assisting the private sector in delivering modern communications infrastructure, built on new digital technologies.
- Enabling Britain to be a global center for creative industries in the digital age, delivering an ever wider range of high-quality content—including public service content—within a clear and fair legal framework.
- Ensuring that people have the skills to flourish in the digital economy, and that all can participate in a digital society.
- Modernizing and improving government services to taxpayers through digital procurement and digital delivery of public services.

The report proposes numerous initiatives that together seek to achieve five goals:

- Modernizing and upgrading wired, wireless, and broadcasting infrastructure to sustain Britain's position as a leading digital economy.
- Providing a favorable climate for investment and innovation in digital content, applications, and services.
- Delivering a range of high-quality public service content, particularly in news.
- Developing the nation's digital skills at all levels.
- Securing universal access to broadband, increasing its adoption, and using it to deliver more public services more effectively and efficiently.

Digital Britain calls for the appointment of a "digital inclusion champion" to advocate ways of serving the millions of residents currently lacking access. The government will also promote online education through a national Home Access Program, as well as bolster electronic government services, including online student loan servicing, school registration, debt advice, employment services, company registration, tax returns for high ratepayers, and voter registration.

Source: United Kingdom Government, Department for Culture, Media, and Sport and Department for Business, Innovation, and Skills, Digital Britain, Final Report, 2009, available at *http://www.culture.gov.uk/images/publications/digitalbritain-finalreport-jun09.pdf*. See also Implementation Plan, 2009, available at: *http://www.culture.gov.uk/images/publications/DB_ImplementationPlanv6_Aug09.pdf*, and Technology Strategy Board, "Our Strategy for 'Digital Britain,'" 2009, available at: *http://www.innovateuk.org/_assets/pdf/Corporate-Publications/TSB_DigitalBritain strategy.pdf*.

The United Kingdom has a robust wireless telecommunications market with five 3G operators, and additionally market entry by virtual network operators, and the rollout of third generation wireless networks capable of providing an expanded array of services. The government aims to promote mobile broadband by expanding available spectrum and fostering competitive alternatives to cellular telephony service. Initiatives include reallocating broadcast TV spectrum in the 800 MHz band to mobile broadband services (exploiting the digital dividend), releasing new spectrum suitable for next generation mobile technologies, and liberalizing the 2G spectrum.[140] The government also will permit wireless carriers to retain their 3G spectrum indefinitely if they start building networks capable of providing 50 Mbit/s next generation broadband services.

United States

Although in many ways the United States has one of the world's most sophisticated telecommunications markets, it has been lagging behind in broadband growth. Accordingly, the government has begun developing its first national broadband strategy. This marks a significant shift in the country's approach to broadband—from a *laissez faire* strategy to a more state-directed and public-private partnership approach. Existing competition in the market and a large user base create significant opportunities for expansion. In June 2009 fixed broadband penetration was

28 percent and the market penetration of 3G services was 34 percent. The United States has a population of 304 million people, with 82 percent in urban areas. In 2008 GDP per capita was $46,716.

In contrast to its early, active, and effective incubation of the Internet through subsidies and promotion, the US government did not apply many broadband interventions used by other nations until 2009. The lack of involvement and public underwriting contrasts with the fact that the United States long ago established an expensive and comprehensive universal service funding mechanism to promote access to affordable narrowband Internet service.[141] In 2009 public fiscal support for broadband totaled $7.2 billion and was part of the economic stimulus package developed in response to the recent economic crisis.[142]

The United States has two major advantages for broadband development: extensive R&D for ICT and competition between DSL and cable networks, both of which have extensive coverage. They have similar market shares. Cable modem service accounts for 29 percent of high-speed lines, DSL for 23 percent, and fiber optic lines reaching end users for 2 percent. The other 46 percent use other technologies, including satellites, terrestrial fixed or mobile, and broadband over power lines. Lines connecting homes and businesses to the Internet at transmission speeds exceeding 200 kbit/s in both directions increased from 80.3 million to 88.4 million in the first half of 2008.[143]

The presence of major telecommunications and IT manufacturers and service providers in the United States supports the growth of advanced ICT. Recently major commitments have been made to broadband networks. For example, one major service provider has committed $25 billion to rolling out fiber optic services to homes and wireless broadband networks.[144] Service-based competition was attempted in the 1990s with a move toward regulated unbundling of networks. But much of that has been reversed, and only a few segments of the wholesale market continue to have regulated unbundling.

The lack of government leadership is one reason the United States lags in broadband. Though this topic is hotly disputed,[145] broadband development in the country has not achieved global leadership in terms of accessibility, affordability, and other evaluative criteria. Many factors have contributed to the comparatively poor performance, including low computer ownership, low population density (which leads to long local loops which, in turn leads to low DSL speeds), high service costs and limited competition in some locales, and the government's failure to implement a coherent national broadband strategy.

There have long been calls for the government to play a more active role in promoting broadband.[146] But the country stuck with a deregulated approach, assuming that the market would build enough capacity to meet the demand.[147] This model did not lead to the expected results because it failed to link the short-term profitability of service providers with the long-term macroeconomic benefits of widespread access to high-speed, low-cost broadband. The 2008 change in administrations, concerns about deteriorating global competitiveness, and the recession of the late 2000s led to rethinking of this strategy. The economic stimulus plan, which marks a change in the role of the public sector, provides the staging ground for a revised broadband strategy.

The strategy being prepared aims to facilitate and expedite the development and use of high-speed broadband infrastructure. The regulator, the Federal Communications Commission (FCC) is developing the strategy with attention to a range of issues. These include identifying the most effective and efficient ways to ensure broadband access for all Americans, finding ways to achieve affordability and maximize use of broadband infrastructure and services, evaluating of the status of broadband deployment (including related grant programs), and using broadband to create jobs and advance economic growth. The FCC recognizes that the $7.2 billion allocated for broadband development will not achieve all the goals for broadband deployment. Accordingly, it must develop a plan that aims for ubiquitous broadband access, with benchmarking to measure progress toward that goal.

Analyzing the approaches of broadband leaders

Outcomes: A cross-country comparison

It is useful to do a cross-country comparison of selected performance indicators to evaluate the success of the various strategies that countries profiled in this report followed. Perhaps the most obvious indicator to use is the penetration of broadband subscribers per 100 inhabitants. As Figure 6 and Figure 7 show, the Republic of Korea has

a high penetration of both wireless and wireline broadband services. As of June 2009, it ranked fifth in the OECD, with a fixed broadband penetration of 32.8 subscribers. Korea has scored the highest fixed broadband penetration among the case study countries throughout the period since 2000, though its lead has narrowed over time.

In addition to having the highest overall subscriber rate, Korea also has the highest penetration of fiber or metro Ethernet subscribers in the user base. This is one reason why it also has some of the fastest speeds and lowest unit prices. At the other extreme, US consumers have the lowest speeds and pay next to the highest unit prices among the case study countries (Table 9).

Country	***Average broadband monthly price per advertised Mbit/s, USD, PPP***	***Average advertised broadband download speed, kbit/s****
Sweden	$17.79	12,297
United States	$10.02	9,641
Finland	$9.63	19,226
Japan	$4.79	92,846
United Kingdom	$4.08	10,673
France	$3.30	51,000
Korea	**$0.85**	**80,800**

Table 9: Average prices and speeds in case study countries, September – October 2008[148]

To carry out a more thorough cross-country comparison, extending beyond broadband to consider other ICTs, it is necessary to use composite indices, of which there are several available to choose from in the ICT sector. Table 10 shows the performance of the case study countries on four of the main indices: the ITU/UNCTAD Digital Opportunity Index (DOI), the ITU ICT Development Index (IDI), the WEF Global Information Technology Report (GITR) and the NSN Connectivity Scorecard.

Index creator	***ITU/UNCTAD Digital Opportunity Index***[149]		***ITU ICT Development***[150]		***WEF/INSEAD Global Information Tech.***[151]		***NSN Connectivity***[152]
Year of index	*2002*	*2006*	*2002*	*2007*	*2002*	*2008*	*2008*
Finland	15	11	8	9	1	6	6
France	29	26	25	23	19	19	9
Japan	2	2	18	12	14	17	3
Korea, Rep.	**1**	**1**	**3**	**2**	**14**	**11**	**10**
Sweden	7	9	1	1	4	2	8
United Kingdom	18	10	10	10	7	15	5
United States	19	20	11	17	2	3	1
# of economies	180	181	154	154	82	134	16

Table 10: Performance of the case study countries in selected composite indices of ICT performance

Bearing in mind the variation in the methodologies used, the numbers of countries included in each index, the different dates and the selection of different indicators, it is perhaps not surprising that no clear pattern emerges. For instance, Korea scores highly in the DOI and the IDI (which is consistent with the analysis above) but poorly in the GITR and the Connectivity Scorecard. The UK shows improved performance in the DOI, but its performance has deteriorated according to the GITR. The United States scores top in the Connectivity Scorecard but comes 6th out of the seven countries in the DOI and the IDI.

Different approaches with common elements

The surveyed countries have followed a range of approaches, drawing on their political, economic, social, and industrial endowments. The role played by the public sectors in these countries ranges from active—with significant

intervention—to passive—with private stakeholders driving the broadband agenda. In the middle is a hybrid approach involving public and private stakeholders working together. Finland, the United Kingdom, and the United States have mostly taken a passive approach but have started moving toward the hybrid approach. On the other hand, France, Japan, Korea, and Sweden have given the public sector a more active role in the broadband agenda, through a public/private partnership.

Many factors are involved in broadband development, and no two countries have followed identical routes. Still, certain common elements in broadband success stories suggest how these countries have developed components of the broadband ecosystem (Table 11).

Components of the ecosystem		*Finland*	*France*	*Japan*	*Korea, Rep.*	*Sweden*	*United Kingdom*	*United States*
Overall vision	Broadband strategies	✓	✓	✓	✓	✓	✓	Planned
Networks and services	Facilities competition	✓	✓	✓	✓	✓	✓	✓
	Service competition		✓	✓	✓	✓	✓	
	Wireless broadband	✓	✓	✓	✓	✓	✓	✓
	Financing rollout	✓	✓	✓	✓	✓	Planned	Planned
Applications and users	Content and media promotion							
	Demand facilitation	✓		✓	✓	✓		

Table 11: Approaches used to develop the broadband ecosystem in the surveyed countries

Broadband strategies are a common feature among the surveyed countries. More important, all the surveyed countries have implemented policies to encourage competition and introduce wireless broadband service through responsive spectrum policy. Most have used public financing to support network rollout or facilitate demand for broadband.

Thus it is possible to split the overall approach into two components: broadband strategies, which lay out broad goals, vision statements, and frameworks and programs to achieve them; and policies and regulations, which follow the strategic framework while implementing the program as the market evolves.

The survey finds that strategies and policies evolve through three stages. At first, they focus on promoting incipient markets through a range of supply- and demand-side policies. These policies reduce entry barriers, support large infrastructure projects, and help reduce the costs of broadband subscriptions for users. In the second stage, the government steps back and allows competition and market forces drive growth. In this stage, the government exercises oversight through competition policy. Finally, as markets move toward maturity, the focus shifts to universalizing broadband to include under-served or un-served populations and communities.

The next chapter focuses on the development of such strategies and the creation of the institutional base to implement them. Chapter 6 lists the policies and programs that support these strategies, focusing on the evolution of the market through the three stages outlined above.

Chapter 5. Strategies to build the broadband ecosystem

The preceding chapters identified how some of the world's most developed broadband markets expanded access and promoted use. Based on the case studies, this chapter and the next identify strategies, policies, and programs to support the growth of the broadband ecosystem. This chapter discusses how strategic frameworks guide the development of policies and programs to expand the broadband ecosystem at each stage of market growth. It does so within the larger context of the evolving role of government and more generally, the public sector, in broadband.

The public sector's evolving role in broadband

The past decade has seen significant debate on what government's role should be in expanding broadband diffusion. Traditionally, the public sector has played two roles in promoting ICT growth: making markets more efficient and ensuring equitable access for all. The mobile telephony market, almost untouched by government in the late 1990s, grew dramatically through market competition. Consequently, many observers thought that the broadband market, then at the initial stage in a few advanced countries, would also grow under minimal government intervention and depending entirely on efficient markets. Indeed, as previous chapters describe, competition promotion policies have been widely used in countries with high broadband penetration.

But countries that established broadband visions and strategies have also intervened to promote, oversee, and universalize their broadband markets. There is also a greater recognition of the benefits of strategic government interventions. A number of commentators now suggest that relying on markets alone might be insufficient to achieve widespread broadband services. As a recent OECD report states, "the private sector should take the lead in developing well-functioning broadband markets, but there are clearly some circumstances in which government intervention is justified."[153]

In 2009 a range of countries with different economic philosophies included broadband in their economic stimulus plans—indicating that they are no longer averse to making strategic investments. In countries such as Australia and Greece these plans suggest that the question is no longer *if* public investment has a role, but *how* such programs should be designed and implemented (**Box D**).

As the foregoing country surveys showed, governments are playing a greater role in broadband market development through a range of strategies and policies. Six of the seven countries stimulated supply, demand, or both. Only the United States did not have an explicit broadband strategy, relying primarily on market forces, through 2009. Now, that too is slated to change with its new national broadband strategy expected to be published in February 2010.

Hence government's role in broadband market development is evolving. Low broadband penetration in most countries shows that diffusion requires more than just market mechanisms and competition policies. Instead, at the initial stage of market development, there is a need for aggressive policies to generate demand, expand networks, and reach underserved areas and communities. Yet the basic principle remains the same: governments should only intervene based on sound economic principles, where the benefits of intervention outweigh the costs.

Government roles in broadband should include developing national strategies—as many middle-income countries are doing (**Box E**), and that framework should aim to promote efficiency and equity, facilitate demand, and promote environmental stewardship. The latter role is essential because broadband is both a potential cause of increased greenhouse gases (notably in the transition from dial-up service to always-on use) and a potential tool for reducing greenhouse gas emissions in other sectors of the economy (for instance, by reducing the need for physical movement of people and goods).

Defining broadband strategies

Countries that have successfully adopted broadband in a short period have typically established vision statements and policy goals. Most OECD countries that lead in broadband penetration—including Denmark, Finland, the Republic of Korea, the Netherlands, Norway, and Sweden—have coherent broadband strategies. Japan, for instance,

Box D: Stimulus plans in Australia and Greece

Australia announced in April 2009 an ambitious national broadband plan. In it, the Government plans that by 2018, 90 percent of Australian homes, schools, and businesses will connect to 100 Mbit/s broadband services. This follows broadband being recognized as essential to boosting long-term economic growth and increasing the country's productivity and competitiveness. The government will start with an initial investment, about 11 percent of the estimated total investment of AU$42 billion, with the rest to come from private companies and issuance of government bonds.

This plan follows a period of intense debate on how to rollout nationwide broadband services. Since 2004, the Government has launched a National Broadband Strategy (NBS), the Connect Australia program (August 2005), June 2007's Australia Connected, and most recently the National Broadband Network (NBN) project in April 2008. These projects did not take off because none of them resulted in proposals that met coverage goals. Now, private companies will be invited to invest and provide technical expertise and resources to support the newly proposed network. However, private sector ownership would be capped at 49 percent and the network will operate on a wholesale-only, open access basis and will have separate retail operations. Further, the government would sell its stake in the company five years after the network is completed if conditions allow.

Greece has lagged among OECD countries in broadband; it ranked lowest in market penetration until late 2006, and remains at the bottom of the tables at about 15 percent. To pull ahead, the Government has designed an ambitious plan with an indicative budget of €2 billion ($3 billion) that will connect about 2 million Greek homes, covering most of the country's population, with optic fiber as part of a nationwide broadband network. It is expected that the Government will invite bids from private firms to build the network by May 2011 and pick the tender's winners by July 2011. The network will replace the ADSL-based network and connect homes with at least 100 Mbit/s.

The original plan was to have a third each financed by the Greek government, the European Union, and private investors. However, in the view of challenging economic conditions, the plan is expected to be revised to increase the share of private investment and develop a public-private-partnership or concession. The FTTH grid would then be run under a 30-year concession by a state-controlled operator, in which private investors might buy a stake of up to 49 percent. This set-up will be reviewed in a new law, a draft of which will be submitted for public consultation in 2010.

In both cases, these Government-supported broadband plans are being used to restructure the market and challenge the power of dominant private firms—Telstra in Australia and OTE in Greece. Significant questions remain about how public funds might potentially distort the market, and how this risk might be balanced with the benefits of overall growth and the strengthening of alternative broadband operators.

Sources: TeleGeography, *http://www.samknows.com/broadband/news/greek-ftth-plan-delayed-for-one-year-10048.html*; Qiang, Christine, Broadband infrastructure investment in stimulus packages: Relevance for developing countries; *http://www.forexyard.com/en/reuters_inner.tpl?action=2009-12-02T092819Z_01_GEE5B01ET_RTRIDST_0_GREECE-BROADBAND-UPDATE-1*

developed its eJapan strategy in 2001 and has updated it several times. Since the mid-1980s Korea has developed six plans that have helped shape broadband policy. The consultative and high-profile nature of strategy development has also helped raise awareness about broadband and put it on the national agenda (**Box F**).

Even market economies that initially resisted public broadband strategies have crossed the fence. For instance, the *Digital Britain* report proposes charging an annual levy of £6 (about $10) on fixed line telephone subscriptions to fund high-speed broadband services across the country (see **Box C**).[154] Similarly, in the United States—after 10 years of debate during which it fell from 2nd to 15th in OECD broadband rankings[155]—the Obama administration announced the development of a national broadband plan coordinated by the regulator, the Federal Communications Commission (FCC).[156]

Box E: Broadband strategies in middle-income countries

Chile was the first Latin American country to announce a national broadband strategy. The strategy identified ICT as a priority for economic development. Chile has also planned and implemented ICT policies from both the supply and demand sides. Four WiMAX operators include regional providers, and the regulator plans to award additional spectrum for a 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 June 2009 Chile's fixed broadband penetration was 10 percent, while mobile broadband penetration was 2 percent.

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 cutting tariffs to 2 percent of per capita income. The regulator has also looked at issuing licenses for the operation of broadband fixed wireless access (BFWA) networks in the 2.4GHz and 3.5GHz bands. In June 2009 Turkey had penetration rates of 9 percent for fixed broadband and 4 percent for mobile broadband.

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. But despite impressive growth, the target for 2006 has not been met. Now the government is focusing on WiMAX, 3G, and FTTH platforms to boost broadband adoption. To that end, the government is funding a fiber optic network that will connect about 2.2 million urban households by 2012. The network will be rolled out by Telekom Malaysia under a public-private partnership. The deal will see the government invest MYR 2.4 billion (US$ 700 million) in the project over 10 years, with Telekom Malaysia covering the remaining costs. The scheme is expected to cost a total of MYR 11.3 billion (US$ 3.28 billion).

Source: Chile, Digital Strategy, http://www.estrategiadigital.gob.cl/files/EstrategiaDigitalChile2007-2012.pdf; TeleGeography GlobalComms database; Turkey Information Society Strategy, http://www.bilgitoplumu.gov.tr/eng/docs/Information%20Society%20Strategy_Turkey.pdf; Malaysia MYICMS strategy, http://www.skmm.gov.my/what_we_do/tech_map/MyICMS_2ndEdition%20.pdf.

These national broadband strategies have some common elements among them. In line with the traditional goals of government, these strategies seek to oversee markets and make them work efficiently. They also seek to universalize broadband and ensure equitable, widespread access for all. But they are increasingly looking to address the demand-side of the broadband ecosystem as well with promotion policies in the initial stages of market development. Of late, countries are also beginning to evaluate the environmental impact of broadband.

Making markets work more efficiently

Because private companies have supplied most broadband networks, services, and applications, some might argue that there are no failures in the broadband market. In 2008 broadband services were available in 182 economies (Figure 13), and by the end of 2009 there were more than 1 billion fixed and mobile broadband users.

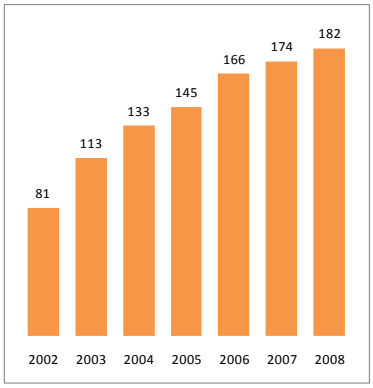


Figure 13: Number of economies with commercially available broadband, 2002–08[157]

But just as there are failures in other markets for public infrastructure, there are market failures in broadband. The structure of the broadband market has sometimes created problems for development of the service. The most common market failure is the persistence of monopoly-type structures in the provision of broadband infrastructure, even when no legal monopoly exists. In many countries the dominance of incumbent public telecommunications operators has been a key obstacle to the development of effective competition in the broadband market.

Other market failures may be associated with insufficient economies of scale. To be fully effective, policies and regulations should aim at building competition. Difficulties in obtaining legal permission to operate, inefficient allocation of radio spectrum, poor information, and limited capital markets are further examples of these market failures. For example, it is not enough to have a competition-friendly authorization regime if the interconnection or spectrum assignment regime is anticompetitive or favors a small group of service providers.

Governments around the world have recognized these market failures. They are typically addressed through regulation: liberalizing licensing regimes, facilitating access to radio spectrum, and allowing access to dominant operators' networks have been cornerstones of policies that have provided for the rapid expansion of broadband services in many countries. Different regulatory interventions can be used to ensure competition, including simplified licensing, interconnection regulation, transparent spectrum assignment processes, and local loop unbundling.

Box F: Using strategies strategically: Raising awareness and the profile of broadband

Governments also use strategies to detail goals on what the economy and society will look like after broadband adoption, bringing broadband on to the national development agenda. The vision and goals should not be limited to the ICT sector, but should connect with other areas of public interest such as economic growth and social development. This will bring broadband to the attention of citizens who will use broadband and reap its benefits.

This strengthens the position of broadband in the national agenda, with ICT policymakers and agencies raising the awareness of high-level political actors such as the head of state, the legislature, and ministries. Support from these entities will be essential to implement policy. For this, ICT policymakers and agencies must first arm themselves with theoretical knowledge on the potential benefits of broadband. Once national leaders and the public recognize the significance of broadband policies, the government is more likely to go through organizational restructuring. And once the restructuring is complete, the policies will gain much more momentum and efficiency.

One of the key success factors for Korea's broadband policy implementation was getting the president and National Assembly to understand the importance of the information society and broadband adoption. Once national leaders became champions of broadband, they generated a strong will to expand the market and made efforts to get citizens and businesses to recognize the benefits of broadband. High-level political leadership and support were also critical to raising awareness about broadband through national ICT projects.

Competition between services or networks will always be the basic requirement for successful broadband markets. Every country surveyed for this report has policy and regulatory frameworks that promote competition. Though approaches differ—some use facility-based competition; others chose services-based competition—every country has worked toward developing and maintaining a competitive market on a level playing field.

Ensuring equitable access for all

A major role of governments in broadband markets is ensuring equitable access for all. This focus on equity can run counter to the emphasis on efficiency just discussed. As discussed in Chapter 6, many governments have taken an active approach to stimulating network rollout in rural and underserved areas.

Providing broadband in rural areas poses significant economic and technical challenges. Costs are higher in areas with low population densities and, unlike other ICT, provision of broadband (for instance, using DSL technologies) encounters technical constraints that lower speeds as distance increases from a central location. Thus the rapid growth of the broadband market has focused on urban centers.

As public and private services are increasingly provided online, the inability of some population groups to access broadband becomes a serious public policy problem. Once broadband use reaches a critical mass (say, 25 percent of the population), it starts being considered indispensable for all. Otherwise, balanced development cannot be achieved due to discrimination based on geographic location.

This challenge has led governments to consider a more active approach to ensuring that broadband is available throughout their territories. As Table 12 suggests, broadband strategies typically include goals for broadband coverage, access, and service quality.[158]

Country	***National broadband strategy (year)***	***Broadband service goals***
Finland	Broadband National strategy (2008)	By 2010, legal right of all citizens to 1 Mbit/s access at affordable levels. By the end of 2015, 99 percent of permanent residences should have access, within 2 kilometers, to a fiber optic or cable network delivering 100 Mbit/s service.
France	France Numérique 2012 (2008)	By 2012, ubiquitous access to 512 kbit/s service at monthly rates of €35 or less.
Japan	eJapan strategy (2001, updated at intervals)	By 2010, a self-sustaining ICT society with ubiquitous high-speed broadband services and ultra-high speed service in urban locales.
Republic of Korea	U-Korea Master Plan (2006)	By 2010, 20 million subscribers (40 percent of the population) with 50-100Mbps. A plan for 1 Gbit/s connectivity is in preparation as of late 2009.[159]
Sweden	Broadband strategy for Sweden (2007)	By 2010, near ubiquitous access to 2 Mbit/s service.
United Kingdom	Digital Britain (2009)	By 2012, 2 Mbit/s service to all households (proposed).
United States	Expected in 2010	No public policy goals yet.[160] National broadband plan being developed.

Table 12: Broadband strategies and service goals in the surveyed countries

Korea and Singapore have established goals of reaching connection speeds of at least 1 Gbit/s by 2012. Korea's government has also adopted a comprehensive broadband strategy focused on providing operators with financial incentives to invest in their networks.[161] European countries such as France[162] and Sweden[163] have used a mix of demand aggregation, public-private partnerships, and universal service obligations to ensure the widespread availability of broadband. Norway's government has subsidized the rollout of broadband infrastructure in areas with no such infrastructure in place. Its goal is to provide 99 percent of the population with fixed broadband coverage.[164]Other governments have set coverage targets, such as 100 percent of communities by 2012 (United Kingdom) or 100 percent of households by 2015 (Finland). Some governments have set targets for fiber optic coverage, such as 4 million households by 2012 (France) or 75 percent population coverage by 2019 (New Zealand).

As noted earlier, broadband investment has also recently featured in fiscal stimulus plans around the world. Broadband is seen as providing a quick win in these stimulus plans because on the supply side it stimulates investment and employment, while on the demand side it creates opportunities for entrepreneurship and spillover effects that benefit the general economy.

Facilitating demand

As noted, the broadband ecosystem involves more than the networks and services offered; it also includes applications and users. Countries are beginning to approach broadband to develop both the supply of broadband (access to networks and services) and the demand for it (adoption by businesses, government, and households). As a result, demand facilitation is thus becoming an important part of broadband development strategies and policies.

Demand facilitation matters because supply rollout—constructing networks and providing services—entails significant costs and risks for investors. This is especially the case in rural and remote areas. Hence government needs to assist development by raising public awareness and stimulating demand.

Demand can be facilitated in several ways (see Chapter 6). One is for government or public agencies to become anchor tenants for broadband services, increasing demand themselves. Another is for the government to help increase demand for broadband from other users such as households and businesses. Accessibility, affordability, and attractiveness are the three pillars for government to use in efforts to increase demand (Table 13). Such efforts should be implemented in a phased manner while gauging market developments—many of the drivers for demand may appear on their own. Hence public support will only have to fill any remaining gaps (such as training for people with disabilities or the elderly, or access for schools in remote areas).

Accessibility	***Affordability***	***Attractiveness***
• Setting up broadband access centers, telecenters, kiosks, and other public access points • Connecting educational institutions to broadband networks • Providing wireless Internet services in public spaces such as airports or business districts • Training all citizens to access and use broadband through digital literacy programs	• Lowering the cost of user terminals by reducing import duties and other taxes or through targeted subsidies • Subsidizing broadband equipment used in educational institutions • Providing consumers with information on providers, pricing options, and available technology	• Supporting local, relevant Internet content in local languages • Putting government and public information online and creating e-government and other e-applications (such as for health, education, and agriculture) • Providing a legal framework for e-commerce and other applications • Educating citizens about the benefits of broadband • Promoting broadband use to businesses and communities

Table 13: The three pillars of facilitating broadband demand

Environmental concerns

Broadband could play an important role in the evolution of the debate about ICT and the environment, particularly climate change. ICT already contributes 2–3 percent of global greenhouse gas emissions, and this share is likely to increase. The problem is partly caused by the use of always-on services such as broadband, as well as the trend toward devices and networks with higher power consumption.

The transmission capacity of different generations of network access technology is doubling about every year. All things being equal, as transmission capacity rises, so will power consumption—for both devices and networks. The challenge is to achieve continually rising transmission capacity while stabilizing or reducing power requirements.

There are technical solutions to this problem.[165] For instance, technical standards could build in alternative power consumption modes to DSL modems (such as standby and sleep in addition to on and off). But it is unlikely that the market will pursue this path without government pressure or incentives. The European Union has developed power saving codes for digital TV set-top boxes, external power supplies, uninterruptible power supplies (UPS), and broadband equipment, and a code is being developed for data centers.

On the positive side, broadband can help reduce greenhouse gas emissions in other industries, and the mitigation effect of ICT is estimated to be up to five times its direct causation effect.[166] Again, some government guidance might be needed to achieve this, such as incentives for telecommuting or support for remote collaboration.

The evolution of broadband strategies

Strategies set the stage for policies, programs, and regulatory measures that implement the vision. In this, they could play a significant role in assuring investors about long-term investments and provide insight about how the regulatory environment might evolve.

Yet, as broadband markets grow, these strategies will also have to be revised and different policies enacted. As discussed, the role of government evolves from market promotion to oversight to universalization of service. The initial focus will be on supply-side promotion combined with a constant focus on competition regulation to ensure that markets remain efficient. In the later stages, however, strategies will have to focus more on universalization, ensuring that broadband is used widely.

Broadband strategies may also evolve as markets undergo qualitative evolution in the level of broadband services, say from broadband at 2 Mbit/s to service at 1 Gbit/s; as the range of applications and types of content available

increase with such qualitative transformations, so too must the approach of the government in promoting, overseeing, and universalizing broadband. Hence, even though first-generation broadband services might be universalized, higher-quality services might be the focus of promotion policies.

Promotion. Early on, promotion strategies focus on developing a national broadband backbone network, creating demand, and establishing an enabling environment for competition and investment (such as by removing market entry barriers). Promotion strategies and their supporting policies allow government to intervene in market creation and facilitation. Supply-side policies enable the development of access to broadband—enabling network operators and service providers to enter the market easily, operate on a level playing field, and, where necessary, provide financial support to reach high-cost areas. Such policies provide incentives to generate demand and reduce risks for network investors at the initial stage of broadband adoption.

The demand-side focus promotes broadband adoption and use; it also enables wider inclusion of otherwise underserved or un-served communities. Here governments make broadband access and services more attractive and accessible to potential subscribers and users by helping to lower prices, putting public services online, and encouraging the diffusion of access devices such as computers. Improving digital literacy is another important aspect of demand facilitation, especially among communities that might otherwise lag in broadband (and general ICT) use.

Oversight. When broadband reaches mass-market status, oversight supports growth in access by ensuring competition among facilities and service providers. Oversight includes policies and regulations to facilitate competition, guard against monopolistic, oligopolistic, and unfair practices, and regulate essential facilities. Hence, the focus of supply-side policies shifts to overseeing the market to ensure vigorous competition in facilities, services, or both. On the demand-side, the government's role moves into creating an online environment that is safe for businesses, households, and children.

Universalization. Universalizing policies address economic goals but also contain social elements based on equity. As broadband market matures, governments seek to cover access gaps through service policies that drive networks into rural and remote areas. On the supply side, governments often seek to help reduce the costs of reaching underserved areas. These policies aim at providing broadband to underserved areas and groups that lack access to it. On the demand side, the shift toward universalization brings an increased focus on underserved communities and groups.

The institutional base for policy implementation

Broadband strategies may define the institutional framework that will implement the various programs and policies. Some of these institutions might be obvious, such as ICT industry regulators, while new agencies may implement specific programs. 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. On the other hand, line ministries such as health, agriculture, education, and public administration may play a role in supporting content development, bringing their services online, or using broadband to streamline their functioning.

A range of institutional structures has been attempted 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, ensuring consistent and efficient promotion of broadband. Establishing legal systems for 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.

However, these dispersed responsibilities seem to have led to rather passive promotional and universalization policies relative to those of some Asian countries. Further, if different organizations develop and implement promotional, oversight, and universalization policies, it will increase the costs of sharing policy goals, pursuing timely deployment, and coordinating priorities, which will likely further decrease efficiency.

Chapter 6. Policies and programs to build broadband

Broadband development strategies are implemented using policies, regulations, and programs. The countries surveyed show how to identify and assign policy interventions to match with stages of market development. Table 14 summarizes key policies, regulatory, and programs that the surveyed countries have used to develop their broadband ecosystems.

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 • Reduce administrative burdens and provide incentives and subsidies for R&D, pilots, and network rollout • Create certification systems for cyber buildings • Allocate and assign spectrum for wireless broadband services	• Consider infrastructure sharing, including unbundling the local loop • Reallocate spectrum to increase bandwidth	• Undertake , using public/private partnerships, as appropriate deployment of open access broadband networks in high-cost or remote areas • Coordinate access to rights of way
Services	• Provide broadband networks to schools, government, etc. (government as an anchor tenant) • Standardize and monitor service quality	• Create an enabling environment for intra- and intermodal competition • Ensure nondiscriminatory access for service, application, and content providers	• Consider expanding universal service obligation to include broadband
Applications	• Undertake government-led demand aggregation • Government agencies as early adopters and innovators Provide e-government and education applications • Promote creation of digital content • Develop local content and hardware sector	• Support secure, private, reliable e-commerce transactions • Implement intellectual property protections	• Develop advanced e-government programs • Offer grants to community champions and broadband demand aggregators
Users	• Provide low-cost computers and other user devices, for instance in education • Develop digital literacy programs for citizens	• Establish ethical guidelines for information use	• Expand universal service programs to underserved communities • Create community access centers • Subsidize user devices for poor households

Table 14: Key policies and programs for building the broadband ecosystem

The policies and regulatory tools in Table 9 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 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 Japan, Korea, and Sweden, have had public-private partnerships and a more active role for the state earlier on.

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

Another important shift is that countries are expanding universal service programs to include broadband. Aside from the surveyed countries, Pakistan has begun deploying broadband networks that compete for subsidies from the Universal Service Fund Company.[167] In 2007 the Dominican Republic's Telecommunications Institute (Indotel), the industry regulator, launched a tender aimed at installing broadband connections in 500 rural communities under an output-based aid scheme.[168] Increasing media converge will put pressure on universal service funds to evolve from a focus on voice- to data-centric networks (which carry all services). Moreover, the improvements in social connectivity and economic competitiveness that derive from broadband make a strong case to include it in universal service programs.

Promote: Policies as a pump primer

Many countries have low broadband penetration and are in the initial stage of market development. These countries should focus on policies that promote the broadband market. Promotional policies can promote 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.

Supply-side promotion policies

Reduce entry regulations to facilitate competition. The first step of broadband policy implementation should be fostering competition with reduced entry regulations. Competition is helped by lowering or removing legal entry barriers into broadband markets. The rapid development and diffusion of broadband is largely due to competition between technologies such as DSL, cable modem, fiber optics, and wireless. To enjoy the full benefits of such competition, governments should not influence the technological choices of providers without good reason.

Use spectrum frequency policies to facilitate wireless service. Forecasts suggest that most broadband market development in the developing world will be through wireless networks. Wireless broadband access efforts will focus on the last mile—from the exchange or node to the subscriber. Allocating the appropriate spectrum for broadband use can significantly alter the business case and usefulness of wireless broadband. Further, governments should manage their radio spectrum appropriately to reduce entry barriers, promote competition, and enable the introduction of innovative technologies.

An important consideration for spectrum policy is which frequencies should be allocated for broadband services and how. The critical choice is whether countries want to maximize their 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 have to 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 TV spectrum freed by the move for wireless broadband services. (Digital TV services are far more spectrally efficient than analog TV 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 is expected to see initial deployments of wireless broadband services in this spectrum as early as 2010,[169] and other countries are considering similar moves.

Given the rapid development of wireless broadband technologies, governments should allow providers to obtain new frequencies by expanding available frequency bands, implement management policies based on market principles, encourage efficient use, and shift spectrum from low-value uses to services such as broadband.[170] Spectrum managers should also keep in mind the impact that their spectrum allocations have on business economics: higher bands make mobile communication more difficult and more expensive. In addition, spectrum managers should look toward newer management models—such as the spectrum-as-commons approach that has been a key factor in the success of Wireless Fidelity (Wi-Fi) networking—to encourage spectrum sharing and innovation.[171]

Most important, spectrum made available for wireless broadband should recognize all potential uses. Put another way, it should be assigned on a technology- and service-neutral basis. This approach is critical to enabling all the different types of applications of broadband services: voice, video, and data can all be provided by wireless broadband technologies. If spectrum authorizations limit what applications can be provided, it will diminish the utility of the broadband service and undermine the business case for the service provider.[172]

Provide government support for national backbone construction. Network construction is the highest entry barrier in the communications industry, requiring significant financial resources. The complete broadband network consists of international connectivity, the domestic backbone network, and subscriber access network. Construction of domestic and international backbone networks is essential to ensure that high quality, low-cost connectivity is available domestically and internationally. Starting with the construction of backbone networks allows connectivity among major agencies and institutions—such as government ministries, universities, research centers, and large businesses—while allowing time to determine how to construct the subscriber network.

Businesses might initially avoid investing in backbone networks because they are unsure of the returns on their investments. Governments can provide upfront support to reduce risks or act as an anchor tenant to induce investment. Numerous policy options are available for countries looking to develop their backbone connectivity. [173]

In Korea, projects connected organizations such as public offices and educational institutes under the government's direction. This approach reduced risks for businesses and promoted backbone network investment. It also established a base for e-government and the information society. Korea's experience in the regard can serve as a reference for many other countries. It is also appropriate that the Korean government allowed service providers to own and manage the network, which the government paid for and used, because doing so reduced government intervention in an area (management) that it could not cover and strengthened its regulatory role.

Less direct measures—such as providing investors with tax benefits and low-interest, long-term loans—can also promote investment in network development.

Take aggressive steps to reduce providers' investment costs. 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 (Figure 14)[174] and wireless networks.[175] They also play a major role in increasing the cost of network deployment for new service providers as well as incumbents.

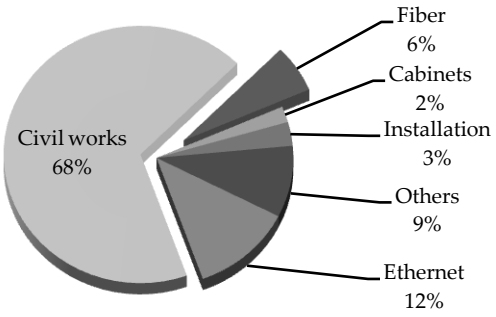


Figure 14: Typical cost components of a fiber optic network

It is possible to cut the costs of backbone network construction by establishing legal grounds for open access to the passive infrastructure (conduits, ducts, poles) of other services (roads, railways, power supply facilities). This approach can significantly lower the cost of rolling out telecommunications networks because adding communications equipment (such as cables) to other infrastructure projects is relatively cheap (Figure 15).

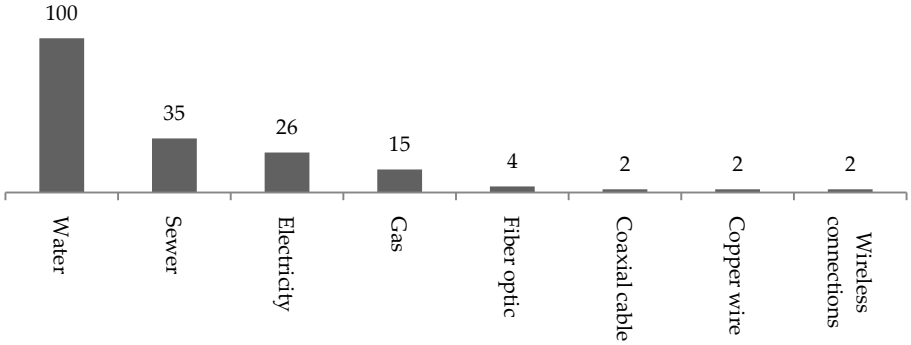


Figure 15: Average cost of infrastructure installation per kilometer (Index: Water=100)[176]

Similarly, when contractors construct other types of new infrastructure, government can require them to build passive infrastructure that communications service providers can access on a nondiscriminatory basis. Another option is to require the installation of basic infrastructure such as ducts when homes and offices are constructed or renovated and impartially providing the facilities to all providers.

Finally, governments can permit or facilitate joint construction of backbone and subscriber networks among providers. Such a policy may facilitate investment only if the market has sufficient competition and there is little chance of collusion, with only a few providers joining the construction. But in markets with less competition and a greater chance of collusion, such a policy can undermine competition and reduce benefits to users such as lower prices and improved service choice and quality. Thus it requires careful consideration.

Demand-side promotion policies

Promote digital literacy. To raise public awareness on the benefits of broadband services and promote their use, governments may provide training on how to use computers and the Internet. Recognizing the importance of a digitally literate population, in the early 2000s, Korea provided free or low-cost training to 10 million citizens who lacked access to ICT.

This training contributed a lot to the rapid and widespread penetration of broadband. In the short run such extensive training generates demand. It is also a step toward universal service, because the program mainly targeted underserved groups (women, military personnel, prisoners). Korea also provided ICT training for children and

students—that changed their learning behaviors and interests and, by extension, altered their parents' views of ICT and broadband.

The digital literacy program integrated both demand and supply sides. It was effective only because it included supply-side policies such as providing financial support to schools for network construction and broadband use.

Distribute low-cost devices and terminals. Despite recent price cuts, devices and terminals for broadband use are still too expensive for citizens of developing countries. For instance, a $400 netbook is more than the GDP per capita of nine Sub-Saharan countries. The so-called "$100 laptop" costs more than a third of GDP per capita in four Sub-Saharan countries (Figure 16).

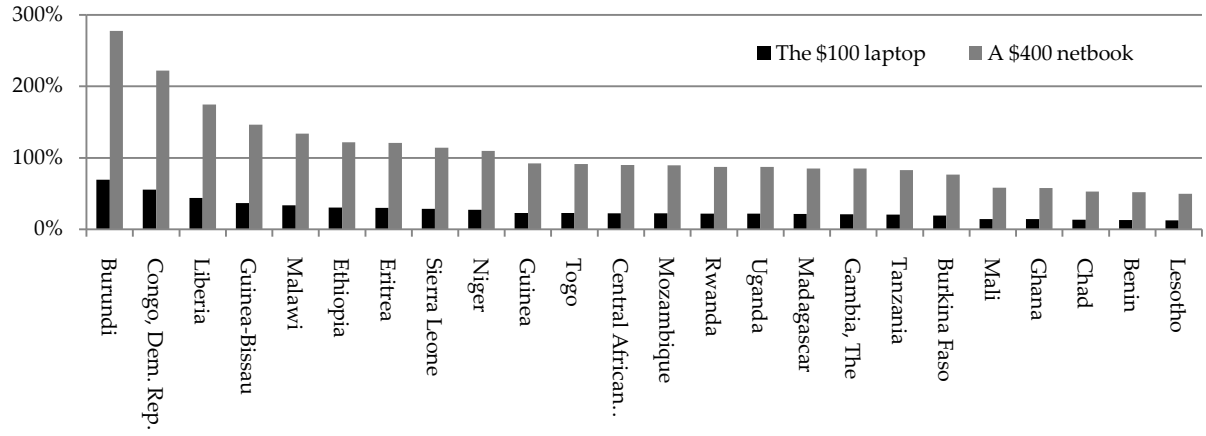


Figure 16: Cost of user devices relative to GDP per capita in selected Sub-Saharan African countries

Thus low- and middle-income countries could consider developing policies and programs that make user devices more affordable for people who want to buy them but lack the means to do so. To increase demand, countries should choose the most suitable approach among various policy schemes. For example, Korea provides loans through postal finance service and allows amortization and distribution of free computers to students from low-income groups and people with disabilities. Sweden offers tax breaks and price reductions for bulk purchases. China and Tunisia subsidize standardized computers for poor and rural households (**Box G**).[177]

Have government serve as an anchor tenant. Government's main pump-priming function on the demand side is to serve as an anchor tenant for broadband services. In addition, computerizing public information and providing public or e-government services through broadband networks is essential. E-government encourages citizens to subscribe to broadband services and provides businesses with more information. It also increases government efficiency and enhances governance.

One reason for caution is that governments should ensure they follow transparent procurement processes and remain, as far as possible, vendor and technology neutral in their approach to e-government and related services. For instance, tenders to develop e-government applications should be competitive, and requests for connectivity services should encourage competition as opposed to preselecting network operators.

Develop online content and media. Online content and media involve two key challenges. A lot of online content and media are in English or other international languages not widely spoken in many developing countries. And even if the language is spoken, the content is often not locally relevant. Hence governments should support content and media development in local languages, with locally relevant content. In Korea content development policies have been a critical component of the overall approach and have evolved in line with market developments.

Box G: Subsidizing user devices

A number of countries have initiated programs to subsidize the purchase of personal computers (PCs), with the intention of overcoming what is often the most expensive component of a traditional broadband subscription. In many cases, the government provides some fiscal incentive to purchase a PC. Countries that have implemented such schemes include Italy (the "PC for Youth Scheme"), Austria, and Sweden. Sweden subsidizes PC purchases by letting companies provide them on a pre-tax basis to employees.

The Republic of Korea has implemented such programs. The "10 Million People Internet Education Project" provided free or subsidized computer training programs for groups like the elderly, military personnel, farmers, and homemakers. The 'Plan for Promoting ICT Use and Distributing PCs to Children of Low Income Families' was launched in 2001 and provides those who cannot afford to have ICT with a PC and a discount Internet access rate. The government also subsidizes companies to provide computer training for their older personnel. The government also provided free computers to 50,000 low-income students with good grades, and free used PCs to people with disabilities and to those receiving public assistance; and through a post office program, leases computers to low-income families on a four-year lease with full support for broadband free for five years.

In the UK, the Government's Home Access Task Force set up a £300m program in September 2008 to give children eligible for free school meals a Home Access Grant. This will provide a free computer and one year's Internet use. The aim is to help over 270,000 households by March 2011.

More recently, in March 2009, China announced that it had selected 14 PC vendors to offer low-priced PCs in rural areas. All the PCs that won the bid are priced from US$290 to US$510. This is part of the National Home Appliance Subsidy Program for rural areas. About 57 people of the population or about 200 million households will be eligible to obtain a 13 percent subsidy if they purchase one of these PCs.

Source: Atkinson, R., International Lessons For Broadband Policy, Presentation at the FCC Broadband Policy Workshop, August 18, 2009; E-Learning Foundation, Home Access Programme, available *http://www.e-learningfoundation.com/home-access-programme*; *http://www.gartner.com/DisplayDocument?id=909330*

Supporting content development is important for generating demand and, if performed strategically, can increase national wealth. Korea's online game industry grew rapidly with broadband penetration and has become a major export industry as broadband expands worldwide.

One enabler of widespread content and media development is the creation of an intellectual property rights (IPR) regime that protects creators' interests while enabling others to use and improve those creations. A well-designed IPR regime provides incentives for growth and development.[178] Well-defined rights allow creators to reap the economic benefits of their work by controlling how the work is used.

However, there are debates about how much such rights should balance the interests of creators with the larger goals of enabling knowledge sharing, fair use, and adaptation.[179] A key debate related to development is whether IPR protection should benefit a few rights holders (primarily from developed countries) or whether a balance can be struck that both provides needed incentives for innovation (that is, protecting intellectual property) but does not exclude potential users in developing countries (that is, granting access).

Some jurisdictions have IPR frameworks containing fair use provisions that allow limited use of copyrighted material without requiring permission from rights holders. And many creators allow free use of their work. IPR regimes that provide the space for others to draw on, use, and improve the work with certain controls also benefit technological and economic development. For instance, the open source movement calls for the publication of source code and has led to widespread collaborations. Open source has led to the creation of widely used technologies such as Mozilla Firefox, a free Internet browser, and Linux, an operating system.[180] More recently, systems such as the Creative Commons licenses allow creators to specify which rights they wish to reserve, allowing a range of possibilities between full copyright and the public domain.[181]

Encourage businesses to use broadband and e-commerce. Large enterprises may be the first users of broadband because they are usually aware of its benefits. But small and medium-size enterprises (SMEs), which make up most of the private sector, often lack understanding of broadband and its impact or cannot afford it. Policy measures for SMEs include developing and providing free or low-cost applications, providing tax breaks for investments in ICT and Web-based services, and giving tax cuts to businesses in the ICT industry (such as software developers).

Countries must also pay attention to the legal foundation, such as allowing the use of electronic signatures encourage businesses to participate in e-commerce. Improvements in information security, including encryption technologies and anti-hacking programs, are critical for stable and safe e-commerce.

Customize policies to expand demand. Countries also need to develop policies for demand generation tailored to their economic, social, and cultural conditions. For instance, Korea's Broadband Building Certification System increased competition in broadband network construction in apartment buildings. It also led to the construction of a high-quality broadband subscriber network in a relatively short period because contractors were aware of the demands from apartment residents, including for robust telecommunications services.

Even policies that involve no cost and require no legal force, such as the Broadband Building Certification System, can be highly effective when properly timed and harmonized with overall policy frameworks. Though the building certification policy may not be as feasible in less populated urban areas of developing countries, it can still serve as a reference for creative, customized policymaking.

Oversee: Facilitate competition-led growth through consistent oversight

The basic aim of government intervention in the communications market—from fixed line telephony to mobile telephony and broadband—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 typical yet important and thus must be implemented consistently and compellingly from the initial to maturity stages of market development.

Support as much as possible new entrants competing with the incumbent

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.[182] 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.

Consider both facility- and service-based competition policy

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

Box H: Local loop unbundling

One specific regulatory intervention used in a number of countries is local loop unbundling (LLU), where the incumbent is mandated to provide access to exchanges and the local loop network so that new market entrants can offer services direct to customers without having to reproduce the incumbent's network. LLU is sometimes used as a surrogate for infrastructure competition, or as a way of inducing price competition between facilities-based and services-based competitors.

The main advantage of LLU is that it permits much faster market entry that would be possible if entrants were obliged to construct their own network. The main disadvantage is that it can potentially be a disincentive to fresh infrastructure investment by the incumbent operator, for instance in deployment of a fiber optic network. Most European and some OECD Asian economies now have laws on LLU, with Switzerland and New Zealand both having put policies in place since 2008. But other countries, such as the USA, have considered but not mandated LLU (leaving it instead to the market) or have not yet developed a policy, such as Mexico.

Countries vary greatly in the percentage of unbundled lines that are open to competitive market entry, ranging from France, which has 70 per cent of lines available, to just 8 per cent in Switzerland. A critical factor is the wholesale price of the LLU connection relative to the retail price for broadband as this determines the profit margin for the new entrant. In France, the LLU price is just €9.29 per month (US$13.76) while in Ireland it is €16.02 (US$23.72).

Source: OECD Communications Outlook, 2009

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 France and Korea 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 (**Box H**).

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 business. Hence France adopted powerful service-based competition from the initial stage to facilitate 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 that do not have an alternative network covering the entire country, it would be more effective to adopt both service- and facility-based competition rather than applying nationwide facility-based competition policies. For large cities with sufficient demand, facility-based competition in the subscriber network might 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 frequency opening and broadband over power lines. 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.

Regulate unfair practices

From the moment a new service provider enters a market, the dominant incumbent devises strategies to maintain its dominance, while the entrant is tempted to engage in unfair practices to increase its market share as quickly as possible. Government must thoroughly regulate such practices to ensure fair competition.

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.

Universalize: Focus on widespread diffusion as broadband market grows

A farsighted policymaker would envision nationwide diffusion of broadband from the outset and pursue that goal through vision and plans. But policy development and execution for broadband universalization cannot gain momentum until a national backbone network is constructed and sufficient, competitive services are provided in cities.

Expand universal service programs to include broadband

Most advanced countries with mature markets are making efforts to universalize broadband services, as described in the broadband plans of Australia and the United Kingdom. In some countries, including Korea, broadband services are already universal.

Other countries are also moving to achieve universal broadband, regardless of whether that goal is stated in law, by using policies focused on rural areas and underserved groups. Policymakers must maximize market competition through stable and efficient policies and expand service coverage as much as possible with minimal government intervention.[183]

Government policies for diffusing broadband to rural areas and underserved groups fall into three categories, and many countries are making these policies complementary. The first policy type involves using regulations. Government requires the dominant incumbent to develop a nationwide network that provides services to rural areas and underserved groups.

Provide financial support for network rollout in rural and underserved areas

This first approach is usually implemented in parallel with the second, under which the government offers subsidies or compensation. In Korea the government-led KT, the dominant provider, committed to constructing networks in rural areas of a certain scale without government support and expanding networks in remote areas with a certain level of subsidies.

This approach is also used by many countries in Europe and by the United States: France, Italy, and Spain encouraged network construction in rural and underserved areas, and the US Department of Agriculture's Rural Utilities Service Telecommunications Program facilitates local providers' network construction in underserved areas.[184] Many developing countries, especially in Latin America and recently Pakistan, also use these types of policies.

The third type of policy—used in France, Sweden, and some US states—involves local governments, central government, or public organizations directly in network construction and service delivery.[185] This type of government intervention can cut transaction costs because it skips complicated procedures including auctions of provider rights. But such direct government intervention may distort the market. Accordingly, institutional tools (such as limiting government's role to providing a fiber network based on open access rules) are generally used to minimize the scope of government intervention.

Foster digital inclusion

Finally, universalization policies can include digital inclusion programs that go beyond the promotion phase. For instance, programs might provide subsidies for low-income households to purchase broadband devices or even subscriptions (see **Box G**), build Internet access centers in remote areas and schools, and deliver digital literacy or training programs to underserved groups such as the rural poor, the elderly, people with disabilities, and minorities.

Chapter 7. Building blocks for broadband

More countries are trying to expand broadband, with many developing countries seeking to cement gains from the rapid expansion of telephone networks over the past decade—mainly mobile but also fixed. Indeed, the market penetration of fixed broadband in the developing world is already where it was with telephony in the early 1980s (Figure 17), suggesting a 25 year lag, though this is shrinking.

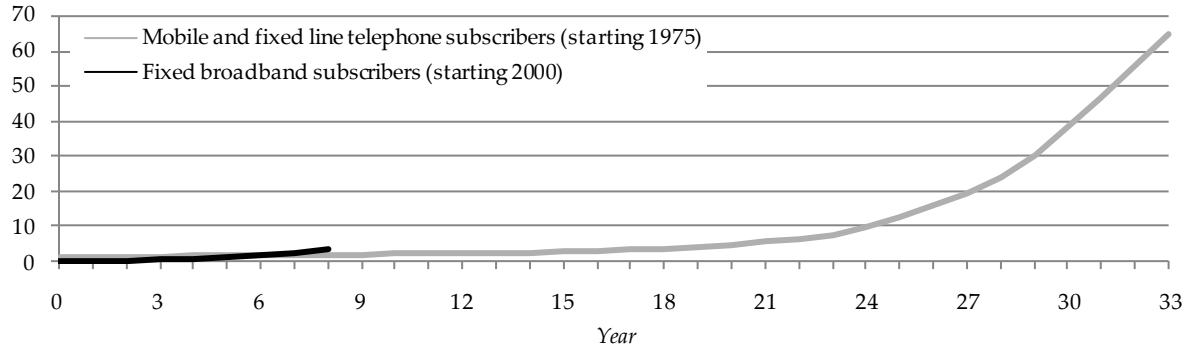


Figure 17: Telephony and fixed broadband subscribers in developing countries (per 100 people)[186]

The countries surveyed in this report suggest three successful building blocks to support the development of the broadband ecosystem. As noted, governments should approach broadband holistically, taking into account all four components of the ecosystem—networks, services, applications, and users.

These building blocks will not always work everywhere: one size does not fit all. Local political economy and socio-cultural circumstances will have to inform the design of policies and programs. Still, it is possible to derive general lessons and identify options based on what has or has not worked in the countries studied.

Building block 1: Be visionary yet flexible

Countries should develop ambitious, practical, holistic visions of the status and role of broadband. A national broadband vision should set goals informed by consultations with the entire range of stakeholders—government agencies, the wider public sector, private investors, the public—so that they both raise awareness and secure broad support. In addition, such vision statements should be backed by realistic programs and specific policies that fit within broad national development goals. These visions should also consider the entire broadband ecosystem, noting the relationship between components and informing the development of policies and programs that develop both supply and demand.

Moreover, governments should remain alert to changing technologies and business models. The Republic of Korea highlights the benefits of flexible policies and regulations, with coordinated implementation capable of meeting the needs of rapidly evolving high technology markets. For example, the government updated its goals for the rollout of services as mobile broadband technologies entered the market. By contrast, the targets that Malaysia‘s regulator set for broadband penetration proved unrealistic, and achievements fell short. The United States also lagged by retaining dependence on a *laissez faire* approach although there are now signs suggesting a rethinking of that strategy. Thus it is important to be flexible.

Flexibility is also needed as the market develops. The three types of policy this report has discussed—promotion, oversight, and universalization—are all essential in broadband deployment, but the focus is likely to shift as the broadband market develops. That is, government would focus more on promotional policies to generate demand and expand supply during the initial stage of market development. It would then shift to overseeing competition and universalizing as the market develops and matures. Hence, though the focus shifts along with market growth, the three policy types must be thoroughly considered at each stage of development.

Thus governments can launch and revise ambitious national broadband visions, including definitions of broadband, service goals (including national and rural coverage), transmission capacity, service quality, and price comparisons.

Building block 2: Use competition to promote market growth

Most countries have not yet seen their broadband markets penetrate more than a few percent of their populations. Hence government's role is even more important in promoting and accelerating growth of the broadband market. A key lesson from the countries surveyed in this report is that competition is critical to successful broadband market promotion.

Each of the countries studied has used different mechanisms to spur competition and promote broadband market growth. Some have focused on facility competition, others service competition. Indeed, the faster pace of broadband development relative to telephony is testament to how countries have absorbed their experiences with the first generation of regulatory reforms. The presence of established, competitive telecommunications firms in many countries has also contributed to broadband market development.

Competition has also contributed to other regulatory decisions. For example, making flexible use of radio spectrum and supporting multiple international bandwidth providers and international gateways can help promote competition in the broadband market. In addition, expanding authorization regimes to allow more participants in the market and to allow these participants to innovate on service offerings and technologies fosters competition.

Apart from implementing policies and regulations to ensure competition (between networks or services), the public sector can promote broadband ecosystem development by sharing financial, technical, or operational risks with the private sector. Public-private partnerships can involve some public financing to unlock significant private investments, through either direct investment or government reallocation of operator profits back into the sector. Public investments, based on predefined and transparent rules, can target subsidies to improve broadband accessibility and affordability in underserved areas.

Such support could promote R&D in new broadband technologies and find its way—through expanded universal service programs—to funding programs that serve poor or underserved areas. Indeed, governments have recently begun investing strategically in broadband partly to stimulate economic growth.

Government willingness to invest in strategic projects often leverages a massive response from the private sector, as in Korea. Hence, even resource-constrained governments can show their commitment to broadband projects by funding part of larger projects. Other measures can include expanding broadband services through infrastructure funding, investment incentives (such as loan guarantees and tax credits), and grants for ICT in research and education.

However, such a government role should not replace or substitute for the normal operation of market mechanisms. Rather government should facilitate or support the private sector. In every case, public-private partnerships should be designed transparently and focus on encouraging as opposed to replacing private innovation and investment. The government must be capable of developing and promoting timely policies based on a thorough understanding of the market, and implementing them according to an appropriate schedule.

Building block 3: Facilitate demand

The public sector can play a major role in promoting demand for broadband. To succeed, such efforts must take into account the economy's culture and knowledge base. For instance, content development policies are useful if online content in local languages is limited. If government or public infrastructure (schools, medical centers, universities, government offices, research or public kiosks) is widespread and widely used, regulatory and legal frameworks can be revised to support broadband service provision in to specific institutions.

The government can act as an early adopter through its procurement policies and provision of e-government services, and thus serve as an anchor tenant for broadband networks. In Korea this approach proved critical to encouraging network providers to invest in the early days of broadband, as the country was recovering from the Asian financial crisis. Demand promotion for broadband service can include digital literacy campaigns and other initiatives such as free or subsidized computers, computer clubs, and support for digital content. Regulators can work with educators to devise and use broadband services, including distance education.

As Korea also shows, countries can also move beyond network rollout and include research, manufacturing promotion, user awareness, ICT skill development, 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.

The implications for developing countries

Across the developing world, countries are looking to increase access to and use of broadband. As this report proposes, it is useful to reconceptualize broadband as an ecosystem and focus on developing a national broadband strategy, promote competition, and facilitate demand. The following considers briefly the implications of these findings for developing countries.

Political and economic conditions vary across the developing world, and each country is endowed with differing technological resources. Some, such as Costa Rica or Croatia, have a relatively well-developed fixed telephone network that could support broadband deployment, while others, such as Romania and India, have widely spread cable TV networks that might be able to provide a measure of facilities-based competition from the start.

This variance makes it unwise to propose universal solutions to grow the broadband ecosystem. Instead, this report provides a long list of policies and programs framed within a strategic framework that allows specific solutions tailored to countries' circumstances. The findings of this report will therefore have different implications for different countries. In some cases, the challenge will be to create the incentives so that widespread networks can be used to offer broadband services. In other countries, the challenge will be to rollout broadband-capable networks. Each country also faces unique resource constraints, requiring broadband strategies to be tailored to the ability of each country to attract private investment and support publicly funded programs. And some countries might find it harder to fund or manage programs offering subsidies, for instance.

Yet, the experiences of the countries surveyed in this report provide emerging best practices that are likely to be useful everywhere. This is for three important reasons. First, the focus should be 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, with mobile telephony). As discussed previously this report identifies policies and programs that support private sector investments and call for only specific, limited, and well-justified public funding interventions in exceptional circumstance. For example, countries such as Korea and France implemented policies that had limited immediate fiscal impact but helped cut the costs for broadband network rollout.

Second, the surveyed markets passed through three stages—promotion when the market was incipient, oversight as competition began to drive growth, and universalization as the market matured. This report provides emerging best practices for each stage of market growth, while stressing the need for an overall strategic thinking.

And third, contrary to the misconception that governments in the surveyed markets 'threw money' at broadband, policymakers in the surveyed countries have been creative and sought to maximize the impact of limited investments rather than simply spending their way to broadband ubiquity. Consequently, developing countries might identify ways by which they might leverage limited resources to maximize impact, prioritizing programs based on demand and market evolution, rather than shying away from policy reform altogether. To help countries in these efforts, the upcoming broadband strategies toolkit will offer more detail on how to convert the broad strategic and policy ideas in this report to practical instruments used in policymaking, regulation and implementation of broadband network development.[187]

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[108] *See* Finnish Communications Regulatory Authority, *Mobile Call Prices 2008 International Comparison* (May 30, 2008)(reporting that Finland had the over-all lowest mobile call prices in Europe and the least expensive mobile broadband subscription rates); available at: http://www.ficora.fi/attachments/suomimq/5yXxCdGU9/Mobile_Call_Prices_2008_-International_Comparison.pdf; *see also*, Finnish Communications Regulatory Authority (FICORA) *Market review 1/2009 The International Communications Markets* (June 30, 2009); available at: http://www.ficora.fi/attachments/5i5K1R7Jv/2009_1_Market_review.pdf.
[109] Petri Rouvinen & Pekka Yla-Anttila, *Case Study: Little Finland's Transformation to a Wireless Giant*, in Soumitra Dutta, Bruno Lanvin,& Fiona Paua (Eds.), The Global Information Technology Report 2003-2004 (New York: Oxford University Press, 2003).
[110] "The target will be set that by 31 December 2015, an optical fiber or cable network permitting 100-megabit connections shall be available throughout the country according to demand, and that at least 99 percent of permanent residences and permanent offices of businesses and public administration bodies have access, through a fixed or wireless subscriber line of no more than two kilometres' length linked to the said network, to communications services and other information society services that require very high-speed connections." *Id*. at 15. It should be noted, however, that a service providing 100 Mbit/s to within 2 kilometres translates to barely 10 Mbit/s at the premises due to the attenuation of the DSL signal.
[111] *See*, e.g., Simon Nora & Alain Minc, The computerization of society : a report to the President of France (MIT Press, 1980)(translation of L'informatisation de la Société. La documentation française (1978).
[112] "Calling Minitel a proto-internet may be a bit of a stretch, but it is not far off." James Arnold, BBC News, *France's Minitel: 20 Years Young* (May 14, 2003); available at: http://news.bbc.co.uk/2/hi/business/3012769.stm.
[113] Paul Budde Communication Pty Ltd, France - Broadband Market - Overview, Statistics & Forecasts.doc18/10/2009
[114] *France Numérique 2012 – Plan de développement de l'économie numérique, octobre 2008*; available at: http://francenumerique2012.fr/ (French only).
[115] *See* Reuters (Nov 17 2009) "France may inject up to US$6bn in high-tech, fiber", at: http://www.reuters.com/article/idUSLH57553920091117
[116] LTE went live in December 2009 in Stockholm and Oslo, from TeliaSonera. It shows the technology is already in place and potentially ready for other markets, see http://gigaom.com/2009/12/14/teliasonera-lte-4g/
[117] http://www.ericsson.com/ericsson/news/archive/2008/081107_lte.shtml
[118] OECD Broadband Portal, available at: http://www.oecd.org/sti/ict/broadband.
[119] This sharing has been particularly difficult because of the topology of the network NTT rolled out. It is impossible to unbundle one subscriber at a time so competitive operators have to pay for a block of customers at a time. Operators are still complaining that the unbundling process is too expensive since they have to pay for lines to users who don't subscribe just to get one additional subscriber.
[120] "Although Japan is more densely populated than the United States (338 people per square kilometer versus 31 in the United States), it has a lower percentage of urban population (66 percent versus 80 percent). This may explain why Japan's broadband policy continues to focus on providing access to rural areas, which still lag behind urban areas in broadband penetration, particularly in access to fiber." Robert D. Atkinson, Daniel K. Correa and Julie A. Hedlund, The Information Technology & Innovation Foundation, *Explaining International Broadband Leadership*, Appendix D: Japan (2008); available at: http://www.itif.org/files/ExplainingBBLeadership.pdf.
[121] e-Japan strategy in 2001, e-Japan strategy II in 2003, e-Japan strategy II Acceleration Package in 2004, IT Policy Package in 2005, a New IT Reform strategy in 2006 and a Policy Package addition to the New IT Reform strategy in 2007. See Kiyoshi Mori, Vice-Minister for Policy Coordination, Japan Ministry of Internal Affairs and Communications, Qualifying, Quantifying, and Meeting the Challenge of Internet Access Cost—Development of the Access Environment in Japan and Future Policy Themes, (Nov. 12, 2007); available at: www.techpolicyinstitute.org/.../presentation_vm-mori_nov9_withoutnote.ppt; see also, Kiyoshi Mori, ICT Research and Development by MIC, (March 4, 2008); available at: http://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/presentation/pdf/080304_1.pdf.
[122] Government of Japan, Basic Law on the Formation of an Advanced Information and Telecommunications Network Society, Art. 8, (Correction of gaps in opportunities for use, etc.), entered into force on January 6, 2001; available at: http://www.kantei.go.jp/foreign/it/it_basiclaw/it_basiclaw.html; *See also*, *Outline of the First Follow-up of the Action Plan of the Basic Guidelines Toward the Promotion of an Advanced Information and Telecommunications Society* (May 19, 2000); available at: http://www.kantei.go.jp/foreign/it/2000/0706outline.html. *Basic Guidelines toward the Promotion of an Advanced Information and Telecommunications Society* was adopted in 1995 and revised in 1998.
[123] "In order for Japan to remain as the world's top ICT nation as well as maintaining and improving its international competitiveness, it is important to develop human resources with expert knowledge and skills in the fast moving ICT sector. Hence, the Ministry of Internal Affairs and Communications launched the 'Support System for ICT Human Resources Training Programs' in FY2001 to help public and quasi-public corporations provide ICT training programs by subsidizing part of their costs. Since then, 650 ICT training programs have benefited from this system and approx. 22,300 people have received ICT training." Government of Japan, Ministry of Internal Affairs and Communications, Digital Opportunity Site, *Efforts in the education sector*; available at: http://www.dosite.go.jp/e/pj/education.html.
[124] Japan IT strategic Headquarters, *New IT Reform strategy – Realizing Ubiquitous and Universal Network Society Where Everyone Can Enjoy the Benefits of IT* – (January 19, 2006); available at: http://www.kantei.go.jp/foreign/policy/it/IT strategy2006.pdf; *Report by Study Group on Systems in Ubiquitous Network Society* (Sep. 2006); available at: http://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/pdf/ubi_report1.pdf; Government of Japan, *Science and Technology Basic Plan* (March 28, 2006); available at: http://www8.cao.go.jp/cstp/english/basic/3rd-Basic-Plan-rev.pdf; Government of Japan, Long Term strategic Guidelines, *"Innovation 25"* (June 1, 2007); available at: http://www.kantei.go.jp/foreign/innovation/innovation_final.pdf.
[125] *See ICT strategy (Digital divide in Japan)*, Digital Opportunity Web Site; available at: http://www.dosite.go.jp/e/pj/itstr-j.html.
[126] "Emobile has gained 200,000 subscribers, who get 7.2 megabits a second, 100 times as much as [what] Verizon" and other carriers offer U.S. subscribers. Chana R. Schoenberger, *Japan's Fastest Wireless Network*, FORBES.COM (March 24, 2008); available at: http://www.forbes.com/forbes/2008/0324/062.html.

[127] Organization for Economic Co-Operation and Development, Directorate for Science, Technology and Industry, Committee for Information, Computer and Communications Policy, Working Party on Communication Infrastructures and Services Policy, *Mobile Broadband: Pricing and Services*, JT03267481 (June 30, 2009); available at: http://www.oecd.org/dataoecd/26/19/43280727.pdf; *see also*, *Mobile phone calls lowest in Finland, Netherlands and Sweden, says OECD report* (Aug. 11, 2009). available at: http://www.oecd.org/document/20/0,3343,en_2649_34225_43471316_1_1_1_1,00.html.

[128] "Leading Japanese companies are changing the way users access mobile Internet content by using unique mobile device capabilities that directly connect the physical world to the mobile Internet experience. Device features such as cameras that read bar codes and preinstalled applications on phones get users to online content and services. Firms are also experimenting with pushing relevant content to users based on location information. Companies looking to connect with customers via the mobile Internet need to provide multiple paths to their mobile Web sites, allow users to share content, and get customer consent for location-based services." Jonathan Browne, *How Japanese Companies Guide Their Customers To Mobile Internet Experiences Firms Use Embedded Device Capabilities to Improve Mobile Internet Usability* (April 23, 2007); available at: http://www.forrester.com/Research/Document/Excerpt/0,7211,42068,00.html.

[129] Hiroyuki Hishinuma, Director for New Competition Policy, Telecommunications Policy Division, Telecommunications Business Department, Telecommunications Bureau, Ministry of Internal Affairs and Communications, *ICT Policy in Japan -Broadband and Mobile* (April 16, 2009); available at: http://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/presentation/pdf/090416_1.pdf.

[130] Heikki Eskelinen, Lauri Frank and Timo Hirvonen, *Does strategy matter? A comparison of broadband rollout policies in Finland and Sweden*, 32 TELECOMMUNICATIONS POLICY, 412, 420 (2008).

[131] Swedish Post and Telecom Agency (PTS), Press Release, *Mobile broadband and fiber are showing rapid growth in the broadband market* (June 9, 2009); available at: http://www.pts.se/en-gb/News/Press-releases/2009/Mobile-broadband-and-fiber-are-showing-rapid-growth-in-the-broadband-market/.

[132] Swedish Post and Telecom Agency (PTS), Press Release, *The Swedish Telecommunications Market 2008*, PTS-ER-2009:21(June 9, 2009): available at: http://www.pts.se/en-gb/Documents/Reports/Telephony/2009/The-Swedish-Telecommunications-Market-2008---PTS-ER-200921/.

[133] Swedish Post and Telecom Agency (PTS), *Proposed Broadband strategy for Sweden*, PTS-ER-2007:7 (Feb. 15, 2007), summary available at: http://www.pts.se/en-gb/Documents/Reports/Internet/2007/Proposed-Broadband- strategy-for-Sweden---PTS-ER-20077/; [hereinafter cited as Summary of Proposed Broadband strategy for Sweden]; complete document available at: http://www.pts.se/upload/Documents/EN/Proposed_broadband_ strategy_eng.pdf;

[134] "[T]he Swedish government aggressively used subsidies to spur broadband deployment, particularly in rural areas of the country. It allocated a total of more than US$800 million. For the U.S. government to match this investment as a share of GDP, it would need to invest more than US$30 billion." Robert D. Atkinson, Daniel K. Correa & Julie A. Hedlund, The Information Technology & Innovation Foundation, *Explaining International Broadband Leadership*, Executive Summary, available at: http://www.itif.org/index.php?id=142.

[135] "Oftel's long term aim is to achieve a level of competition in broadband markets that will ensure that consumer and business needs can be met in the absence of regulation,.i.e., effective and sustainable competition. There is unlikely to be a "single solution," whereby broadband is delivered using one technology only. Consumer needs vary greatly and the market is best-placed to decide how, and with which technologies, this can best be achieved." Government of the United Kingdom, Office of Telecommunications, *Delivering a competitive broadband market – Oftel's regulatory strategy for broadband* (Dec. 19, 2001); available at: http://www.ofcom.org.uk/static/archive/oftel/publications/broadband/other/stratb1201.htm.

[136] Ofcom acknowledges that "[a]though local loop unbundling (LLU) had been introduced several years previously, it was only in 2005 that it became an attractive alternative to BT's wholesale DSL products for ISPs." Ofcom, *the Communications Market 2008*, Ch. 4, *Telecoms*, 201; available at: http://www.ofcom.org.uk/research/cm/cmr09/CMRMain_4.pdf. The monthly rental cost of an LLU line is currently £1.30 for DSL broadband services and £7.20 for voice and broadband. *Id*.

[137] *See* Openreach, *Keeping the UK Connected*; available at: http://www.openreach.co.uk/orpg/aboutus/Downloads/web_corp_brochure.pdf.

[138] "We are also proposing to remove regulation from parts of the wholesale narrowband market as well as all remaining retail narrowband obligations on BT." Ofcom, *Impact of the strategic Review of Telecoms*, Executive Summary, 1.26 (May 29, 2006); available at: http://www.ofcom.org.uk/telecoms/btundertakings/impact_srt/.

[139] United Kingdom Office of Communications, *Delivering super-fast broadband in the UK Setting the right policy framework*, Public Consultation, 1.12 (Sep. 23, 2008); available at: http://www.ofcom.org.uk/consult/condocs/nga_future_broadband/.

[140] *See* Ofcom, *Mostly Mobile, Ofcom's mobile sector assessment*, Second consultation (July 8, 2009); available at: http://www.ofcom.org.uk/consult/condocs/msa/msa.pdf. *See also*, Application of spectrum liberalisation and trading to the mobile sector, Executive Summary (Feb. 2009). Ofcom proposed to: 1) remove the technology restrictions that currently apply to these bands: in the first instance to allow 3G (UMTS) technology to be used in the 900 MHz and 1800 MHz bands; in the longer term to allow any technology that will not cause harmful interference to neighbouring users to be deployed in both these bands and the 2.1GHz band; 2) allow spectrum in these bands to be traded, so that those who can make best use of this spectrum have the opportunity to gain access to it through commercial negotiation, rather than regulatory intervention; 3) require the current holders of the 900 MHz spectrum (Vodafone and O2) each to give up a proportion of the 900 MHz spectrum they currently hold (2 x 2.5MHz each, out of a current total of 2 x 17.4MHz each) to allow a third operator to have access to this particularly important spectrum; and 4) review the level of Administered Incentive Pricing (AIP) applying to the 900 MHz and 1800 MHz spectrum so that in future it reflects the full economic value of this spectrum post liberalization, so as to encourage its efficient use.

[141] *See, e.g.*, Milton L. Mueller, *Universal Service Competition, Interconnection, and Monopoly in the Making of the American Telephone System* (American Enterprise Inst. Press 1997)(reporting on the long history of carrier and government efforts to promote universal service). In 1996, The U.S. Congress amended the Communications Act of 1934, as amended, to require the Federal Communications Commission to encourage the deployment, on a reasonable and timely basis, of advanced telecommunications capability to all Americans and to initiate a notice of inquiry to determine the availability of such services. Telecommunications Act of 1996, Sec. 706, Advanced Telecommunications Incentives, P.L. 104-104, 110 Stat. 56 (1996) *codified at* 47 U.S.C. §706 (2008).

[142] The American Recovery and Reinvestment Act of 2009 allocates US$4.7 billion to the National Telecommunications and Information Administration ("NTIA") and US$2.5 billion to the Agriculture Department's Rural Utilities Service ("RUS") program to encourage investment in, and use of, broadband services by awarding grants, loans or loan guarantees.

[18] Federal Communications Commission, Industry Analysis and Technology Division Wireline Competition Bureau, High-Speed Services for Internet Access: *Status as of June 30, 2008* (July 2009); available at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-292191A1.pdf.
[144] Verizon has committed US$18 billion for its national fiber optic network, spent about US$5 billion acquire spectrum and is now expecting to spend close to US$2 billion on the rollout of an associated LTE network. http://gigaom.com/2009/10/05/verizon-spearheads-effort-to-pour-1-3b-into-lte/; http://gigaom.com/2008/03/20/verizon-and-att-score-in-700mhz-auction/; http://www.lightreading.com/document.asp?doc_id=104704
[145] "[T]here is substantial competition in the provision of Internet access services." AT&T Inc. and BellSouth Corp., Application for Transfer of Control, Memorandum Opinion and Order, 22 FCC Rcd. 5662, 5724-25 (2007). In 2008 the FCC stated that "advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion." Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, Fifth Report, 23 FCC Rcd 9615, 9616 (2008); available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-08-88A1.pdf. On the other hand, the Organization for Economic Co-Operation and Development ranks the United States 15th among OECD nations in market penetration per 100 inhabitants. OECD, Broadband Statistics, Table 1d, OECD Broadband subscribers per 100 inhabitants, by technology, December 2008 (2009): available at: http://www.oecd.org/document/54/0,3343,en_2649_34225_38690102_1_1_1_1,00.html. The Information Technology & Innovation Foundation, 2008 ITIF Broadband Rankings also place the United States in the 15th position; see http://www.itif.org/files/2008BBRankings.pdf. See also, S. Derek Turner, free press, 'Shooting the Messenger' Myth vs. Reality: U.S. Broadband Policy and International Broadband Rankings(July, 2007); available at: http://www.freepress.net/files/shooting_the_messenger.pdf; Presentation of Dr Tim Kelly, Lead ICT Policy Specialist, infoDev/World Bank, FCC Workshop: International lessons (Aug. 18, 2009); available at: http://www.broadband.gov/docs/ws_int_lessons/ws_int_lessons_kelly.pdf.
[146] Communication Workers of America, Speed Matters: Affordable high speed Internet for all, October 2006, available at http://files.cwa-union.org/speedmatters/SpeedMattersCWAPositionPaper.pdf
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[151] World Economic Forum, available at: http://www.weforum.org/en/initiatives/gcp/Global%20Information%20Technology%20Report/index.htm
[152] Nokia-Siemens Networks, Connectivity Scorecard, available at: http://www.connectivityscorecard.org/images/uploads/media/TheConnectivityReport2009.pdf
[153] OECD, *Broadband Growth and Policies in OECD countries*, 2008, p. 12.
[154] See: http://www.culture.gov.uk/what_we_do/broadcasting/5631.aspx/.
[155] See Kelly, Tim (2009) "International Broadband Benchmarks" and other papers presented at the FCC workshop on "International lessons for broadband policy", 18 August 2009, available at: http://www.broadband.gov/ws_int_lessons.html.
[156] The American Recovery and Reinvestment Act of 2009 (Recovery Act) was signed into law by President Obama on February 17th, 2009. The U.S. Federal Communications Commission (FCC) is currently working in coordination with the National Telecommunications and Information Administration (NTIA) to perform the FCC's role under the Recovery Act. Specifically, in conjunction with the Broadband Technology Opportunities Program established by the Act, the FCC has been tasked with creating a National Broadband Plan by February 17, 2010. The Recovery Act states that the National Broadband Plan shall seek to ensure all people of the United States have access to broadband capability and shall establish benchmarks for meeting that goal. See http://www.broadband.gov/index.html
[157] ITU. Note: Broadband is defined as speeds equal to or in excess of 256 kbit/s
[158] http://wirelessfuture.newamerica.net/publications/policy/100_megabits_or_bust
[159] http://gigaom.com/2009/02/01/by-2012-koreans-will-get-a-gigabit-per-second-broadband-connection/
[160] FCC recently upgraded its baseline definition of broadband from 200 kbps to 786 kbps in one direction.
[161] See, for example, ITU *Broadband Korea: Internet Case Study*, 2003
[162] Broadband for Africa, Policy for Promoting the Development of Backbone Networks, World Bank 2008
[163] Explaining International Broadband Leadership, Robert D. Atkinson, Daniel K. Correa, Julie A. Hedlund, The Information Technology and Innovation Foundation, May 2008
[164] See OECD (2008) *Broadband Growth and Policies in OECD Countries*
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[175] Pyramid Research, *The Next Billion: How Emerging Markets Are Shaping the Mobile Industry*, October 2007, p. 33

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[177] PCWorld, China offers computers subsidy for farmers, March 5, 2009, available at: http://www.pcworld.com/businesscenter/article/160750/china_offers_computer_subsidy_for_farmers.html; Babnet Tunisie. 2005. "Ordinateur familial: Rude et...douloureuse sera la concurrence." Available at http://www.babnet.net/cadredetail.asp?id=2549. Accessed July 2005.; and Serene Zawaydeh. 2003. "Tunisia Internet & Datacomm Landscape Report." Arab Advisors Group, Strategic Research Service: Amman, Jordan.
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[182] Marin Fransman, Global Broadband Battles: Why the US and Europe Lag While Asia Leads, pp. 28-32; 'Disruptive competitors' means newly entered operators that are so aggressive with their pricing that they do not cover their costs and end up making short-run losses.
[183] Navas-Sabatier, Juan, Dymond, Andrew and Niina Juntunen, Telecommunications and Information Services for the Poor, The World Bank, 2002
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