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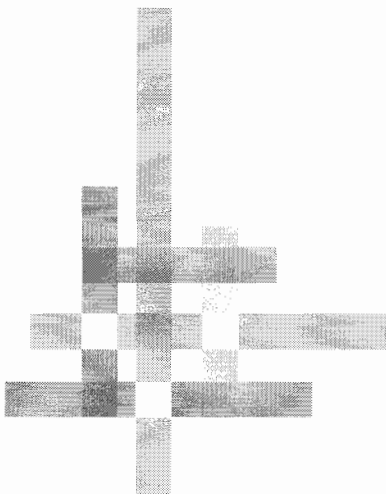
OVERVIEW

# Broadband Strategies Handbook

Tim Kelly and Carlo Maria Rossotto  
*Editors*



THE WORLD BANK



# Overview Broadband Strategies Handbook

## Editors

Tim Kelly and Carlo Maria Rossotto

Coordinated by Telecommunications Management  
Group, Inc.



**THE WORLD BANK**  
Washington, D.C.



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Innovate. Connect. Transform.

This booklet contains the Executive Summary and the introduction of chapter 1 as well as a list of contents from the forthcoming book, *Broadband Strategies Handbook*.

To order copies of the full-length book, published by the World Bank, please use the form at the back of this booklet. The report is also available online at [www.infodev.org/broadband](http://www.infodev.org/broadband).

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**The manuscript for this overview edition disseminates the findings of work in progress to encourage the exchange of ideas about development issues. The text is not final and is not for citation.**

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## FOREWORD

The world is shifting from narrowband to broadband. Services that were only available in the form of static, text-based websites 10 years ago are now offered in full-motion, high-definition video. Usage-based transmission prices that were once prohibitive are now bundled into an affordable monthly “all you can eat” charge. A decade after the dot.com bubble burst because network realities had not yet caught up with user aspirations, a whole new generation of Internet entrepreneurs is ready to take their ideas to the stock market.

Nevertheless, a gap remains between the developed and the developing world when it comes to broadband. For instance, not a single one of the top 10 economies by average broadband speed is in the Southern Hemisphere. The digital divide that was once measured in terms of differences in *access* to communications is now measured in terms of differences in *quality* of access. Slow speeds for download translate into lost economic opportunity. Yet the evidence seems to suggest that, where broadband is available in developing countries, it is a major contributor to economic growth. For instance, a 10 percent increase in the penetration rate of broadband in developing countries is associated with a 1.4 percent increase in gross domestic product (GDP) per capita, higher than the equivalent relationship for developed countries. The developing world has adopted mobile phones much more readily than tethered ones, so as mobile broadband becomes more readily available, a further boost to growth can be expected.

A decade ago, *infoDev* and the World Bank’s Information and Communication Technology (ICT) Sector Unit joined forces with the International Telecommunication Union (ITU) to develop a handbook for regulators around the world on basic principles of telecommunication regulation. The *Telecommunication Regulation Handbook* subsequently became a bestseller and was updated and reissued in 2010. It formed the

basis for the ICT Regulation Toolkit (<http://www.ictregulationtoolkit.org>), which now delivers around 1,000 downloads daily.

This new *Broadband Strategies Handbook* is intended as a next-generation tool for policy makers, regulators, and other relevant stakeholders as they address issues related to broadband development. It aims to help readers, particularly those in developing countries, by identifying issues and challenges in broadband development, analyzing potential solutions to consider, and providing practical examples from countries that have addressed broadband-related matters. It goes beyond the regulatory issues and looks more broadly at the challenges of promoting and universalizing broadband access. It will also form the basis for a toolkit—<http://www.broadband-toolkit.org>—that will complement the other toolkits and technical assistance guides available from the World Bank Group.

This new handbook has been made possible through the generous funding of the Korea Trust Fund for ICT for Development. We hope that it will meet the requirements of developing-country policy makers and regulators for sound advice on developing national strategies for broadband. But we also hope that it will provide incentives for users to share their own experiences, via the toolkit website, of what works well. Consider this handbook, then, as a living resource that will grow as the broadband market worldwide grows.

Valerie D'Costa  
Program Manager  
*infoDev*

Philippe Dongier  
Sector Manager  
ICT Sector Unit



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This handbook, case studies, and other reports have been generously funded by the Korean Trust Fund (KTF) on Information and Communication Technology for Development (ICT4D). The KTF is a partnership between the government of Korea and the World Bank. Its purpose is to advance the ICT4D agenda, with the goal of contributing to growth and reducing poverty in developing countries. The report has also benefited from funding from the U.K. Department for International Development. The handbook is part of a longer-term project to create a broadband toolkit (see <http://www.broadband-toolkit.org>), an online resource for regulators and policy makers. Future updates of the handbook, as well as the full text of the case studies, practice notes, indicators, and training materials will be posted there.

The authors retain sole responsibility for any residual errors.



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## ABOUT THE AUTHORS

This report was prepared and input documents were coordinated by Telecommunications Management Group, Inc. (TMG). TMG is a telecommunications and information technology consulting firm providing regulatory, policy, economic, technical, and financial advice. Established in 1992, TMG is composed of a team of regulatory experts, lawyers, economists, market analysts, business development and investment specialists, engineers, and spectrum management specialists.

TMG advises public and private sector clients on issues related to information and communication technology (ICT) and provides assistance to regulators and policy makers on regulatory and policy reform matters. TMG has advised more than 60 countries on regulatory reform issues in Africa, Latin America and the Caribbean, Asia, Europe, and the Middle East. In addition, TMG has worked on regulatory matters with international and regional organizations involved in ICT issues.

The TMG team that worked on this project includes Flavia Alves, Kari Ballot-Lena, Jeff Bernstein, Joel Garcia, Janet Hernandez, Daniel Leza, Sofie Maddens-Toscano, Jorge Moyano, William Wiegand, David Wye, and Amy Zirkle as well as outside consultants Michael Minges, Calvin Monson, and Bjorn Wellenius.







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## EXECUTIVE SUMMARY

The *Broadband Strategies Handbook* is a guide for policy makers, regulators, and other relevant stakeholders as they address issues related to broadband development. It aims to help readers, particularly those in developing countries, by identifying issues and challenges in broadband development, analyzing potential solutions to consider, and providing practical examples from countries that have addressed broadband-related matters.

The handbook consists of seven chapters and two appendixes that look at how broadband is defined, why it is important, and how its development can be encouraged. Throughout the handbook, broadband is viewed as an *ecosystem* consisting of supply and demand components, both of which are equally important if the expansion of broadband networks and services is to be successful. In addressing the challenges and opportunities that broadband gives rise to, the handbook discusses the policies and strategies that government officials and others should consider when developing broadband plans, including what legal and regulatory issues to address, what broadband technologies to choose, how to facilitate universal broadband access, and how to generate demand for broadband services and applications.

Chapter 1, “Building Broadband,” introduces the concepts of broadband by defining the term “broadband” more conventionally (that is, speed or functionality) as well as explaining how this handbook seeks to define the term as broadband comes to be seen as an enabling platform. This chapter examines why broadband, both as an information and communication technology (ICT) and as an enabling platform, is important and focuses on how it can help to transform a country’s economic development and improve employment growth, provided that effective policies are put in place that encourage the use of broadband as an essential input by all sectors of the economy. Chapter 1 also identifies the main trends fostering the deployment of broadband networks (supply side) and

the adoption of broadband services and applications (demand side). Lastly, this chapter offers a framework—the broadband ecosystem—to assist policy makers and stakeholders in viewing broadband policies in a more holistic manner and as a means to ensure the greatest impact throughout the economy and society.

Chapter 2, “Policy Approaches to Promoting Broadband Development,” identifies the issues that governments and the private sector will face when developing policies and programs to support broadband development. It discusses policies and strategies for promoting the build-out of broadband networks as well as ways to encourage the use of broadband services and applications, particularly in populations that may have limited knowledge of or interest in broadband. In that context, the impacts of broadband on other sectors (education, health, banking, environment, and cybersecurity) are discussed. The chapter also addresses the options for funding broadband development strategies and identifies the issues associated with measuring the effectiveness of policies designed to promote network build-out and user demand.

Chapter 3, “Law and Regulation in a Broadband World,” discusses the key policies and regulatory trends that policy makers and regulators are considering to foster broadband. As the world moves to a converged ICT environment, countries are reforming their traditional legal and regulatory frameworks and developing new laws and regulations to address some of the supply and demand issues associated with broadband development. This chapter covers a wide range of policy issues, including liberalization of licensing frameworks, spectrum management policies to maximize wireless broadband, Internet Protocol (IP) interconnection regulation, policies to promote competition in the various segments of the broadband supply chain, vertical integration in a converged environment, network neutrality, cybersecurity and data protection, and regulation of online content.

Chapter 4, “Extending Universal Broadband Access and Use,” discusses what roles governments should play in promoting universal broadband access when market mechanisms do not meet goals for broadband access and use on their own. The chapter seeks to define a broadband development strategy capable of addressing market failures, to provide an overview of what policy makers can do to address perceived shortfalls in the market, and to work toward achieving universal broadband service. It discusses the universal service objectives that a government strategy may pursue, the role of private-led competitive markets in achieving these objectives, the role of the government in narrowing or eliminating gaps between markets and the country’s development needs, and how effective government strategies can be designed to meet such challenges. It finally examines the use of fiscal

resources to support private supply of broadband, including the choice of instruments, use of subsidies, and use of different mechanisms to collect and disburse funds for subsidies.

Chapter 5, “Technologies to Support Deployment of Broadband Infrastructure,” focuses on the supply side of the broadband ecosystem. It describes the various wireline and wireless technologies now being used to build out broadband infrastructure, including examples of broadband deployments throughout the world. The objective of the chapter is to provide policy makers with an overview of how broadband networks work and their components. It describes the broadband supply chain from a topological perspective, starting from international connectivity and progressing to regional, national, and, finally, local access deployment solutions. It describes the technologies being deployed in each of these segments, including fiber optics, satellite, microwave, mobile wireless, and traditional copper wire. Finally, chapter 5 addresses some of the implementation issues associated with these technologies, including open access, quality of service, and spectrum constraints.

Chapter 6, “Driving Demand for Broadband Networks and Services,” recognizes that, although supply-side issues are important, simply building networks does not guarantee that they will be used or used most effectively. This chapter thus focuses on the issue of demand facilitation: what government and the private sector can do to spur the use and adoption of broadband networks and services by consumers. In particular, this chapter identifies various policies that may be implemented where demand is stifled because consumers are not aware of the benefits of broadband, broadband is not affordable, or broadband is not attractive or relevant to them. This chapter also highlights the importance of public-private cooperation to facilitate demand and increase broadband access to a wider number of users worldwide.

Chapter 7, “Global Footprints: Stories from and for the Developing World,” addresses the main challenges that developing countries face in deploying broadband networks, including underdeveloped infrastructure, low income, significant differences between rural and urban areas, constrained inter- and intra-modal competition, and weakness of regulatory and legal frameworks. This chapter assesses the broadband bottlenecks and opportunities found in developing countries and discusses the importance of improving broadband infrastructure and leveraging existing infrastructure to create greater competition in the broadband market. Chapter 7 further highlights the status of broadband development in different developing regions around the world and summarizes broadband experiences in Brazil, Kenya, Morocco, St. Kitts and Nevis, Sri Lanka, Turkey, and Vietnam.





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## CHAPTER 1

# Building Broadband

In just the past decade, the world of information and communication technology (ICT) has changed dramatically, evolving from a means by which information can quickly travel from point to point into an enabling platform for countless new and expanded personal, social, business, and political uses. In short, the Internet has become an integral part of people's lives. Consumers can use broadband networks to access the Internet at speeds up to or exceeding 100 megabits per second (Mbit/s) over wired connections in their homes and offices, and they can use their broadband-enabled mobile phones and other devices for a wide range of activities, including surfing the World Wide Web, engaging in two-way real-time video chats, purchasing goods and services online, streaming video or music, and conducting financial transactions.

But broadband is not just about improving the speed at which users can read online news, play video games, and engage in social networking, although these are useful drivers of demand and do provide benefits to users. It is also an enabling platform that allows developers and individual users to enhance existing services and to develop previously unimaginable tools that improve business and society. The benefits of broadband can expand beyond the ICT sector itself, reverberating throughout the economy and serving as an essential input for all other sectors, including education,

health, transportation, energy, and finance. Its role as a transformative technology is similar to the impact that electricity has had on productivity, growth, and innovation over the last two centuries, with the potential to redefine how economies function. Broadband can also be a critical enabler of civic and political engagement and the exercise of fundamental rights such as freedom of expression and opinion. However, in order to achieve broadband's full potential, its reach must be expanded in both developing and developed economies. Governments must implement effective policies that spur construction of broadband networks as well as encourage the uptake of broadband services in all sectors of the economy.

The rollout of broadband requires significant investment from the private sector as well as support from the public sector. It also requires a long-term perspective because the benefits of broadband will not occur overnight. For developing countries with limited resources, it may be difficult to focus on broadband when many of their communities do not have schools for children, safe drinking water, or access to hospitals and health care. However, broadband offers countries an enabling platform and new tools to foster growth, extend public services, enhance businesses, and benefit their people. Making broadband a priority within a country's development agenda will be necessary to ensure that the digital divide between developed and developing countries does not extend further. In crafting a broadband strategy, however, countries should ensure that the use of public funds is supported by sound economic analysis and that the benefits of investing in broadband are weighed against the benefits of investing in other areas, such as energy, health, or education. Market-based solutions for the deployment and uptake of broadband are generally preferable to government investment in order to avoid straining public finances.

This first chapter of the handbook is designed to "set the stage" for the discussion in subsequent chapters of the various ways in which government policy makers and the private sector can promote greater deployment of broadband networks and services, particularly in developing countries. It first describes what broadband is and how it may be defined. Next, it explains why broadband is important by identifying how it contributes to the growth and development of a country's economy, noting, in particular, the findings of several studies pointing to broadband's impact on gross domestic product (GDP) and employment. Then, it considers the trends that characterize the development of broadband. Lastly, this chapter addresses the approaches that governments can use to support the development of broadband, by focusing on both the deployment of broadband networks (supply-side approaches) and the adoption of broadband services and applications (demand-side approaches). Overall, this chapter seeks to

demonstrate that broadband can enable growth and productivity throughout the economy, provided that appropriate and specific policies are designed, developed, and effectively implemented.

## **What Is Broadband?**

Despite its worldwide growth and promotion by policy makers, network operators, and content providers, broadband does not have a single, standardized definition. The term “broadband” may refer to multiple aspects of the network and services, including (a) the infrastructure or “pipes” used to deliver services to users, (b) high-speed access to the Internet, and (c) the services and applications available via broadband networks, such as Internet Protocol television (IPTV) and voice services that may be bundled in a “triple-play” package with broadband Internet access. Further, many countries have established definitions of broadband based on speed, typically in Mbit/s or kilobits per second (kbit/s), or on the types of services and applications that can be used over a broadband network (that is, functionality). Due to each country’s unique needs and history, including economic, geographic, and regulatory factors, definitions of broadband vary widely.

Traditionally, however, broadband has often been defined in terms of data transmission speed (that is, the amount of data that can be transmitted across a network connection in a given period of time, typically one second, also known as the data transfer rate or throughput). Defining broadband in terms of speed has been an important element in understanding broadband, particularly since the data transfer rate determines whether users are able to access basic or more advanced types of content, services, and applications over the Internet.

However, attempts to define broadband in terms of speed present certain limitations. First, broadband speed definitions vary among countries and international organizations, generally ranging from download data transfer rates of at least 256 kbit/s on the low end, as in India, South Africa, the International Telecommunication Union (ITU), and the Organisation for Economic Co-operation and Development (OECD), to faster than 1.5 Mbit/s on the high end, as in Canada (see ITU 2009, 22). Second, definitions based on speed may not keep pace with technological advances or with the speeds, services, and applications required for the application to function properly. In other words, what is considered “broadband” today may be regarded as too slow in the future, as more advanced applications technologies are developed. Thus, any speed-based definition of broadband will need to be updated over time. Third, such definitions may not reflect the speeds realized by end



users, so the speeds advertised by commercial broadband providers may be much higher than the speeds set by the government as broadband or vice versa. For example, while Colombia's broadband speed definition is 1 Mbit/s, its average broadband connection speed is already 1.8 Mbit/s.

Due to the limitations of definitions based on speed, some countries (Brazil) and international organizations (the OECD) have decided or proposed not to categorize broadband in terms of speed, but are instead looking at broadband in terms of functionality, focusing on what can and cannot be done with a certain type of connection.<sup>1</sup> However, establishing a definition of broadband based only on functionality may make the term overly subjective. A legal definition of broadband Internet access based on speed is easy to apply: if broadband is defined as at least 1.5 Mbit/s of download speed, then a 2 Mbit/s connection is broadband, while a 1 Mbit/s connection is not. When broadband is defined in terms of functionality, the distinction between what is and is not broadband becomes less straightforward. Is being able to watch a YouTube video equivalent to having a broadband connection? What if it takes minutes to buffer and starts and stops throughout?

In considering what broadband is and how it should be defined, this chapter and the handbook as a whole view broadband more holistically as a high-capacity ICT platform that improves the variety, utility, and value of services and applications offered by a wide range of providers, to the benefit of users, society, and multiple sectors of the economy. From a policy perspective, broadband should be viewed more broadly as an enabling ICT platform that can potentially influence the entire economy and thus may act as a general-purpose technology (GPT) that is used as a key input across sectors. To capture the full range of potential benefits, policy makers may find it useful to consider broadband as an ecosystem comprising both supply-side considerations (network platforms) and demand-side considerations (e-government initiatives, development of services and applications, promotion of broadband use). To encourage the diffusion of broadband-enabled innovations throughout the economy, policy makers should also consider the absorptive capacity of various sectors, including health, education, energy, and transportation. Unless all of these elements—supply, demand, and absorptive capacity—are coordinated, broadband's impact on the economy as a whole will be constrained.

## **Why Is Broadband Important?**

With the appropriate policies in place, broadband is a transformative platform that affects the ICT sector as well as other sectors of the economy.

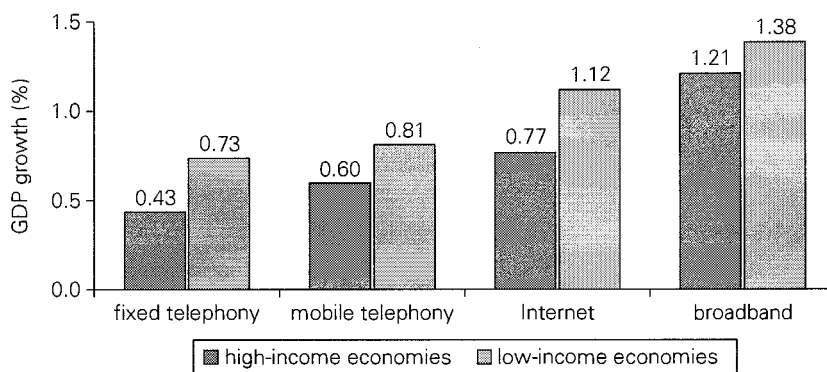
While some may disagree on the precise economic and social benefits that can be specifically attributed to broadband and may challenge the studies that have found a large impact, few can argue against the fact that broadband has dramatically changed our personal lives, our businesses, and our economies. Moreover, as an enabling ICT platform and potential GPT, broadband can facilitate growth and innovation in the ICT sector and throughout the economy, serving as a vital input for each sector that strengthens the economy as a whole. The multiplier effect of broadband can drive GDP, productivity, and employment growth; however, policies that support the supply and demand elements of the ecosystem as well as the absorptive capacity to learn and incorporate broadband capabilities into other sectors must all be in place in order to realize such benefits.

### **Impact of Broadband on Gross Domestic Product**

Due to their potentially wide-ranging impacts and ability to provide easier access to information that increases efficiencies and productivity in the economy, it is unsurprising that increased use of broadband networks and services has been found to produce positive outcomes that reverberate throughout a country, particularly involving GDP. A frequently cited World Bank study found that low-income and middle-income countries experienced “about a 1.38 percentage point increase in GDP for each 10 percent increase in broadband penetration” between 2000 and 2006 (Qiang and Rossotto 2009, 45; see also Kim, Kelly, and Raja 2010). This study further found that the development impact of broadband is greater in emerging economies than in high-income countries, which “enjoyed a 1.21 percentage point increase in per capita GDP growth” for each 10 percent increase in broadband penetration. The study also demonstrated that broadband has a potentially larger growth effect than other ICTs, including wireline telephony, mobile telephony, and the Internet, as shown in figure 1.1. Broadband’s predominance may be unexpected considering that, over the last decade, mobile telephony has been the fastest-growing ICT worldwide, with a global penetration rate in 2010 of 76.2 for every 100 persons.<sup>2</sup>

Other studies support the World Bank findings. Management consulting firm McKinsey and Company estimated 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” (Buttkereit et al. 2009). Additionally, a study of OECD countries by consulting firm Booz & Company found, among high-income countries, a strong correlation between average annual GDP growth and broadband penetration, wherein “countries in the top tier of broadband penetration have also exhibited 2 percent higher

**Figure 1.1 Effect of Various Information and Communication Technologies on GDP Growth in High- and Low-Income Economies, 2000–06**



Source: Adapted from Qiang and Rossotto 2009, 45.

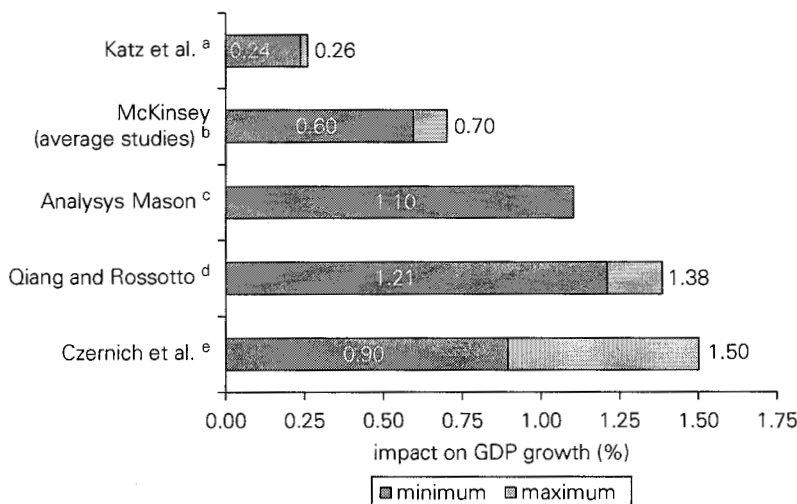
Note: Measures the percentage point increase in gross domestic product that is associated with a 10 percent increase in different information and communication technologies.

GDP growth than countries in the bottom tier of broadband penetration” (Friedrich et al. 2009, 4).

Although numerous studies have found a positive impact of broadband on economic growth, the estimate of its actual magnitude varies. For example, a 10 percent increase in broadband penetration has been found to increase economic growth from a low of range of 0.24 percent to a high of 1.50 percent (figure 1.2).

While these studies provide important insight into the growth effects of broadband, data collection and further systematic research and analysis in this area are needed, particularly for developing countries. Currently, there is ample anecdotal evidence of the effects of broadband on economic growth, with some cases highlighted in box 1.1. However, these cases provide only limited evidence of the impact that broadband has on the economy as a whole. It is also important to note that investment in broadband or policies fostering its deployment or adoption are unlikely to produce significant GDP gains without complementary investments or policies in other sectors, notably education, innovation, civic participation, and health care. However, even with the implementation of appropriate policies, the impacts of broadband on growth in certain areas may be limited. For example, in seeking to improve health outcomes developing countries may be in less need of high-tech, expensive telemedicine and more in need of low-tech, inexpensive solutions, such as mosquito nets and deworming pills (Kenny 2011).

**Figure 1.2 Estimated Minimum and Maximum Impact on Gross Domestic Product of a 10 Percent Increase in Broadband Penetration**



Sources: Czernich et al. 2009; Qiang and Rossotto 2009; Analysys Mason 2010; Beardsley et al. 2010; Katz et al. 2010.

a. Includes only Germany.

b. Average of five country studies: Australia, the Arab Republic of Egypt, Malaysia, New Zealand, and the United Kingdom; various sources for 2003 and 2004 and Qiang and Rossotto for 2009.

c. Limited to mobile broadband impact in India.

d. Various countries; upper range applies to developing countries, and lower range applies to developed countries.

e. Sample of 20 OECD countries.

### Box 1.1: Examples of Broadband's Effects on Economic Growth around the World

The following examples highlight how broadband has improved economic outcomes in countries at all levels of development, as well as how different countries are working to improve broadband penetration rates.

**Canada.** Over the last several years, broadband access studies in Canada have focused on the importance of broadband for economic

growth and development, particularly in rural areas. In 2005, for example, Industry Canada commissioned a survey to be conducted in the rural areas of British Columbia regarding subscribers' views of the significance of broadband access. More than 90 percent of all business respondents reported that their businesses would be negatively affected if

*continued*

### Box 3.1 continued

they did not have broadband access, and over 55 percent stated that they would not be able to operate their businesses without broadband. Additionally, 62 percent of business owners reported that broadband increased productivity to some extent, with a majority stating that broadband increased productivity by over 50 percent.

**China** Between 2010 and 2013, China's network operators—China Unicom, China Telecom, and China Mobile—are expected to invest an estimated ¥ 62 billion (US\$5 billion) in the creation of a single wireless broadband access network, providing speeds of 1 Mbps or more. These investments will be necessary considering that the number of wireless broadband subscribers in China is expected to reach 182 million by 2013, which represents growth of nearly 77 percent between 2010 and 2013. Set against these figures, the impact of broadband on China's GDP is anticipated to be substantial. Dial-up and broadband Internet together is expected to contribute a combined 2.5 percent to GDP growth for every 10 percent increase in penetration.

**India** A study released by Analysys Mason in December 2010 on the deployment of wireless broadband in India found that each percentage point increase in mobile broadband penetration could increase India's GDP by 0.11 percent by 2015, which would yield Rs 162 billion (US\$3.8 billion). The study

breaks down the impact on GDP based on direct contributions (revenues from services and devices), second-order contributions (revenues or cost savings from increased worker productivity), and ecosystem contributions (revenues from value added and other services enabled by wireless broadband).

**South Africa** In July 2010, the South African government issued the Broadband Policy for South Africa. The policy provides that, by 2013, 15 percent of the country's households will have direct access to broadband of at least 256 kbps download speed, with broadband reaching within 2 kilometers of the remaining households. A 2010 study by Analysys Mason reviewed the likely direct and indirect effects that the broadband policy might have on South Africa's economy, finding that wireless broadband is expected to increase the country's GDP by 1.8 percent—over R 72 billion (US\$8.4 billion)—by 2015. In addition, wireless broadband is expected to create about 28,000 new jobs directly, not including jobs created outside the communications industry. As a result, the direct effect of wireless broadband alone (that is, spending on broadband services and broadband-enabled devices) is expected to increase the GDP of South Africa by 0.71 percent by 2015, or R 28.5 billion (US\$3.7 billion). However, the biggest impact on GDP is expected to come from productivity and efficiency gains.

Sources: Zlati, Schmitt, and Qian 2009; Zhao and Yuan 2010; Analysys Mason 2010; South African Department of Communications 2010.

Additionally, despite providing a new educational resource, broadband can also create a new distraction if careful controls are not in place that limit Internet access to nonacademic sites such as Facebook, YouTube, and file-sharing websites (Belo, Ferreiray, and Telangz 2010).

## Broadband, Employment, and Job Creation

Broadband enables job creation through three main channels: (1) direct jobs created to deploy the broadband infrastructure, (2) indirect and induced jobs created from this activity, and (3) additional jobs created as a result of broadband network externalities and spillovers (Katz 2009). Each of these channels focuses on a different type of jobs: unskilled, skilled, and highly skilled. Direct jobs relate primarily to civil works and construction of broadband infrastructure, which involve more low-tech positions. Indirect and induced jobs require various levels of skilled workers. However, network-effects (that is, spillover) jobs are mainly high-skill jobs requiring specific technical knowledge and education. Indeed, broadband spillover employment effects are not uniform. Instead, they tend to concentrate in service industries, such as financial services or health care. Broadband can also produce some effects in middle-skill jobs, such as in manufacturing, usually related to the use of ICT and requiring ICT skills.

Numerous studies have estimated the impact of broadband on job creation in specific countries by calculating employment multipliers for each of these job creation categories (table 1.1). While these studies are country specific and cannot be applied directly to other nations, they provide an estimate of the potential employment gains that could result from effective broadband development, which is between 2.5 and 4.0 additional jobs for each broadband job. Some studies have estimated the impact of broadband

**Table 1.1 Estimated Broadband Employment Creation Multipliers in Various Countries**

Study	Scope	Type I	Type II	Network effects
Crandall, Jackson, and Singer 2003	United States	—	2.17	—
Katz, Zenhäusern, and Suter 2008	Switzerland	1.40	—	—
Atkinson, Castro, and Ezell 2009	United States	—	3.60	1.17
Katz and Suter 2009	United States	1.83	3.43	—
Libenau et al. 2009	United Kingdom	—	2.76	—
Katz et al. 2009	Germany	1.45	1.93	—
Average		1.56	2.78	1.17

Sources: Katz 2009, citing Crandall, Jackson, and Singer 2003; Katz, Zenhäusern, and Suter 2008; Atkinson, Castro, and Ezell 2009; Katz and Suter 2009; Libenau et al. 2009; Katz et al. 2009.

Note: Type I = (direct + indirect) / direct; type II = (direct + indirect + induced) / direct; — = not available.

on the employment creation rate. For instance, Katz (2009) estimated that an increase of about 8 percentage points in broadband penetration in 12 Latin American countries could result in an increase of almost 8 percent on average in their employment rate.<sup>3</sup>

As with broadband's effects on GDP, further data collection and analysis are needed to confirm the positive impact that broadband has on employment growth. Aside from the studies identified in table 1.1, some researchers have reported anecdotal evidence of how broadband development has stimulated the job market, including in the European Union (EU), Brazil, Malaysia, and the United States.

- In the EU, a study estimated that broadband could create more than 2 million jobs throughout Europe by 2015 and result in an increase in GDP of at least €636 billion (Fornfeld, Delaunay, and Elixmann 2008, 6).
- In Brazil, broadband was found to add up to 1.4 percent to the employment growth rate (Broadband Commission for Digital Development 2010, 15).
- In Malaysia, the Malaysian Communications and Multimedia Commission (MCMC) estimated in 2008 that achieving 50 percent broadband penetration by 2010 could create 135,000 new jobs in the country.<sup>4</sup> The MCMC further projected that the number of jobs created would reach 329,000 by 2022, based on a broadband penetration rate of 50 percent.
- Overall, an evaluation of multiple studies showed that, for every 1,000 additional broadband users, approximately 80 new jobs are created (Almqvist 2010).
- In the United States, a nationwide study examined how broadband deployment affects job creation, determining that availability of broadband at the community level adds more than 1 percent to employment growth (Katz and Avila 2010, 3).

Additionally, although broadband is likely to have overall positive effects on job growth, short-term job losses may result from broadband-enabled improvements in productivity due to process optimization and capital-labor substitution. However, countries have confirmed that broadband creates many more jobs than it displaces in the longer term. For example, a study commissioned by the European Commission found a positive impact on employment in 2006, with net creation of 105,000 jobs throughout Europe due to broadband deployment.





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