



# Building Broadband

STRATEGIES AND POLICIES FOR  
THE DEVELOPING WORLD

Yongsoo Kim  
Tim Kelly  
Siddhartha Raja



THE WORLD BANK



# Building Broadband



# Building Broadband

STRATEGIES AND POLICIES FOR  
THE DEVELOPING WORLD

Yongsoo Kim  
Tim Kelly  
Siddhartha Raja



THE WORLD BANK  
Washington, D.C.

© 2010 The International Bank for Reconstruction and Development / The World Bank  
1818 H Street, NW  
Washington, DC 20433  
Telephone: 202-473-1000  
Internet: [www.worldbank.org](http://www.worldbank.org)  
E-mail: [feedback@worldbank.org](mailto:feedback@worldbank.org)

All rights reserved

1 2 3 4 13 12 11 10

This volume is a product of the staff of the International Bank for Reconstruction and Development / The World Bank. The findings, interpretations, and conclusions expressed in this volume do not necessarily reflect the views of the Executive Directors of The World Bank or the governments they represent.

The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgement on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

#### **Rights and Permissions**

The material in this publication is copyrighted. Copying and/or transmitting portions or all of this work without permission may be a violation of applicable law. The International Bank for Reconstruction and Development / The World Bank encourages dissemination of its work and will normally grant permission to reproduce portions of the work promptly.

For permission to photocopy or reprint any part of this work, please send a request with complete information to the Copyright Clearance Center Inc., 222 Rosewood Drive, Danvers, MA 01923, USA; telephone: 978-750-8400; fax: 978-750-4470; Internet: [www.copyright.com](http://www.copyright.com).

All other queries on rights and licenses, including subsidiary rights, should be addressed to the Office of the Publisher, The World Bank, 1818 H Street, NW, Washington, DC 20433, USA; fax: 202-522-2422; e-mail: [pubrights@worldbank.org](mailto:pubrights@worldbank.org).

ISBN: 978-0-8213-8419-0

eISBN: 978-0-8213-8420-6

DOI: 10.1596/978-0-8213-8419-0

#### **Library of Congress Cataloging-in-Publication Data**

Kim, Yongsoo.

Building broadband : strategies and policies for the developing world / Yongsoo Kim, Tim Kelly, and Siddhartha Raja.

p. cm.

Includes bibliographical references and index.

ISBN 978-0-8213-8419-0 — ISBN 978-0-8213-8420-6 (electronic)

1. Internet service providers—Korea (South) 2. Broadband communication systems—Korea (South) I. Kelly, Tim (Tim John Charles) II. Raja, Siddhartha, 1980- III. Title.

HE8420.5.K564 2010

384.3'3—dc22

2010021581

# Contents

Foreword	ix
Acknowledgments	xiii
About the Authors	xv
Abbreviations	xvii
Executive Summary	xxi
<b>1 The Status and Importance of Broadband</b>	<b>1</b>
The Status of Broadband Connectivity	1
Why Has Broadband Become a Policy Issue?	4
This Volume's Contents	8
Notes	11
References	12
<b>2 Rethinking Broadband as an Ecosystem</b>	<b>15</b>
The Broadband Ecosystem	15
The Importance of the Ecosystem	16
Networks	18
Services	21
Applications	24
Users	25
Notes	29
References	30
<b>3 Broadband Market Development in the Republic of Korea</b>	<b>35</b>
Why Korea?	36
Country Profile	42
Broadband Market	43

Developing the Broadband Ecosystem	50
The Strategic Framework: Informatization Plans and Funding	54
Supply-Side Policy	55
Demand-Side Policy	62
Evaluating Korea's Approach	63
Notes	64
References	65
<b>4 Experiences of Other Broadband Leaders</b>	<b>67</b>
Finland	67
France	69
Japan	71
Sweden	73
United Kingdom	75
United States	78
Analyzing the Approaches of Broadband Leaders	80
Notes	84
References	88
<b>5 Strategies to Build the Broadband Ecosystem</b>	<b>95</b>
The Public Sector's Evolving Role in Broadband	95
Defining Broadband Strategies	99
The Institutional Base for Policy Implementation	109
Note	110
References	110
<b>6 Policies and Programs to Build Broadband</b>	<b>113</b>
Promote: Policies as a Pump Primer	116
Oversee: Facilitate Competition-Led Growth through Consistent Oversight	126
Universalize: Focus on Widespread Diffusion as the Broadband Market Grows	131
Notes	133
References	133
<b>7 Building Blocks for Broadband</b>	<b>137</b>
Building Block 1: Be Visionary, Yet Flexible	137
Building Block 2: Use Competition to Promote Market Growth	139
Building Block 3: Facilitate Demand	141



Implications for Developing Countries	141
Note	143
<b>Index</b>	<b>145</b>
<b>Boxes</b>	
2.1 Truth in Labeling for Broadband Speeds	20
2.2 Three Trends in User Devices	26
4.1 Digital Britain	76
5.1 Broadband Strategies in Middle-Income Countries	97
5.2 Using Strategies Strategically: Raising Awareness and the Profile of Broadband	100
6.1 Subsidizing User Devices	123
6.2 Local Loop Unbundling	129
<b>Figures</b>	
ES.1 The Broadband Ecosystem	xxii
1.1 Growth Effects of Telecommunications	5
1.2 Broadband Activities Cited as Important by Users	7
2.1 The Broadband Ecosystem	16
2.2 Monthly Internet Traffic per Capita, 2009	23
3.1 Korea's Approach to Developing the Broadband Ecosystem	38
3.2 Penetration of Wireline Broadband Services in Various Countries, 2000–09	40
3.3 Share of 3G Subscriptions in Wireless Markets in Various Countries, 2002–09	41
3.4 Korea's Gross National Income per Capita, 1957–2007	43
3.5 Korea's Fixed Broadband Market by Access Technology, 2002–08	45
3.6 Market Shares of Korea's Fixed Broadband Operators, 2001–09	47
3.7 The Transition to Internet Banking in Korea, 2003–08	51
3.8 Evolving Goals of Content Promotion Policies in Korea	59
5.1 Number of Countries with Commercially Available Broadband, 2002–08	101
6.1 Cost Analysis for a Fiber-to-the-Home (FTTH) Deployment, Greenfield Scenario	120
6.2 Average Cost of Infrastructure Installation per Kilometer	120

6.3	Cost of User Devices Relative to GDP per Capita in Selected Sub-Saharan African Countries	122
7.1	Telephony and Fixed Broadband Subscribers in Developing Countries	138

## Tables

ES.1	Stages of Broadband Development	xxiv
1.1	Global Broadband Subscriptions: Wireline and Wireless, September 2009	2
1.2	Broadband Connections Relative to Voice Telecommunication Connections, December 2008	3
2.1	Penetration of Wireless and Wireline Broadband Subscriptions, December 2009	21
3.1	The Dominance of Local Firms in the Search Market: Search Properties by Query Volume	51
3.2	Strategies, Policies, and Regulations Used to Develop Korea's Broadband Ecosystem	52
3.3	Korea's Broadband Infrastructure Development Policies	56
3.4	Public and Private Investments in Broadband in Korea, 1995–2005	57
3.5	Content Promotion Plans in Korea	59
3.6	Korea's Regulations for Broadband	61
4.1	Average Broadband Prices and Speeds in Case Study Countries, September–October 2008	81
4.2	Performance of Case Study Countries in Selected ICT Indexes	82
5.1	Broadband Strategies and Service Goals in the Surveyed Countries	104
5.2	The Three Pillars of Facilitating Broadband Demand among Users	106
6.1	Key Policies and Programs for Building the Broadband Ecosystem	114

# Foreword

The developing world has seen spectacular growth in the information and communication technology (ICT) sector over the past decade. Almost 75 percent of the world's mobile telephone subscriptions are in low- and middle-income countries. These countries have also become the sites of many exciting innovations and have realized significant economic development benefits. However, developing countries lag in the adoption and use of broadband. At the end of 2009, countries in North America and the European Union accounted for more than 50 percent of the world's 1 billion fixed and mobile broadband subscriptions, but South Asia and Sub-Saharan Africa combined had less than 3 percent of the global share.

This inequality threatens to create a new digital divide. It is a major hurdle to economic development and social inclusion. Without access to broadband connectivity, governments, businesses, communities, and individuals will be unable to participate fully in the global information society and knowledge economy.

Not surprisingly, many governments are now focusing on expanding broadband access and use. This book offers policy makers and regulators a list of policies and programs to draw upon as they develop the strategic and policy frameworks to grow broadband in their countries. It does not suggest a universal solution but rather offers a framework to allow policy makers to consider how they might promote, oversee, and universalize broadband.

This book suggests an ecosystem approach to broadband policy that could help in the design of strategies, policies, and programs that support network expansion, have the potential to transform economies, improve the quality and range of services, enable application development, and broaden adoption among users. To identify emerging best practices to nurture this ecosystem, this volume analyzes the Republic of Korea and other leading broadband markets. It identifies three building blocks to support the growth of the broadband ecosystem: defining visionary but flexible strategies, using competition to promote market growth, and facilitating demand.

Most countries that have seen significant growth in broadband laid out their vision early. Such plans usually defined service goals and policy and regulatory frameworks, and also identified investment opportunities for the private sector. More important, the more successful countries have updated these plans regularly to reflect evolving market conditions.

Countries with successful broadband markets typically also had vigorous competition among various networks as well as among service providers. As with mobile telephony, countries should focus on enabling competition to the maximum extent possible to promote market growth. Besides market scale, this approach requires appropriate regulatory frameworks to ensure a level playing field that attracts private investment.

An important but often neglected building block is demand facilitation. This includes raising awareness about the benefits of broadband and improving affordability and accessibility for the largest number of users. Successful countries have often focused on creating a suite of useful applications that increase the relevance of broadband to the widest base of users. Programs to mainstream ICT use in education, health, or government have been common.

The public sector has typically focused on catalyzing the market in its early stages and on creating the appropriate enabling environment for private sector growth. Strategic partnerships between public and

private actors to universalize broadband services are also common in mature markets.

As developing countries are increasingly focusing on the benefits and impact of ICT on economic development and social inclusion, the World Bank Group is committed to supporting its client countries in the creation of appropriate strategic and policy frameworks that would enable private investment, preferably in a competitive setting, to address the demand for broadband.

Mohsen A. Khalil

Director, Global Information and Communication Technologies  
The World Bank Group



# Acknowledgments

The study on which this book is based was funded entirely by the Korea Trust Fund (KTF) on Information and Communication Technology for Development. The fund is a partnership between the government of the Republic of Korea and the Global Information and Communication Technologies (GICT) Department of the World Bank Group. The fund is administered by the Information for Development Program (*infoDev*), which is a multidonor grant facility housed at GICT. It is particularly appropriate that the KTF financed this book, *Building Broadband: Strategies and Policies for the Developing World*, because Korea approached its own broadband as an ecosystem, using a variety of policies and programs within a visionary strategic framework to create one of the most successful broadband markets in the world.



This book benefited from inputs, ideas, and reviews from World Bank colleagues and management, as well as from peer reviewers. The authors are grateful to Mohsen Khalil, director of GICT, for his guidance and support throughout the preparation of the manuscript. The authors also thank Philippe Dongier, sector manager of GICT's Policy Division, and Valerie D'Costa, program manager of *infoDev*, for comments and support. In addition, the authors appreciate the reviews and comments from Catherine Burtonboy, Victor Mulas Gomez, Juan Navas-Sabater, Christine Qiang, David Satola, Rajendra Singh, and Björn Wellenius of the World Bank; François Auclert of the International Finance Corporation; and John Windhausen of TelePoly Consulting.

The team also thanks Taylor Reynolds of the Organisation for Economic Co-operation and Development, Enrique Rueda-Sabater of Cisco Systems, and Steve Wells of Datawave Limited for comments and ideas.

The case study of Korea is based on a detailed study prepared by Ovum Consulting. Case studies of the other countries covered by the book were prepared by Rob M. Frieden of the Pennsylvania State University. Paul Holtz edited the report, and Anthony Nathan and Mather Pfeiffenberger provided administrative support.



## About the Authors

**Yongsoo Kim** is a deputy secretary to the president of the Republic of Korea for broadcasting, information, and communications. Before joining the Office of the President, he spent two years as a senior information and communication technology (ICT) specialist in the Policy Division of the Global Information and Communication Technologies (GICT) Department in the World Bank Group, where he advised several developing countries on broadband policy and telecommunications regulatory issues. He also led the analytical work on broadband policy in the Bank. Before joining the Bank, Yongsoo worked as a director general of the Ministry of Information and Communications in Korea. He holds a bachelor's degree and a master's degree in public policy from Seoul National University. He also holds two master's degrees in law, from Columbia Law School and Georgetown University Law Center.

**Tim Kelly** is the lead ICT policy specialist at the Information for Development Program (*infoDev*) at the World Bank in Washington, D.C., where he is responsible for the programs on access for all and on the mainstreaming of ICTs for development. He was previously head of the Strategy and Policy Unit at the International Telecommunication Union (ITU), where he worked between 1993 and 2008. Before joining ITU, he spent five years as a communications policy analyst with the Organisation for Economic Co-operation and Development and three years with Logica Consultancy Ltd. He has a master's degree (with honors) in geography and a PhD in industrial economics from the University of Cambridge. Over

the past 20 years, Tim has specialized in the economics of the telecommunications industry. He has written or coauthored more than 30 books on the subject, including the ITU's Internet Reports series and World Information Society Reports series. He was in charge of the content team for the World Summit on the Information Society, which concluded in November 2005.

**Siddhartha Raja** is an ICT policy analyst in the Policy Division of the GICT Department in the World Bank Group. His responsibilities span South Asia, the Middle East, and Eastern Europe and include sector strategy development, policy formulation, and regulatory capacity building. He has published journal articles, book chapters, and conference papers on the political economy of telecommunications, the sociology of technology, and the politics of development. Siddhartha has a master's degree in infrastructure policy studies from Stanford University, has studied media law and policy at the University of Oxford, and is currently completing his doctorate in telecommunications policy from the University of Illinois.

# Abbreviations

\$	All dollar amounts are in U.S. dollars unless otherwise indicated
3G	third-generation (mobile communications)
ADSL	asymmetric digital subscriber line
ATM	automated teller machine
BcN	Broadband convergence Network
BRIC	Brazil, the Russian Federation, India, and China
BWA	broadband wireless access
CDMA2000	Code Division Multiple Access 2000
DMB	digital multimedia broadcasting
DOI	Digital Opportunity Index
DSL	digital subscriber line
DSLAM	digital subscriber line access module
EU	European Union
EV-DO	Evolution Data Optimized
FCC	U.S. Federal Communications Commission
FIFA	Fédération Internationale de Football Association (International Federation of Association Football)
FTTH	fiber (optic) to the home
G2G	government to government
G4B	government for businesses
G4C	government for citizens
Gbps	gigabits per second
GDP	gross domestic product
GHz	gigahertz
GITR	<i>Global Information Technology Report</i>

GNI	gross national income
HSDPA	high-speed downlink packet access
HSPA	high-speed packet access
ICT4D	Information and Communication Technology for Development
ICT	information and communication technology
IDI	ICT Development Index
IMT-2000	International Mobile Telecommunications–2000
Indotel	Instituto Dominicano de las Telecomunicaciones (Telecommunications Institute of the Dominican Republic)
<i>infoDev</i>	Information for Development Program
IP	Internet protocol
IPR	intellectual property rights
IPTV	Internet protocol television
ISDN	Integrated Services Digital Network
IT	information technology
ITU	International Telecommunication Union
kbps	kilobits per second
KONEPS	Korea Online E-Procurement System
KT	Korea Telecom
KTF	Korea Trust Fund
LAN	local area network
LLU	local loop unbundling
LTE	Long Term Evolution
Mbps	megabits per second
MHz	megahertz
MyICMS	Malaysian Information, Communications, and Multimedia Services
NSN	Nokia Siemens Network
OECD	Organisation for Economic Co-operation and Development
PC	personal computer
R&D	research and development
SKT	South Korea Telecom
SMEs	small and medium-size enterprises
TD-SCDMA	Time Division–Synchronous Code Division Multiple Access

TV	television
UBcN	Ultra Broadband convergence Network
UNCTAD	United Nations Conference on Trade and Development
VDSL	very-high-speed digital subscriber line
W-CDMA	Wideband Code Division Multiple Access
WEF	World Economic Forum
WiMAX	worldwide interoperability for microwave access
WLAN	wireless local area network



# Executive Summary

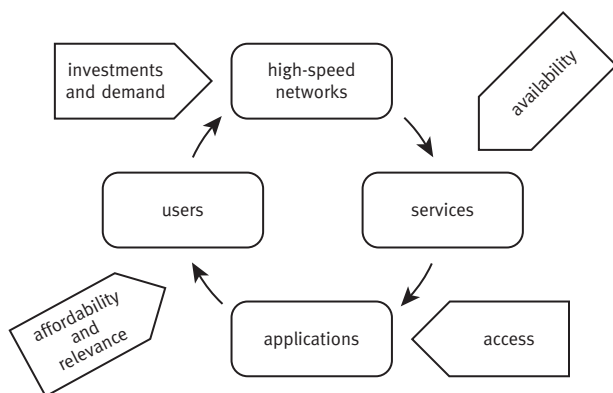
A growing number of countries are seeking to spur broadband development. This book offers policy makers and regulators an analysis of approaches that leading countries have taken in expanding their broadband markets, with a focus on the Republic of Korea. In addition, case studies cover Finland, France, 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—exceeded 1 billion globally (see table 1.1 in chapter 1). Most of these connections are in developed countries, with developing countries lagging significantly.

## **Redefining Broadband**

This book 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 they carry, the applications they deliver, and users (figure ES.1). Each of these components has been transformed by technological, business, and market developments.

**Figure ES.1 The Broadband Ecosystem**

Source: Authors' representation.

Defining broadband to include both the supply and the demand sides of the market also leads to a rethinking of approaches to expanding 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 it is also important to facilitate demand for and adoption of broadband.

## Strategies and Policies

Country approaches to broadband development 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 provide the base for policy implementation in the early stage, allowing the creation of a well-defined framework and institutions to implement policies and regulations.

To derive a list of these policies and regulations, this book focuses on the Republic of Korea—which is one of the most successful broadband markets and has deployed a wide range of policies 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 (table ES.1).

## Broadband Building Blocks

This book proposes three building blocks that countries may wish to consider as they develop their broadband markets. These building blocks are not the only tools available for growth, nor do they apply 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 visions and goals served as frameworks under which policies and regulations were developed to implement the strategies through public-private partnerships. But such strategies were not static; they adapted to evolving markets and accommodated new technologies. By 2009, all the countries surveyed had or were developing national broadband strategies.
- *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 targeted specific gaps or triggered larger private investments. Furthermore, every country surveyed relied on competition to expand the broadband market. Some focused on facility-based competition, and others focused on service-based competition. The more successful countries generally also benefited from intermodal competition, notably between digital subscriber line (DSL), cable modem, and third-generation 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 early stages of

**Table ES.1 Stages of Broadband Development**

<b>Component</b>	<b>Early stage: Promote</b>	<b>Mass market: Oversee</b>	<b>Universal service: Universalize</b>
Goal	<ul style="list-style-type: none"> <li>■ Focus on promotional policies as a pump-primer to spread broadband networks.</li> </ul>	<ul style="list-style-type: none"> <li>■ Facilitate competition through consistent, enabling regulation.</li> </ul>	<ul style="list-style-type: none"> <li>■ Universalize broadband service as the market grows.</li> </ul>
Networks	<ul style="list-style-type: none"> <li>■ Develop an enabling environment through policies and regulations that promote investment and market entry.</li> <li>■ Reduce administrative burdens and provide incentives and subsidies for research and development, pilots, and network rollout.</li> <li>■ Create certification systems for cyber buildings.</li> <li>■ Allocate and assign spectrum for wireless broadband services.</li> </ul>	<ul style="list-style-type: none"> <li>■ Consider infrastructure sharing, including unbundling the local loop.</li> <li>■ Reallocate spectrum to increase bandwidth.</li> </ul>	<ul style="list-style-type: none"> <li>■ Undertake, using public-private partnerships as appropriate, deployment of open access broadband networks in high-cost or remote areas.</li> <li>■ Coordinate access to rights of way.</li> </ul>
Services	<ul style="list-style-type: none"> <li>■ Provide broadband networks to schools, government agencies, and the like (using the government as an anchor tenant).</li> <li>■ Standardize and monitor service quality.</li> </ul>	<ul style="list-style-type: none"> <li>■ Create an enabling environment for intra- and intermodal competition.</li> <li>■ Ensure nondiscriminatory access for service, application, and content providers.</li> </ul>	<ul style="list-style-type: none"> <li>■ Consider expanding universal service obligations to include broadband.</li> </ul>

Applications	<p>Undertake government-led demand aggregation, with government agencies as early adopters and innovators.</p> <ul style="list-style-type: none"> <li>■ Provide e-government and education applications.</li> <li>■ Promote creation of digital content.</li> <li>■ Develop local content and hardware sectors.</li> </ul>	<ul style="list-style-type: none"> <li>■ Support secure, private, and reliable e-commerce transactions.</li> <li>■ Implement intellectual property protection.</li> </ul>	<ul style="list-style-type: none"> <li>■ Develop advanced e-government programs.</li> <li>■ Offer grants to community champions and broadband demand aggregators.</li> </ul>
Users	<ul style="list-style-type: none"> <li>■ Provide low-cost computers and other user devices (for instance, in education).</li> <li>■ Deliver digital literacy programs for citizens.</li> </ul>	<ul style="list-style-type: none"> <li>■ Establish ethical guidelines for information use.</li> </ul>	<ul style="list-style-type: none"> <li>■ Expand universal service programs to underserved communities.</li> <li>■ Construct community access centers.</li> <li>■ Subsidize user devices for poor households.</li> </ul>

Source: Authors' compilation.

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; such funds have supported research, manufacturing promotion, content development, user awareness, information and communication technology (ICT) skill development, and digital literacy programs.

## **Application to Developing Countries**

Countries across the developing world are seeking to increase access to and use of broadband. Broadband is considered a general-purpose technology that stimulates growth in the wider economy and creates business opportunities. But given varying political and economic circumstances, providing universal solutions is impossible. Thus, the findings in this book have different implications for different countries.

The book develops a long list of policies and programs arranged within a strategic framework that allows specific solutions tailored to country circumstances. The building blocks identified are useful everywhere because they focus on improving incentives and the climate for private investment—a policy that even countries with very limited resources should be able to follow. The policies and programs fall into three stages: promotion when the market is incipient, oversight as competition begins to drive growth, and universalization as the market matures (see table ES.1). The book provides emerging good practices to support broadband market growth at each stage.

Developing countries can also use the experiences of the surveyed countries to find ways to leverage even limited resources for maximum effect and to develop programs that are based on demand and market evolution. As an aid to countries in these efforts, a broadband strategies toolkit is being developed by the Global Information and Communication Technologies Department of the World Bank. It will provide more detail and a wider range of case studies on how to convert the broad strategic and policy ideas in this book into practical

instruments used in policy making, regulation, and implementation of broadband network development.<sup>1</sup>

## Note

1. As resources are developed during 2010–12, the toolkit will be posted at the Web site of the Information for Development Program (*infoDev*), <http://www.infodev.org>. An existing toolkit for ICT regulation is available at the ICT Regulation Toolkit Web site, <http://www.ictregulationtoolkit.org>.



# 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 significant global expansion in access to telecommunications provided by mobile phones.

### The Status of Broadband Connectivity

Globally, more than 1 billion broadband subscriptions exist. In September 2009, there were more than 465 million wireline broadband subscriptions (nearly three times the number in December 2004)<sup>1</sup> and more than 575 million wireless high-speed data subscriptions (almost 20 times as many as in December 2004).<sup>2</sup> By 2013, the number of broadband subscriptions (both wireline and wireless) is expected to exceed 3 billion as today's narrowband networks are upgraded to broadband (Pyramid Research Group 2008, 16). 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, European Union (EU) and North American countries together contain about half of

global subscribers, while South Asia and Sub-Saharan Africa contain less than 3 percent (table 1.1).

Broadband networks have significant scope to grow. Worldwide, less than 22 percent of wireline telephones have been upgraded to digital subscriber line (DSL) broadband connections, and third-generation (3G) cellular connections account for just over 10 percent of wireless telephone subscriptions. Again, regional discrepancies are significant (table 1.2). In North America, conversion of fixed lines is more advanced, while in the EU and most developing regions, the conversion of mobile subscriptions to broadband is taking the lead.

Data for cable broadband—broadband services provided over cable television (TV) networks—also suggest wide variation among

**Table 1.1 Global Broadband Subscriptions: Wireline and Wireless, September 2009**

<b>Region</b>	<b>Broadband subscribers (million)</b>	<b>Market penetration (per 100 inhabitants)</b>
East Asia and Pacific	381.4	17.8
Eastern Europe and Central Asia	49.2	12.4
European Union	294.1	60.5
Latin America and the Caribbean	52.4	9.2
Middle East and 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	1,040.5	15.6

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

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



**Table 1.2 Broadband Connections Relative to Voice Telecommunication Connections, December 2008**

<b>Region</b>	<b>3G/total wireless (percent)</b>	<b>DSL/total mainlines (percent)</b>
East Asia and Pacific	13.8	19.4
Eastern Europe and Central Asia	1.6	12.7
European Union	21.8	46.9
Latin America and the Caribbean	2.4	18.0
Middle East and North Africa	7.0	7.3
North America	28.7	21.9
South Asia	0.2	9.4
Sub-Saharan Africa	3.8	7.1
World	10.5	22.4

*Sources:* World Bank analysis based on data from the Wireless Intelligence database (3G) and from TeleGeography's GlobalComms database (DSL).

countries. In Bulgaria, cable broadband subscribers account for 62 percent of broadband subscribers, while in neighboring Turkey that share is 1 percent. In the United States, half of broadband subscriptions are through cable TV networks, while in the United Kingdom, the share is about a quarter.<sup>3</sup>

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.<sup>4</sup>

Moreover, anticipated investments indicate that gaps in broadband access, at least for fixed networks, will continue to widen. A recent World Bank study found a potential “next generation network gap” between countries that already had higher broadband penetration and those that did not (Singh and Raja 2008, 40). The significant investments being planned through government stimulus packages are also generally higher among existing broadband leaders (Qiang 2009). 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 (Biggs and Kelly 2006). All these factors suggest that the broadband digital divide may not narrow anytime soon.

## **Why Has Broadband Become a Policy Issue?**

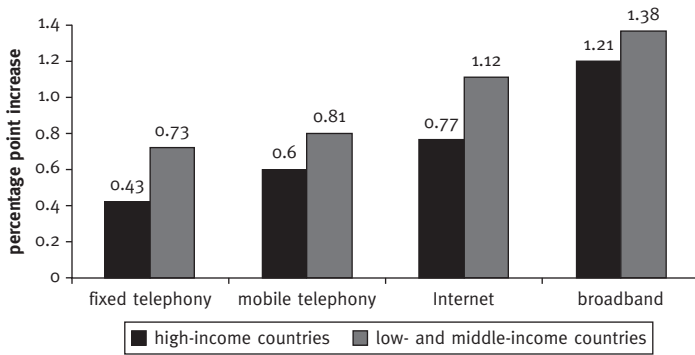
Broadband is a general-purpose technology that significantly affects how people live and work. It is a key driver of economic growth and national competitiveness (see, for example, OECD 2009) and can contribute to social and cultural development.

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 who lack easy access to broadband may miss economic and social opportunities. Cities with extensive broadband availability attract more services firms and so create more jobs than their narrowband counterparts (Woyke 2008). 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 Effects**

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 1.1). In a similar study, McKinsey & Company estimates that “a 10 percent increase in broadband’s household penetration delivers a boost to a country’s GDP that ranges from 0.1 percent to 1.4 percent” (Buttkereit and others 2009, 4). Booz & Company

**Figure 1.1 Growth Effects of Telecommunications**

Source: Qiang, Rossotto, and Kimura 2009.

Note: Figure shows the GDP percentage point increase resulting from a 10 percentage point increase in penetration of selected ICTs.

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” (Friedrich and others 2009, 5). 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” (Friedrich and others 2009, 4). These studies are the latest in the already extensive work estimating broadband’s economic effects.<sup>5</sup>

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 (Google.com 2008). China’s leading Internet search engine, Baidu.com, has a market capitalization of more than \$14 billion, has more than 6,000 employees, and in 2008 had revenues of \$460 million.<sup>6</sup>

Developers have also been extremely active in creating applications for various handsets. Annual sales of applications for Apple’s iPhone exceed \$2.4 billion and stimulated additional hardware sales (Malik

2009). Thus, broadband creates significant economic opportunities for users, service providers, application developers, and network operators alike. McKinsey & Company 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” (Buttkereit and others 2009, 3).

## Social Benefits

Broadband also has social benefits: it connects consumers, businesses, and governments and facilitates social interaction (OECD 2009, 7). 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 (Aker 2008) and raises producer incomes (Jensen 2007). Information about the performance of governments and politicians makes governments more accountable (Besley and Burgess 2002) and improves public services (Reinikka and Svensson 2004).

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 [I]nternet and email play an important role in maintaining these dispersed social networks. Rather than conflicting with people’s community ties, we find that the [I]nternet fits seamlessly with in-person and phone encounters” (Boase and others 2006, i). The Pew study, which was conducted in 2004, found that Internet users are more likely to receive help on a range of key issues,

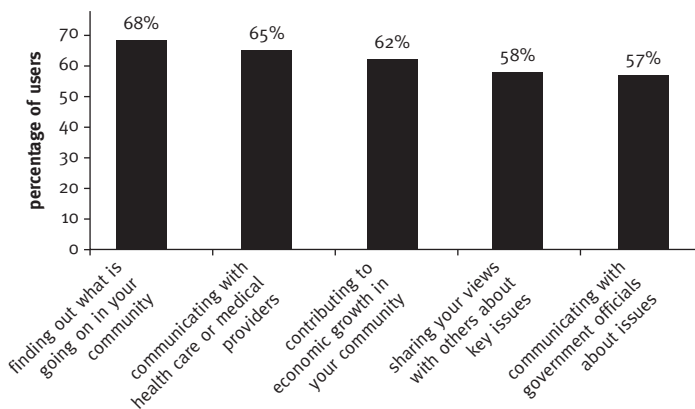
with 85 percent of users receiving help compared with 72 percent of nonusers. The issues included looking for information about a medical condition, making a financial decision, and seeking a new job. Broadband supports these social ties. A 2009 report by Pew (Horrigan 2009) found that many people consider broadband an important part of their lives (figure 1.2).

## The Policy Response

Recognizing the widening broadband divide and the risk that some groups may miss the economic and social benefits of broadband access and use, policy makers 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 policy makers are also realizing that success in broadband is harder to achieve than is success in mobile telephony, the spread of which was driven by huge consumer demand and falling ownership costs.

**Figure 1.2 Broadband Activities Cited as Important by Users**



Source: Horrigan 2009.

Broadband has both supply and demand considerations. For instance, although the usefulness of a telephone is obvious even to illiterate or poor individuals, the same can rarely be 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, thereby making ownership relatively costly (even with falling prices for hardware and subscriptions). Using broadband also requires some level of digital literacy. Consequently, broadband access and use remain incipient in the developing world.

## This Volume's Contents

This volume comprises seven chapters. Chapter 2 proposes rethinking how the term *broadband* is used given recent developments in networks, services, applications, and users. The book draws on academic and technical sources to reconceptualize broadband as an ecosystem.

Chapter 3 provides a 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 the 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 in 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 book provides concepts and principles derived from studies of Korea and other high-income countries, its scope has some limits.<sup>7</sup> It avoids prescriptions because there is great diversity in market status across countries. The book does not provide details on how policies or regulations should be developed. Countries will have to prepare such policies on the basis of their own circumstances, resources, and goals.<sup>8</sup>

Furthermore, this volume focuses on the development of the broadband access market—that is, the retail and not wholesale market for broadband. It addresses domestic and international backbone connectivity, given its importance for broadband market development; however, the focus remains on the links between users and providers of broadband services—the so-called last mile of broadband networks. But high-quality, low-cost international connectivity is essential for domestic broadband development; otherwise widespread adoption of broadband will face major bottlenecks. For detailed examinations of backbone policies and programs, see earlier work by the World Bank (Williams 2008) and the forthcoming Broadband Strategies Toolkit (see p. 10).

This book 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 book 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 (2009, 7) 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. Rules such as the European Commission’s State Aid Rules should be well understood and implemented in a transparent manner.<sup>9</sup>

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, and cable conduits—and opening rights of way significantly cut costs and create minimal market distortions (OECD 2008; Qiang 2009).

## Future Efforts

This volume is the first stage of a larger project. With support from the Republic of Korea’s Trust Fund on Information and Communication Technology for Development (ICT4D), *infoDev*, and the World Bank’s Global Information and Communication Technologies Department are now developing a toolkit for broadband strategies. The Broadband Strategies Toolkit will be a rich source of information, regulatory and licensing documents, and practical examples related to policy making, 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 book.<sup>10</sup>



## Notes

1. To qualify as broadband, transmission capacity must be at least 256 kilobits per second in one or both directions. See also Partnership on Measuring ICT for Development (2009). *Wireline* includes subscribers using cable television, digital subscriber line, or other wireline or fixed technology-based broadband connections. Data are for 2009 and are from TeleGeography's GlobalComms database.
2. *Wireless* includes the number of CDMA2000 (Code Division Multiple Access 2000) 1xEV-DO (Evolution Data Optimized), CDMA2000 1xEV-DO Rev. A, W-CDMA (Wideband Code Division Multiple Access), W-CDMA HSPA (high-speed packet access), and TD-SCDMA (Time Division-Synchronous Code Division Multiple Access) subscriptions. Data are for 2009 and are from the Wireless Intelligence database.
3. Data are for 2009 and are from TeleGeography's GlobalComms database.
4. Data are for 2009 and are from TeleGeography's GlobalComms database.
5. For a comprehensive review of the literature, see Qiang, Rossotto, and Kimura (2009).
6. See the January 4, 2010, summary in Google Finance at <http://www.google.com/finance?q=NASDAQ:BIDU>.
7. For instance, a number of high-income countries had widespread wireline telecommunications networks (either telephone or cable television) in place when broadband services were introduced. In contrast, the growth of broadband in lower- and middle-income countries will likely depend on the spread of wireless networks, at least in the access segments that reach subscribers. The present book has had to follow this approach because major developments in broadband are still confined to the developed world and are only now spreading to the developing world.
8. A new World Bank service—the Broadband Strategies Toolkit—is intended to provide low- and middle-income countries with additional practical information on how to select, craft, and apply policies for broadband development.
9. In that arrangement, the European Commission's Directorate General of Competition monitors state aid to the ICT sector and helps develop state aid policy in this field. *State aid* is defined as an advantage in any form conferred on a selective basis to undertakings by national public authorities. Given this

definition, a number of measures, such as research and development aid or regional aid to ICT companies, have to be monitored by the Directorate General of Competition to avoid market distortions. The Directorate General of Competition also clears aid that is beneficial to consumers by providing new research grants and encouraging the development of new products, such as open source. See [http://ec.europa.eu/comm/competition/sectors/ICT/overview\\_en.html](http://ec.europa.eu/comm/competition/sectors/ICT/overview_en.html).

10. The toolkit will be posted at the *infoDev* Web site (<http://www.infodev.org>) as resources are developed, during 2010 to 2012. An existing toolkit for ICT regulation is available at <http://www.ictregulationtoolkit.org>.

## References

Aker, Jenny C. 2008. "Does Digital Divide or Provide? The Impact of Cell Phones on Grain Markets in Niger." University of California, Berkeley.

Besley, Timothy, and Robin Burgess. 2002. "The Political Economy of Government Responsiveness: Theory and Evidence from India." *Quarterly Journal of Economics* 117 (4): 1415–51.

Biggs, Phillippa, and Tim Kelly. 2006. "Broadband Pricing Strategies." *info* 8 (6): 3–14.

Boase, Jeffrey, John B. Horrigan, Barry Wellman, and Lee Rainie. 2006. "The Strength of Internet Ties." Pew Internet & American Life Project, Washington, DC. <http://www.pewinternet.org/Reports/2006/The-Strength-of-Internet-Ties.aspx>.

Buttkereit, Sören, Luis Enriquez, Ferry Grijpink, Suraj Moraje, Wim Torfs, and Tanja Vaheri-Delmulle. 2009. "Mobile Broadband for the Masses." McKinsey & Company, Louvain-la-Neuve, Belgium. [http://www.mckinsey.com/client-service/telecommunications/mobile\\_broadband.asp](http://www.mckinsey.com/client-service/telecommunications/mobile_broadband.asp).

Friedrich, Roman, Karim Sabbagh, Bahjat El-Darwiche, and Milind Singh. 2009. "Digital Highways: The Role of Government in 21st Century Infrastructure." Booz & Company, New York.

Google.com. 2008. "Google Annual Report." Google.com, Mountain View, CA.

Horrigan, John B. 2009. "Home Broadband Adoption 2009." Pew Internet & American Life Project, Washington, DC. <http://www.pewinternet.org/Reports/2009/10-Home-Broadband-Adoption-2009.aspx>.

Jensen, Robert. 2007. "The Digital Divide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector." *Quarterly Journal of Economics* 122 (3): 879–924.

Malik, Om. 2009. "How Big Is the Apple iPhone App Economy? The Answer Might Surprise You." GigaOM Network, San Francisco, CA. <http://gigaom.com/2009/08/27/how-big-is-apple-iphone-app-economy-the-answer-might-surprise-you>.

OECD (Organisation for Economic Co-operation and Development). 2008. *Broadband Growth and Policies in OECD Countries*. Paris: OECD. [http://www.oecd.org/document/1/0,3343,en\\_2649\\_34223\\_40931201\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/1/0,3343,en_2649_34223_40931201_1_1_1_1,00.html).

———. 2009. "Broadband and the Economy." Ministerial background report prepared for the OECD Ministerial Meeting on the Future of the Internet Economy, Seoul, June 17–18. <http://www.oecd.org/dataoecd/62/7/40781696.pdf>.

Partnership on Measuring ICT for Development. 2009. "Revisions and Additions to the Core List of ICT Indicators." International Telecommunication Union, Geneva. [http://www.itu.int/ITU-D/ict/partnership/material/CoreICTIndicators\\_e\\_rev2.pdf](http://www.itu.int/ITU-D/ict/partnership/material/CoreICTIndicators_e_rev2.pdf).

Pyramid Research Group. 2008. "Global Fixed and Mobile Broadband Outlook: The Transformation of Networks, Business Models, and Growth Opportunities." Pyramid Research Group, Cambridge, MA.

Qiang, Christine. 2009. "Broadband Infrastructure Investment in Stimulus Packages: Relevance for Developing Countries." World Bank, Washington, DC. [http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1208273252769/Broadband\\_Investment\\_in\\_Stimulus\\_Packages.pdf](http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1208273252769/Broadband_Investment_in_Stimulus_Packages.pdf).

Qiang, Christine, Carlo Rossotto, and Kaoru Kimura. 2009. "Economic Impact of Broadband." In *Information and Communications for Development 2009: Extending Reach and Increasing Impact*, 35–50. Washington, DC: World Bank.

Reinikka, Ritva, and Jakob Svensson. 2004. "The Power of Information: Evidence from a Newspaper Campaign to Reduce Capture." Policy Research Working Paper 3239, World Bank, Washington, DC.

Singh, Rajendra, and Siddhartha Raja. 2008. "Convergence in ICT Services: Emerging Regulatory Responses to Multiple Play." Working Paper, World Bank, Washington, DC. <http://siteresources.worldbank.org/EXTINFORMATIONAND>

COMMUNICATIONANDTECHNOLOGIES/Resources/Convergence\_in\_ICT\_services\_Emerging\_regulatory\_responses\_to\_multiple\_play.pdf.

Williams, Mark. 2008. "Broadband for Africa: Policy for Promoting the Development of Backbone Networks." World Bank, Washington, DC. [http://site.resources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/Broadband\\_for\\_Africa-backbone\\_policy.pdf](http://site.resources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/Broadband_for_Africa-backbone_policy.pdf).

Woyke, Elizabeth. 2008. "America's Most Wired Cities." Forbes.com, January 10. [http://www.forbes.com/2008/01/09/wired-cities-wifi-tech-wireless-cx\\_ew\\_0110wired.html](http://www.forbes.com/2008/01/09/wired-cities-wifi-tech-wireless-cx_ew_0110wired.html).

# 2

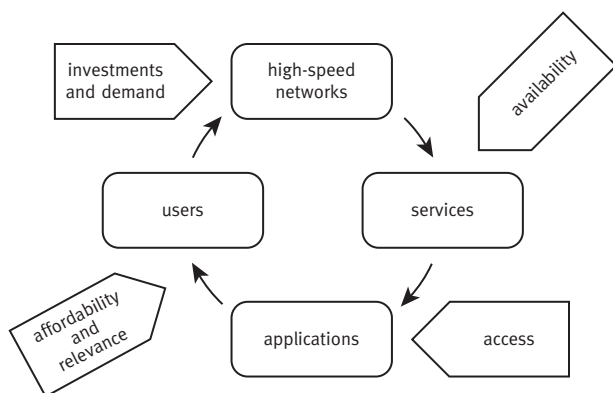
## Rethinking Broadband as an Ecosystem

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 (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 book 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 2.1.

The ecosystem includes the networks that support high-speed data communication and the services those networks provide. It also includes the applications provided by those 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. Those networks increase the availability of high-quality services to both users and application providers. Applications access those services to reach users, who respond to the affordability of the services and relevance of the applications. Users

**Figure 2.1 The Broadband Ecosystem**

Source: Authors' representation.

then grow in number and sophistication, demanding and driving greater investments in networks and 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. 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 leads to 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, ignoring users and applications—the demand side—could lead to an incomplete policy or strategy.

Because various interdependencies exist among the components of the broadband ecosystem, a holistic approach to broadband has produced better results. Those interdependencies link the various components in multiple ways. Investments in high-speed networks improve the quality of service and promote the creation of more complex and 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 higher-quality services. Widespread access to services has also allowed users to create their own content, again driving the demand for high-quality services that not only do more than simply download content, but also allow sharing among users. The following sections explore those developments.

As the countries surveyed in this volume show, building a high-speed telecommunications network is only the necessary first step in developing a broadband system. A range of policies and programs is 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 toward 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 the 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 subscribers, 128 million are from Brazil, the Russian Federation, India, and China (known as the *BRIC countries*), twice the subscriber base in 2006.<sup>1</sup> The number of wireless broadband networks has also expanded. In September 2009, there were more than 575 million high-speed subscriptions over mobile networks—people using third-generation (3G) or more advanced systems.<sup>2</sup> In mid-2009, there were 343 wireless broadband networks (TeleGeography 2009), and these networks were based on technologies such as WiMAX (worldwide interoperability for microwave access).

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 ISDN [Integrated Services Digital Network] at 1.5 or 2.0 [megabits per second]” (ITU 2004, 55). But more recent definitions are based on the way that 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 [kbps], in one or both directions” (ITU 2009, 22).

Wide variations also occur across countries. The Canadian Radio-television and Telecommunications Commission (2009) defines high-speed Internet service as having data speeds at or above 128 kbps, whereas broadband service involves data speeds at or above 1.5 megabits per second (Mbps). The U.S. Federal Communications



Commission recently upgraded its definition of broadband from 200 kbps to 800 kbps as part of its ongoing development of a national broadband strategy.<sup>3</sup> The Digital Britain plan seeks to deliver universal broadband services at 2 Mbps by 2012 (BIS and DCMS 2009, 12). In February 2009, the Republic of Korea unveiled plans to build a broadband network that allows data uploads and downloads of 1 gigabit per second (Gbps) by 2013 (Paul 2009).

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 Mbps or faster, up from the 256 kbps defined in the Broadband Policy of 2004 (*Hindu Business Line* 2009). Also concerns are growing about truth in labeling of broadband service speeds (box 2.1).

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

Developments in technologies and business models are enabling networks to reach more people at lower costs. In developed countries, fiber-optic networks are moving closer to users, reaching their neighborhoods, offices, and homes. Simultaneously, in developing countries, 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 2.1). In Sub-Saharan Africa, subscriptions using wireless broadband are more than eight times those using wireline, suggesting the potential for wireless broadband in areas where traditional wireline infrastructure might be absent.

This book does not recommend a minimum connectivity standard for broadband because that standard is a moving target. Rather, it

### Box 2.1 Truth in Labeling for Broadband Speeds

The world over, broadband service providers advertise bandwidths that are often higher than those actually experienced by users. For instance, a report from Ofcom (2009) in the United Kingdom found that 9 percent of surveyed users on packages advertised as 8 Mbps received actual average speeds of closer to 6 Mbps; one in five received less than 2 Mbps on average.

Advertised and actual bandwidths vary for many reasons. In addition to technical reasons such as the technology used and the distance from network nodes (such as exchanges), actual bandwidth depends on contention—that is, how many users share bandwidth simultaneously.

This issue has emerged as users demand more bandwidth for their applications and services. And some governments have begun to respond. The government of the Czech Republic 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 approach has also become a topic of discussion in the United States with respect to its first national broadband strategy. The strategy points out that average actual download speeds are half of average advertised speeds, and it proposes four steps to improve transparency in the market (FCC 2010). In its recommendations to member countries, the OECD advises governments to “discourage harmful business conduct and practices such as misleading advertising” (Rooney 2008).

*Source:* OECD 2008.

proposes that countries consider their policy and strategic goals, together 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

**Table 2.1 Penetration of Wireless and Wireline Broadband Subscriptions, December 2009**

Region	Number of subscriptions per 100 inhabitants	
	Wireless broadband	Wireline broadband
East Asia and Pacific	9.7	8.1
Eastern Europe and Central Asia	5.3	7.1
European Union	36.5	24.0
Latin America and the Caribbean	3.4	5.7
Middle East and 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

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

the standard, but 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, and data—were offered. But convergence has eroded the boundaries between these segments. Increasingly, all are being carried as Internet protocol (IP) data packets (Singh and Raja 2008, 40). Momentum for a shift to IP-based broadband networking based on so-called next-generation networks is growing. For example, broadband-enabled telephone networks allow subscribers to watch television broadcasts using IPTV (Internet protocol television) or to stream video over the Internet (say, through video repository Web sites 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 these elements use 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.

Different aspects should be considered. 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 Mbps (OECD 2009). Booz & Company suggests that first generation broadband offer 512 kbps to 2 Mbps—enough for rich media, social networking, and videoconferencing. But for more advanced uses, such as next-generation television and telelearning, the company estimates bandwidth requirements at more than 20 Mbps (Friedrich and others 2009, 5). 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.

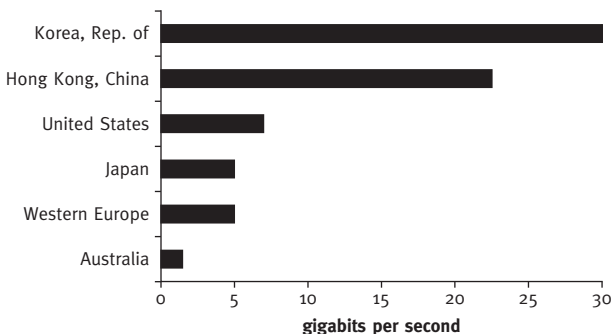
Another important dimension of broadband service quality is latency—the time taken for data to move from source to destination—which is critical for real-time applications such as voice telephony, Internet video broadcasting, and gaming, all of which are drivers of broadband adoption. The higher the quality of broadband service is in the face of growing demand, the better prepared an economy is to use tomorrow's applications and benefit from broadband-enabled innovation (Cisco 2009).

Demand for bandwidth is increasing and will continue to grow. Between 2002 and 2008, demand for international submarine cable bandwidth grew 54 percent per year. And supply is rising to meet this demand: more submarine cables will be built between 2009 and 2011 than were built between 1999 and 2001, at the height of the

telecommunications boom.<sup>4</sup> 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 quadrupled, reaching 1.5 billion.<sup>5</sup> The growth of dynamic, collaborative Web 2.0 applications depends on the ability of users to interact (see the next section, titled “Applications”), but it 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 Hong Kong, China, and in Korea, for example, monthly Internet traffic already exceeds 20 Gbps per capita and is growing by more than 50 percent per year (figure 2.2).<sup>6</sup> Indeed, some worry that a deluge of bandwidth-hungry applications will overwhelm the Internet (see, for example, Nemertes Research 2007).

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 (asymmetric digital subscriber line) connection for a business user fell 74 percent between 2005 and 2008. In Turkey, the decrease was 57 percent, and in Peru, it was 17 percent.<sup>7</sup>

**Figure 2.2 Monthly Internet Traffic per Capita, 2009**



Source: Minnesota Internet Traffic Studies, <http://www.dtc.umn.edu/mints/home.php>.

## 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, applications are more commonly being hosted in the "cloud," a representation of the Internet and other networks. Broadband connectivity allows users to link to those clouds. This linking allows users to use multiple devices to access the same services or information while keeping the costs of software and data distribution very low (*Economist* 2009a). 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 Docs 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 feature, in turn, helps reduce the need for computing power on user devices, thereby lowering costs and simplifying design.

Another major development in recent years has involved Web 2.0 applications. Those 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, mashups, and folksonomies—are interoperable, user centered, and collaborative.<sup>8</sup> Unlike the "traditional Web," Web 2.0 applications 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.<sup>9</sup> 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.<sup>10</sup> 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 (*Economist* 2009b).

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, it is expected to account for a third. In 2008, the global market for mobile telephone “infotainment” was \$35 billion.<sup>11</sup> 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 those sites (Madden 2009).

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 (Hanna and others 2009). As the OECD (2006, 9) notes, “The public sector has a major role as a producer and user of digital content and applications”—including those 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 (OECD 2006).

## Users

Users are the fourth part of the broadband system. Broadband users have substantially different opportunities than those of 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

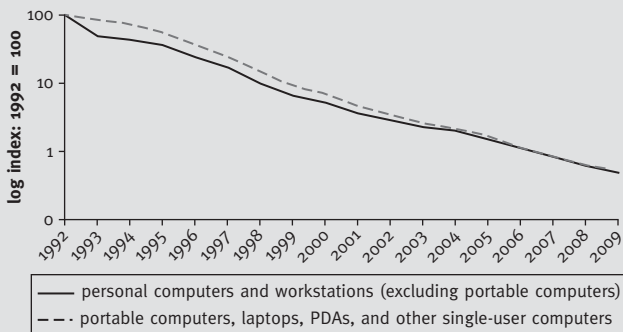
consume, create, and share content. Box 2.2 describes three trends in user devices that promise to alter the terrain of the computing and communications industries, bringing them closer to convergence.

Broadband devices also allow mobility. Growth in the number of mobile wireless broadband networks has been steady. By December

### Box 2.2 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: prices have dropped more than 90 percent over the past decade. Indeed, producer price indexes for the computer manufacturing industry have plummeted since 1992 (see box figure).

**Box Figure Prices of Computer Hardware in the United States, 1992–2009**



Source: U.S. Bureau of Labor Statistics, <http://www.bls.gov/ppi/#tables>.

Note: PDA = personal digital assistant.

Second, mobile telephones are becoming smarter. Popular smartphones include handsets powered by Windows or Linux



**Box 2.2 continued**

derivatives. Smartphones 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 (Wolfe 2008). In 2009, smartphone sales likely accounted for 13 percent of global phone sales. Smartphone sales grew by 27 percent in 2008, but growth was expected to slow to 9 percent in 2009 (Paul Budde 2009a).

A third development is netbooks—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 (Reardon 2009).

Pyramid Research Group (2009) predicts that netbooks will accelerate mobile broadband adoption among low-income customers, estimating that mobile broadband subscriptions will rise by 25 percent after services fall below \$20 per 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 (MarketWatch 2009). More recently, mobile handset maker Nokia announced the release of its own netbook, the Booklet 3G (Nokia 2009).

*Source:* Authors' analysis.

2009, more than 250 mobile networks (based on the fourth-generation Long Term Evolution platform and the IEEE 802.16e mobile standard such as WiMAX) had been planned or deployed.<sup>12</sup> The number of subscribers on HSPA (high-speed packet access) networks, which connect users at up to 14 Mbps, has almost quintupled, reaching 160 million in 2009.<sup>13</sup> In developing countries, broadband will likely

be a predominantly wireless phenomenon; mobile WiMAX networks already serve 21 low- and middle-income countries (TeleGeography 2009).

Similarly, an April 2009 survey by the Pew Research Center's Internet & American Life Project found that 56 percent of U.S. adults have accessed the Internet wirelessly, such as while using a laptop, mobile device, game console, or MP3 player (Horrigan 2009b). The most common way people get online using a wireless network is with a laptop: 39 percent of U.S. 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 improved business organization, including the speed and timing of process reengineering and automation, as well as the diffusion of information within organizations (Khalil, Dongier, and Qiang 2009; Momentum Research Group 2005). 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 (Horrigan 2009a, 33).<sup>14</sup>

Broadband users are also creating new content and consuming new media. For example, the share of U.S. adult Internet users who have a profile on an online social network site has more than quadrupled in the past four years—rising from 8 percent in 2005 to 35 percent today, according to the Pew Internet & American Life Project's December 2008 tracking survey (Lenhart 2009).

Twitter, an application that allows users to broadcast short text messages, permits cross-platform communication and has an estimated 6 million users.<sup>15</sup> Formed in 2006, it is already a powerful organizing and political tool across the world (Johnson 2009). And other Web sites such as YouTube, which estimates suggest contains more than

100 million videos, not only host user-created content, but also are developed by users—as distinct from the media corporations that have dominated the market for decades. Estimates suggest that YouTube crossed 1 billion video views *per day* in mid-2008. As Hardy and Hessel (2008) noted in *Forbes* magazine, the site is likely the “biggest television station on the planet.”

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, consumers will use mobile devices to create content and watch user-created content, with higher uplink data transmission speeds and other consumer devices allowing easier content upload (OECD 2009, 262). The demand for mobile broadband capable of video capture and sharing will only grow.

## Notes

1. Data are from TeleGeography’s GlobalComms database.
2. Data are from the Wireless Intelligence database.
3. In the *2008 Data Gathering Order*, the U.S. Federal Communications Commission updated the broadband reporting speed tiers and created the term *first generation data* for services with data speeds between 200 and 768 kbps in the faster direction and the term *basic broadband tier 1* for services with speeds between 768 kbps and 1.5 Mbps in the faster direction. Subsequent tiers were labeled *broadband tier 2* through *broadband tier 7* (FCC 2009, 51).
4. Data are from TeleGeography’s Global Bandwidth Research Service database.
5. Figures are based on World Bank analysis using data from the Economist Intelligence Unit’s database.
6. Data are for 2009 and are from the Minnesota Internet Traffic Studies at <http://www.dtc.umn.edu/mints/home.php>.

7. Figures are based on World Bank analysis using data from the Economist Intelligence Unit's database.
8. Wikipedia provides an evolving, collaborative discussion of Web 2.0 applications. See [http://en.wikipedia.org/wiki/Web\\_2.0](http://en.wikipedia.org/wiki/Web_2.0).
9. Estimates of the number of users are based on data collected by the authors.
10. In June 2009, Facebook was valued at \$6.5 billion, while the market capitalization of the Washington Post Company was \$3.3 billion and that of the New York Times Company was \$730 million (Womack 2009).
11. The infotainment sector included ringtones (accounting for 40 percent of the \$35 billion), gaming, graphics, video, and audio (including music). See Paul Budde Communication (2009b).
12. Data are from TeleGeography's 4G Research Service database.
13. Data are from the Wireless Intelligence database.
14. Data are from a survey conducted between March 26 and April 19, 2009, of 2,253 adults age 18 or older.
15. Estimates of the number of Twitter and YouTube users are based on data collected by the authors.

## References

Akamai. 2009. "State of the Internet Report, Q1 2009." Akamai Technologies, Cambridge, MA. <http://www.akamai.com/stateoftheinternet/>.

BIS (U.K. Department for Business, Innovation, and Skills) and DCMS (U.K. Department for Culture, Media, and Sport). 2009. *Digital Britain*. London: Stationery Office. <http://www.culture.gov.uk/images/publications/digitalbritain-finalreport-jun09.pdf>.

Canadian Radio-television and Telecommunications Commission. 2009. *Communications Monitoring Report*. Ottawa: Canadian Radio-television and Telecommunications Commission. [http://www.crtc.gc.ca/eng/publications/reports/policy\\_monitoring/2009/2009MonitoringReportFinalEn.pdf](http://www.crtc.gc.ca/eng/publications/reports/policy_monitoring/2009/2009MonitoringReportFinalEn.pdf).

Cisco. 2009. "Global Broadband Quality Study Shows Progress, Highlights Broadband Quality Gap." Cisco Systems, San Jose, CA. [http://www.cisco.com/web/MT/news/09/news\\_021009a.html](http://www.cisco.com/web/MT/news/09/news_021009a.html).

*Economist*. 2009a. "Cloud Computing: Clash of the Clouds." *Economist*, October 15.

———. 2009b. "The Rebirth of News." *Economist*, May 14.

FCC (Federal Communications Commission). 2009. "A National Broadband Plan for Our Future." GN Docket 09-51, Notice of Inquiry. *FCC Record* 24 (6): 4342, 4381.

———. 2010. *Connecting America: The National Broadband Plan*. Washington, DC: FCC. <http://www.broadband.gov/download-plan/>.

Friedrich, Roman, Karim Sabbagh, Bahjat El-Darwiche, and Milind Singh. 2009. "Digital Highways: The Role of Government in 21st Century Infrastructure." Booz & Company, New York.

Hanna, Nagy K., Christine Zhen-Wei Qiang, Kaoru Kimura, and Siou Chew Kuek. 2009. "National E-Government Institutions: Functions, Models, and Trends." In *Information and Communications for Development*, 83–102. Washington, DC: World Bank. [http://siteresources.worldbank.org/EXTIC4D/Resources/5870635-1242066347456/IC4D\\_2009\\_Chapter6.pdf](http://siteresources.worldbank.org/EXTIC4D/Resources/5870635-1242066347456/IC4D_2009_Chapter6.pdf).

Hardy, Quentin, and Evan Hessel. 2008. "GooTube." *Forbes*, June 16. <http://www.forbes.com/forbes/2008/0616/050.html>.

*Hindu Business Line*. 2009. "TRAI for 'Redefining' Floor Broadband Speed at 2Mbps." *Hindu Business Line*, July 24. <http://www.thehindubusinessline.com/2009/07/24/stories/2009072451070400.htm>.

Horrigan, John. 2009a. "Home Broadband Adoption 2009." Pew Internet & American Life Project, Washington, DC. <http://www.pewinternet.org/Reports/2009/10-Home-Broadband-Adoption-2009.aspx>.

———. 2009b. "Wireless Internet Use." Pew Internet & American Life Project, Washington, DC. <http://www.pewinternet.org/Reports/2009/12-Wireless-Internet-Use.aspx?r=1>.

ITU (International Telecommunication Union). 2004. "Case Study: How ITU's Broadband Standards Improve Access to the Internet." In *ITU and Its Activities*

*Related to Internet-Protocol (IP) Networks*, 55–65. Geneva: ITU. [http://www.itu.int/osg/spu/ip/chapter\\_seven.html](http://www.itu.int/osg/spu/ip/chapter_seven.html).

———. 2009. *Manual for Measuring ICT Access and Use by Households and Individuals*. Geneva: ITU. <http://www.itu.int/ITU-D/ict/publications/hhmanual/2009/material/HHManual2009.pdf>.

Johnson, Steven. 2009. “How Twitter Will Change the Way We Live.” *Time*, June 5.

Khalil, Mohsen, Philippe Dongier, and Christine Zhen-Wei Qiang. 2009. “Overview.” In *Information and Communications for Development*, 3–18. Washington, DC: World Bank.

Lenhart, Amanda. 2009. “Adults and Social Network Websites.” Pew Internet & American Life Project, Washington, DC. <http://www.pewinternet.org/Reports/2009/Adults-and-Social-Network-Websites.aspx>.

Madden, Mary. 2009. “The Audience for Online Video-Sharing Sites Shoots Up.” Pew Internet & American Life Project, Washington, DC. <http://www.pewinternet.org/Reports/2009/13--The-Audience-for-Online-Video-Sharing-Sites-Shoots-Up.aspx>.

MarketWatch. 2009. “Intel Forecasts Hefty Margins for Gross Profit.” MarketWatch, NY. <http://www.marketwatch.com/story/intel-margins-soar-as-manufacturing-might-kicks-in-2009-10-13>.

Momentum Research Group. 2005. “Net Impact Latin America: From Connectivity to Productivity.” Momentum Research Group, Austin, TX. [http://www.netimpactstudy.com/nila/pdf/netimpact\\_la\\_full\\_report\\_t.pdf](http://www.netimpactstudy.com/nila/pdf/netimpact_la_full_report_t.pdf).

Nemertes Research. 2007. “The Internet Singularity, Delayed: Why Limits in Internet Capacity Will Stifle Innovation on the Web.” Nemertes Research, Mokena, IL. [http://www.nemertes.com/studies/internet\\_singularity\\_delayed\\_why\\_limits\\_internet\\_capacity\\_will\\_stifle\\_innovation\\_web\\_0](http://www.nemertes.com/studies/internet_singularity_delayed_why_limits_internet_capacity_will_stifle_innovation_web_0).

Nokia. 2009. “Nokia Booklet 3G Mini Laptop Unveiled.” Nokia Conversations, August 24. <http://conversations.nokia.com/2009/08/24/nokia-booklet-3g-mini-laptop-unveiled>.

OECD (Organisation for Economic Co-operation and Development). 2006. “Digital Broadband Content: Digital Content Strategies and Policies.” Report DSTI/ICCP/IE(2005)3/Final, OECD, Paris. <http://www.oecd.org/dataoecd/54/36/36854975.pdf>.

———. 2008. *Broadband Growth and Policies in OECD Countries*. Paris: OECD. [http://www.oecd.org/document/1/0,3343,en\\_2649\\_34223\\_40931201\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/1/0,3343,en_2649_34223_40931201_1_1_1_1,00.html).

———. 2009. *Information Technology Outlook 2008*. Paris: OECD. [http://www.oecd.org/document/20/0,3343,en\\_2649\\_33757\\_41892820\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/20/0,3343,en_2649_33757_41892820_1_1_1_1,00.html).

Ofcom. 2009. *U.K. Broadband Speeds 2009: Consumers' Experience of Fixed-Line Broadband Performance*. London: Ofcom. [http://www.ofcom.org.uk/research/telecoms/reports/broadband\\_speeds/broadband\\_speeds/broadbandspeeds.pdf](http://www.ofcom.org.uk/research/telecoms/reports/broadband_speeds/broadband_speeds/broadbandspeeds.pdf).

Paul, Ian. 2009. "South Korea to Get Super High-Speed Broadband." ABC News, February 3. <http://abcnews.go.com/Technology/PCWorld/story?id=6794550>.

Paul Budde Communication. 2009a. *Global-Mobile Handset Market*. Sydney: Paul Budde Communications.

———. 2009b. *Global-Mobile Media: Content & Services Trends*. Sydney: Paul Budde Communications.

Pyramid Research Group. 2009. "Mobile Broadband for the Masses: The Case for Bundled Netbooks." Pyramid Research Group, Cambridge, MA.

Reardon, Marguerite. 2009. "Sprint Sells Netbook for a Buck." CNET News, July 7. [http://news.cnet.com/8301-1035\\_3-10280886-94.html](http://news.cnet.com/8301-1035_3-10280886-94.html).

Rooney, David. 2008. "Broadband Wind Rises." *OECD Observer* 268 (June). [http://www.oecdobserver.org/news/fullstory.php/aid/2666/Broadband\\_wind\\_rises.html](http://www.oecdobserver.org/news/fullstory.php/aid/2666/Broadband_wind_rises.html).

Singh, Rajendra, and Siddhartha Raja. 2008. "Convergence in ICT Services: Emerging Regulatory Responses to Multiple Play." Working Paper, World Bank, Washington, DC. [http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/Convergence\\_in\\_ICT\\_services\\_Emerging\\_regulatory\\_responses\\_to\\_multiple\\_play.pdf](http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/Convergence_in_ICT_services_Emerging_regulatory_responses_to_multiple_play.pdf).

TeleGeography. 2009. *WiMAX Market Tracker* 13 (2).

Wolfe, Alexander. 2008. "Is the Smartphone Your Next Computer?" *Information Week*, October 6. <http://www.informationweek.com/thisweek/10-06-2008>.

Womack, Brian. 2009. "Facebook Employees Offered \$100 Million for Shares." Bloomberg.com, July 13. <http://www.bloomberg.com/apps/news?pid=20601087&sid=a3StPF2tZb0I>.





# 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 and 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-income country to a high-income country. Korea has also considerably raised its investment in information and communication technology (ICT), as both a cause and a 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. Korea has not followed the traditional model used by other high-income countries; its model strikes a unique balance between cooperation and governance. It is important to understand how and why this model worked, reflecting Korea's cultural, political, and institutional context. The government has intervened in the market in many ways, but in a focused and strategic manner. Its actions have been critical to triggering and guiding private sector development and tying these private efforts to its own sector objectives and country conditions.

Broadband growth in Korea has been extremely impressive, growing from less than 1 Internet user per 100 inhabitants in 1995 to one of the world's most highly penetrated broadband markets today. The 1998 introduction of high-speed Internet services by provider Thru-net was among the world's first commercial launches of broadband. By June 2009, fixed broadband penetration was 33 percent of the population, and market penetration of third-generation (3G) services was 77 percent.<sup>1</sup>

This chapter begins by explaining why Korea's experience suggests emerging best practices for growing broadband markets. The chapter then profiles the country, describes its broadband market, and outlines the approaches it took to market development.<sup>2</sup>

## Why Korea?

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

- The government followed a holistic approach to developing the broadband ecosystem.
- The country has experienced rapid growth in its broadband market and, until recently, 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 and played a significant role in developing broadband. The impressive scale of government interventions provides a wealth of policy lessons for other countries.

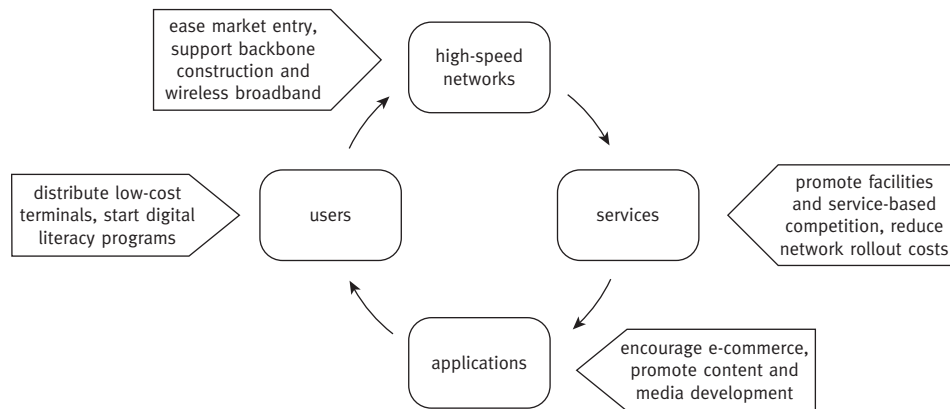
Korea also shows how an integrated, holistic approach to developing broadband—viewing it as more than simply a network or improved

communications service—was critical to the program’s success. The government 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 3.1.

Broadband networks and services grew quickly because of 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 television (TV) network, Thrunet, introduced broadband services. Other providers entered the market by leasing cable infrastructure. In 1999, multiple operators launched asymmetric digital subscriber line (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 penetration rising from 27 percent to 69 percent of households. 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,

**Figure 3.1 Korea's Approach to Developing the Broadband Ecosystem**



Source: Authors' representation.

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, e-mail, and participation in cyber communities. Today, the focus is 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. EDU-NET, 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, Korea's broadband penetration rate was the highest in the world, and it remained so until 2006. Korea still has the highest household penetration of broadband<sup>3</sup> and scores highest in measures of broadband quality.<sup>4</sup> In 2009, market penetration for fixed broadband services was 32 per 100 inhabitants.<sup>5</sup>

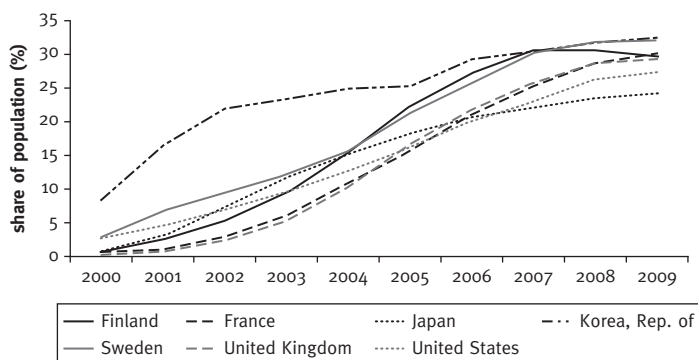
Consequently, in the early stages of its development, Korea's broadband market experienced rapid expansion in supply and demand, allowing it to defy the S-curve associated with the diffusion of technologies and innovations (Rogers 1995, 257), which applies to most ICT goods and services (see also Czernich and others 2009). In other words, it grew at a much faster rate than expected in the early years of development, so a relatively high penetration rate was reached very quickly. In the early years of broadband development, Korea's

trajectory was quite different from that of other leading broadband economies (figure 3.2). 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.

Mobile broadband has also been successful in Korea, though some networks lag in adoption. Hence, the Korean case is 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 3.3).

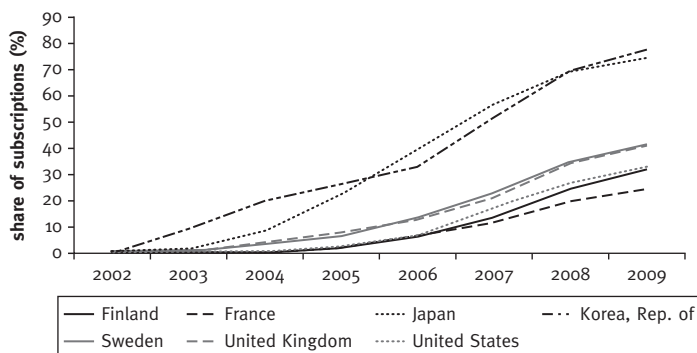
In 2002, more advanced Code Division Multiple Access 2000 (CDMA2000) Evolution Data Optimized (EV-DO) services began targeting enterprise customers and early adopters. EV-DO services currently have a 30 percent share of the mobile market. In 2006, KT (Korea Telecom) and SKT (South Korea Telecom) launched WiBro services (the Korean equivalent of WiMAX, or worldwide interoperability for microwave access). But contrary to government predictions of 5.0 million subscribers within three years of launch, WiBro had

**Figure 3.2 Penetration of Wireline Broadband Services in Various Countries, 2000–09**



Source: World Bank analysis based on data from TeleGeography's GlobalComms database.

**Figure 3.3 Share of 3G Subscriptions in Wireless Markets in Various Countries, 2002–09**



Source: World Bank analysis based on data from the Wireless Intelligence database.

just 0.2 million subscribers in February 2009, with service coverage limited to metropolitan Seoul. However, Wideband Code Division Multiple Access (W-CDMA) services were launched commercially in 2003, and in 2006, high-speed downlink packet access (HSDPA)<sup>6</sup> 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.

## 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 practices 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 Internet protocol television (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, and data) to justify infrastructure investment.

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

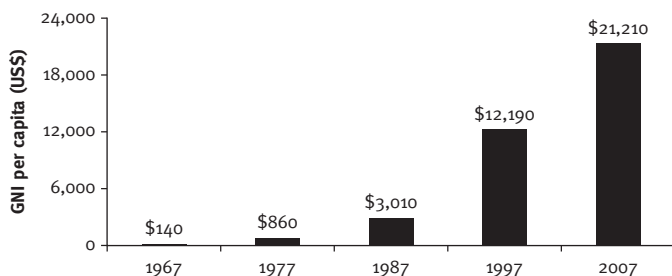
## Country Profile

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 Organisation for Economic Co-operation and Development, United Nations, World Trade Organization, and the Group of 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 3.4). 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. Between 1960 and 1990, Korea was the world's second-fastest-growing economy.



**Figure 3.4 Korea's Gross National Income per Capita, 1957–2007**



Source: Bank of Korea data.

Korea has had a democratic government since 1987 and, according to the United Nations Development Programme, ranks 26th of 182 economies on the Human Development Index (UNDP 2009). More pertinent to this study, the International Telecommunication Union and United Nations Conference on Trade and Development ranked Korea first in their most recent Digital Opportunity Index, a measure of preparedness for the information society (ITU and UNCTAD 2007).

Korea also ranks second on the Information Society Index,<sup>7</sup> sixth on the E-Government Readiness Index,<sup>8</sup> and seventh on the World Economic Forum's Global Competitiveness Index (World Economic Forum 2009). 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 (World Bank 2009).

## 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 and then provides an overview of the market players.

## Fixed Broadband

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

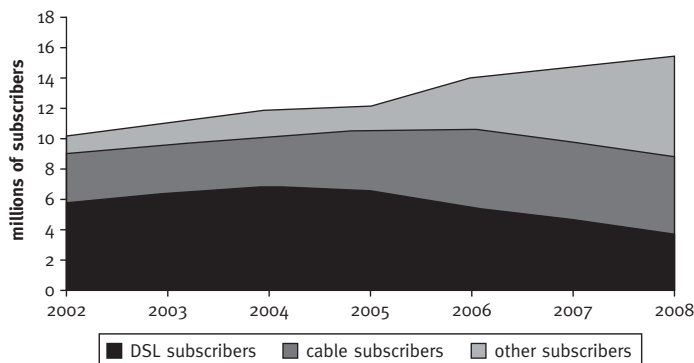
- *Early stage, 1998–99.* Broadband services were first commercialized.
- *Growth stage, 2000–02.* The number of subscribers and household penetration rate increased dramatically.
- *Market maturity, 2003–05.* The growth of broadband adoption slowed, and signs of market saturation emerged.
- *Move to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

Developments in the fixed market are shown in figure 3.5.

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 1997 to introduce competition in the local telephone market. But it soon moved into high-speed Internet provision, launching Internet access services in Seoul, Busan, Incheon, and Ulsan in 1999. By the end of 2002, Hanaro had deployed fiber-optic networks covering 100 cities. It provided services using both ADSL and cable modem access. Hanaro's success threatened to undercut the strategy and the revenue, which at the time were based around ISDN (Integrated Services Digital

**Figure 3.5 Korea's Fixed Broadband Market by Access Technology, 2002–08**



Source: TeleGeography's GlobalComms database.

Note: DSL = digital subscriber line. "Other" includes mainly fiber-optic and fixed wireless subscribers.

Network) and premium rate leased line services to business users, of the incumbent KT. But KT responded rapidly, entering the ADSL market in 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 telecommunications world's great success stories. One question arises: Why was the broadband market, initially promoted using cable infrastructure, subsequently dominated by ADSL service providers in the late 1990s? The answer lies in three features of the Korean market:

- Digital subscriber line (DSL) providers were able to install digital subscriber line access modules (DSLAMs) in high-rise dwellings, bypassing the incumbent's telecommunication exchanges. The ability of competitive DSL providers to link DSLAMs with the incumbent's network is one of the important outcomes of the policy on local loop unbundling (LLU).

- Building owners regarded broadband infrastructure as necessary to increase the attractiveness and value of their properties.
- The regulatory burden imposed on cable TV operators prevented the emergence of national providers that could compete with telecommunications companies.

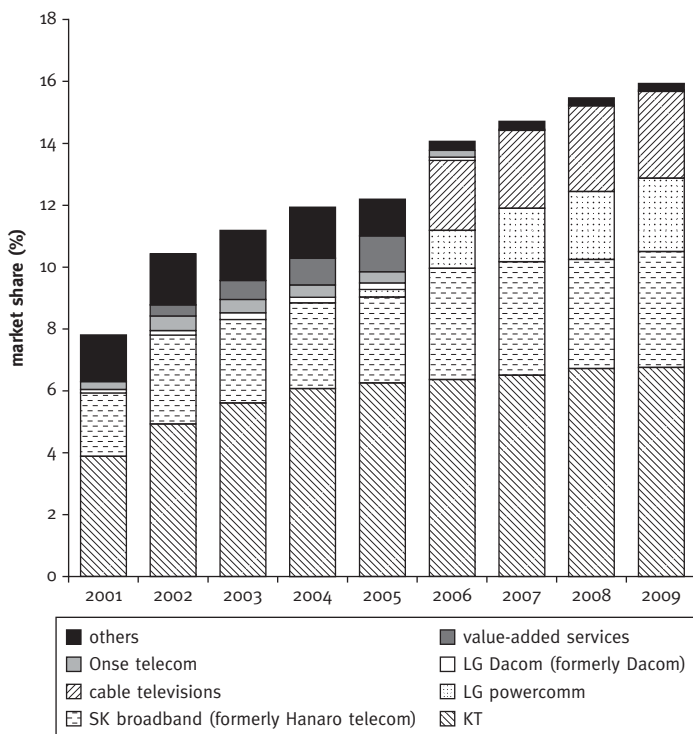
As noted, between 2000 and 2002, Korea experienced one of the world's fastest increases in broadband penetration, with the number of subscribers increasing by 200 percent and the household penetration rate increasing from 27 percent to 69 percent. Growth in subscribers was accompanied by the introduction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

However, 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 SKT. This market instability was more than simply a reflection of the broadband life cycle. 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 43 percent of the country's broadband connections. The evolution of fixed broadband market shares is shown in figure 3.6.

**Figure 3.6 Market Shares of Korea's Fixed Broadband Operators, 2001–09**



Sources: Korea Communications Commission and Ovum data.

Broadband standards and technologies sorted themselves out primarily through the market rather than because of actions by the authorities. Still, the government—through agencies such as the Electronics and Telecommunications Research Institute (ETRI) and Korea Information Society Development Institute (KISDI)—has played an important role in standards-making agencies such as the International Telecommunication Union, complementing the work of the private sector.

## Mobile Broadband

Korea's mobile broadband market is well established, providing 97 percent coverage to a base of 47 million subscribers in June 2009, or nearly three times the number of 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 because of concerns about network congestion and in part because of 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, followed by the launch of W-CDMA services by SKT and KT. SKT and KT formally launched these services on the opening night of the FIFA (Fédération Internationale de Football Association, or International Federation of Association Football) World Cup in June 2002. The services were commercially launched in December 2003. In June 2006, KT and SKT launched WiBro. And in September 2006, HSDPA technologies were launched for the first time in the world in Korea.

As noted, contrary to government predictions of 5.0 million subscribers three years from launch, the number of WiBro subscribers in Korea had reached only 0.2 million by February 2009, with service coverage limited to the metropolitan area of Seoul. But uptake of W-CDMA and HSDPA has been far more extensive, with a combined subscriber base of almost 21 million in 2009.

The government's attempts to promote WiBro in anticipation of market demand for WiMAX-like services, ahead of the global standardization process, may have backfired. WiBro has suffered by

comparison with other mobile broadband services, especially in pricing comparisons. Likely only bundled tariffs with fixed broadband will have a substantial effect on the uptake of WiBro, because both HSDPA and WiFi provide capabilities similar to WiBro. In addition, WiBro is unlikely to compete with fixed broadband because of the large difference in access speeds. Currently, in Korea the access speed for fixed broadband is up to 100 megabits per second (Mbps), while that for WiBro is just 2 Mbps.

## **Applications, Services, and Content**

The rapid growth of demand in Korea, driven by both market and government use, played a key role in accelerating broadband development in its early stages. The key services that drove the adoption of broadband were online share trading, Internet-based education, and interactive online games. As take-up increased, there was a move away from passive uses of the Internet (such as data searching) toward more interactive services (such as shopping, e-mail, and participation in cyber communities). Today, the most popular broadband services are music downloads and gaming, but information acquisition remains a close second, just ahead of e-mail 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 a 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 industry 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. As of 2006, its value exceeded \$3.4 billion, with online games and entertainment services being the key contributors. The mobile content industry, valued at \$588 million in 2006, is led by music, ringtones, and mobile games.

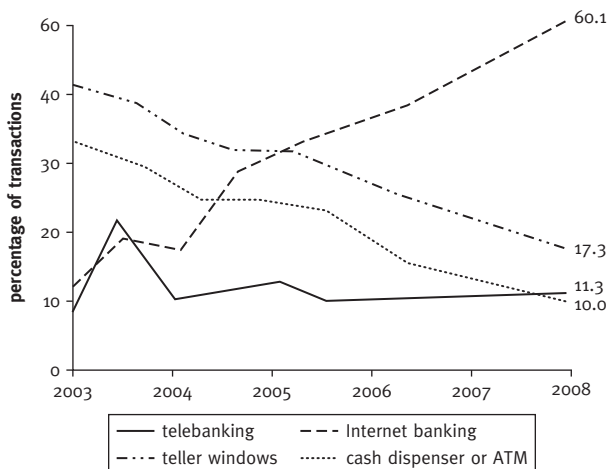
Banking provides a good example of the rise of the Internet, with online transactions accounting for 60 percent of total transactions by 2008—at the expense of both physical infrastructure, such as bank branches and automated teller machines (ATMs) and telebanking (figure 3.7). Korea is also unusual 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 (table 3.1).

## Developing the Broadband Ecosystem

Numerous policy developments and initiatives brought Korea's broadband market to its current state. Table 3.2 summarizes the strategies, policies, and regulations that Korea has used to develop its broadband ecosystem.

The government's approach to promoting ICT in general and the broadband market in particular has been to formulate strategic development frameworks through the use of consecutive master plans that run over a number of years. Each framework has outlined the



**Figure 3.7 The Transition to Internet Banking in Korea, 2003–08**

Source: Bank of Korea data.

**Table 3.1 The Dominance of Local Firms in the Search Market: Search Properties by Query Volume**

Rank	Portal	Searches (million)	Market share (percent)
1	Naver ( <a href="http://www.naver.com">http://www.naver.com</a> )	2,135	61.9
2	Daum ( <a href="http://www.daum.net">http://www.daum.net</a> )	680	19.7
3	Google ( <a href="http://www.google.co.kr">http://www.google.co.kr</a> )	251	7.3
4	Yahoo! ( <a href="http://www.yahoo.co.kr">http://www.yahoo.co.kr</a> )	140	4.1
5	Nate ( <a href="http://www.nate.com">http://www.nate.com</a> )	132	3.8
6	eBay ( <a href="http://www.auction.co.kr">http://www.auction.co.kr</a> )	24	0.7
7	Paran ( <a href="http://www.paran.com">http://www.paran.com</a> )	21	0.6

Source: ComScore data.

government's broad policy goals and laid out a number of supporting policies, including the following:

- Plans for public investment in broadband infrastructure and incentives for private investment

**Table 3.2 Strategies, Policies, and Regulations Used to Develop Korea's Broadband Ecosystem**

Component	Promotion	Oversight	Universalization
Ecosystem definition and strategy	<ul style="list-style-type: none"> <li>■ First National Informatization Promotion Plan</li> <li>■ Cyber Korea 21</li> <li>■ u-Korea Master Plan</li> <li>■ IT839 Strategy, including Broadband convergence Network (BcN)</li> </ul>	<ul style="list-style-type: none"> <li>■ Framework Act on Telecommunications</li> <li>■ Telecommunications Business Act</li> <li>■ Fair Trading Act</li> </ul>	<ul style="list-style-type: none"> <li>■ First and Second Master Plans for Closing the Digital Divide</li> <li>■ e-Korea Vision 2006</li> <li>■ Broadband IT Korea Vision 2007</li> </ul>
Networks	<ul style="list-style-type: none"> <li>■ Korea Information Infrastructure: early focus on backbone</li> <li>■ Broadband technological standards</li> <li>■ Cyber building certification</li> <li>■ Promotion of technology standardization</li> <li>■ Ultra Broadband convergence Network (UBcN)</li> </ul>	<ul style="list-style-type: none"> <li>■ Government ownership of KT until 2002</li> </ul>	<ul style="list-style-type: none"> <li>■ Korea Information Infrastructure: later focus on rural connectivity</li> <li>■ Low-interest loans for network rollout in rural areas</li> </ul>
Services	<ul style="list-style-type: none"> <li>■ Broadband as a value-added service</li> <li>■ Quality monitoring system and service-level agreements</li> </ul>	<ul style="list-style-type: none"> <li>■ Broadband as a facilities-based service</li> <li>■ Network access regulations</li> <li>■ Internet service provider peering regulation</li> <li>■ Local loop unbundling (LLU)</li> <li>■ Significant market power regulation (ex ante pricing and service restrictions)</li> </ul>	<ul style="list-style-type: none"> <li>■ Subsidized services for poor citizens</li> </ul>

		<ul style="list-style-type: none"> <li>■ Bundling regulation</li> <li>■ Number portability for voice over Internet protocol</li> </ul>	
Applications	<ul style="list-style-type: none"> <li>■ Content promotion frameworks</li> <li>■ Informatization Promotion Fund</li> <li>■ Industrial initiatives such as tax reductions for emerging Internet sectors, research and development and technology transfer promotion, and promotion of information technology in traditional industries</li> <li>■ Promotion of demand for broadband services through e-government, e-commerce, and e-learning initiatives</li> </ul>	<ul style="list-style-type: none"> <li>■ Intellectual property rights protection</li> <li>■ Strengthening of cyber trust and security systems, such as antivirus software promotion</li> </ul>	<ul style="list-style-type: none"> <li>■ Promotion of applications accessible to people with disabilities</li> </ul>
Users	<ul style="list-style-type: none"> <li>■ Subsidies for computer purchases by low-income households</li> <li>■ 10 million people in Internet education program</li> </ul>	<ul style="list-style-type: none"> <li>■ Information-use ethics</li> </ul>	<ul style="list-style-type: none"> <li>■ Free Internet access centers in remote areas</li> <li>■ Broadband access in all schools</li> </ul>

Source: Authors' compilation.

- 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
- Various supporting industrial policies such as research and development (R&D) promotion and incentives to revitalize venture capital markets.

At the end of each master plan, achievements have been assessed 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 extended to implementing competition policies as well as regulations deemed appropriate to fostering long-term sustainable growth in the broadband market.

## **The Strategic Framework: Informatization Plans and Funding**

Since 1996, the government has established a number of master plans to develop an information society. They are the following:

- 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 remainder 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 follows:

- 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 3.3). 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

**Table 3.3 Korea's Broadband Infrastructure Development Policies**

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

Source: Ovum data.

Note: ATM = automated teller machine; ADSL = asymmetric digital subscriber line; FTTB = fiber to the building; FTTH = fiber to the home; Gbps = gigabits per second; HSDPA = high-speed downlink packet access; Mbps = megabits per second; VDSL = very-high-speed digital subscriber line; W-CDMA = Wideband Code Division Multiple Access; WiBro = Wireless Broadband.

in 1995 and included construction of a national high-speed public backbone, development of ICT applications, and promotion of R&D and information technology (IT) 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 (ITU 2003, 33).

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 telecommunication and broadcasting sectors, thereby 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 South

Korea's effort [from other countries] is the intense cooperation between the IT industry and the government" (Ihlwan, Edwards, and Burrows 2005).

Hence, much of the funding for Korea's broadband infrastructure projects has come from the private sector rather than the public sector. Though the government invested more than \$900 million in the Korea Information Infrastructure project, that amount represents a small share of the \$33 billion invested overall and was just 8 percent of the government's IT budget between 1998 and 2003. By comparison, public investment in e-government development accounted for 20 percent of the IT budget during that 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 Korea's broadband market. Between 1995 and 2005, government funding for broadband ecosystem development was less than \$1.0 billion, out of a total \$32.5 billion, and accounted for a declining percentage as the private sector took over (table 3.4). That trend continues with the more advanced Ultra Broadband convergence Network

**Table 3.4 Public and Private Investments in Broadband in Korea, 1995–2005**

<b>Main goal</b>	<b>1995–97: Construct backbone network</b>	<b>1998–2000: Broaden access</b>	<b>2001–05: Upgrade the backbone and access networks</b>	<b>Total</b>
Government funding (US\$ million)	173	262	371	806
Total investment (public and private, US\$ million)	1,982	6,964	23,581	32,527
Share of public investment in total (percent)	8.73	3.76	1.57	2.48

Source: Ovum data.

(UBcN): \$27.8 billion of the investment for the UBcN will come from the private sector, with just \$1.1 billion in public funding.

One mechanism for government intervention has been the Informatization Promotion Fund, introduced in 1993. The principle guiding the fund, as defined in the Informatization Promotion Act, is that the government is to set aside money to finance projects fostering information use. Until the Korean Communications Commission was established in 2008, the fund was jointly managed and administered by the Ministry of Information and Communication and the Institute of Information Technology Advancement, 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 fund's main goal is to ensure that profits from the ICT industry remain in the industry. Money from the fund is used to support ICT-related R&D, develop and diffuse standardization in the ICT industry, train ICT workers, promote broadband network rollout, and promote e-government. The Informatization Promotion Fund includes financing by the government and the private sector, through spectrum licensing fees;<sup>9</sup> revenue-based contributions from operators;<sup>10</sup> and proceeds from the fund's operation, including loans. Between 1993 and 2002, the total value of the fund was \$7.8 billion.

## **Content Promotion Policies**

Initiatives to develop Korea's broadband market have included a number of content promotion plans and support (table 3.5). But with the notable exception of gaming, the domestic content and programming industry in Korea has been less successful than the hardware industry. The main reason is the linguistic isolation of the Korean market, because the Korean language is not widely spoken outside the country. One side effect of this circumstance is the success of domestic search engines relative to international, English-language engines.

As Korea's content sector has grown, so have the goals of the government's content promotion plans (figure 3.8). Convergence is a



**Table 3.5 Content Promotion Plans in Korea**

Year	Initiative
Framework plans and supporting policies	
1992	Information-use promotion plan
1998	Multimedia content industry promotion plan
1999–2002	Internet protocol and Internet service provider 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
1997	Korea Multimedia Content Promotion Centre
1998	Korea Software Industry Promotion Agency
2000	Software Industry Promotion Act
2000	Management of Digital Content Act
2002	Online Digital Contents Industry Advancement Act

Source: Ovum data.

**Figure 3.8 Evolving Goals of Content Promotion Policies in Korea**

Source: Korea Information Society Development Institute and Korea Software Industry Promotion Agency data.

current theme for the future development of the communications content industry, including digital content. The advanced platform integration that Korea has achieved is in part the result of the new possibilities provided 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 those 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 3.6).

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

- Light regulation to promote competition in the early, growth, and market maturity stages of broadband, through 2005
- Increased regulation from 2005 to 2007, 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.

**Table 3.6 Korea's Regulations for Broadband**

<b>Year</b>	<b>Regulation</b>
1997	Broadband is designated as a value-added service.
2000	Quality monitoring is extended to broadband.
2000–01	3G licenses are granted.
2002	Service-level agreements are introduced for broadband.
2002	Network access regulations are imposed.
2002	KT privatization is completed.
2002	LLU is introduced.
2004	Network access regulations are extended to fiber.
2005	Internet service provider peering regulation is introduced.
2005	Rights are granted to provide WiBro services.
2005	Pricing regulation is introduced.
2005	Broadband is recategorized as a facilities-based service.
2007	Roadmap is issued for telecommunications regulation.
2007–08	Bundling regulation is eased.
2008	Number portability is introduced for voice-over-Internet provider.
2008	Regulations are removed on handset subsidies.

Source: Ovum data.

The light regulatory approach adopted by the Ministry of Information and Communication (the former Ministry of Telecommunications) 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, the Ministry of Information and Communication adopted a heavier regulatory stance. In 2005, it introduced price regulation and reclassified broadband as facilities-based services. But the regulatory

environment has recently eased. For example, bundling regulations have eased, and regulation of mobile handset subsidies has been fully removed.

## Demand-Side Policy

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

- 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 (government for citizens—for example, home tax services); G4B (government for businesses—an e-procurement service for businesses contracting with the government); and G2G (government to government—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. They were implemented through an e-government roadmap that contained 31 policies, which arose as a result of government attempts to diversify and develop policies adapted to niche markets rather than from a lack of direction.

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

One of the 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 people with disabilities.

## 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 extremely 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 the following:

- Rapid expansion of supply and demand in the early stages of development of Korea's broadband market
- Growth in Internet use that was not limited to typical early adopters such as youth and the college-educated population
- Rapid expansion in trade of goods related to ICT and broadband.

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

- The government's long-term strategic planning

- The success of plans such as the Korea Information Infrastructure project and Cyber Korea 21 (a plan to develop the Korean Information Society by 2002)
- Liberalization of the telecommunications market and the creation of a highly competitive environment
- Demand-side drivers, including low broadband pricing.

The government's regulatory policies have also been successful, particularly in expanding competition in the broadband market.

## Notes

1. Unless otherwise stated, data in this chapter are from the Korea Communications Commission.
2. The complete case study on the Republic of Korea will be available at the Information for Development Program Web site, <http://www.infodev.org>.
3. Data are for 2009 and were provided by Strategy Analytics.
4. The broadband quality score is for 2009 and comes from Oxford University (United Kingdom) and Oviedo University (Spain).
5. Even though Korea is ranked 7 of 30 Organisation for Economic Co-operation and Development countries in penetration on a per capita basis, it remains the leader in both household and fiber/LAN (local area network)-based penetration, and Korean consumers enjoy some of the lowest monthly prices anywhere for megabits per second. Furthermore, the market is characterized by competition between technologies—digital subscriber line, cable, and fiber each have market shares of about one-third—and some of the fastest connections. Korea is also taking the lead in wireless broadband; it was one of the first countries to launch 3G mobile services, and estimates suggest that in 2008, it was among the largest markets in Asia for wireless broadband and commercial Wi-Fi operations (BMI 2008).
6. Another widespread international standard for mobile broadband, HSDPA is an evolution of W-CDMA (sometimes called 3G 3.5) offering transmission speeds of up to 14 megabits per second.

7. International Data Corporation's Information Society Index can be found at <http://www.idc.com/groups/isi/main.html>.
8. Data are from the United Nations E-Government Readiness Knowledge Base at <http://www2.unpan.org/egovkb>.
9. Following the beauty contest award of IMT-2000 (International Mobile Telecommunications-2000) licenses, the government imposed a contribution rate of 3 percent of total expected revenue (W 1.30 trillion for asynchronous technology operators and W 1.15 trillion for synchronous technology operators). At the time of the award, W 650 billion was levied, with the remainder to be charged in installments between 2007 and 2011.
10. The contribution rate was initially 0.75 percent of the previous year's total revenue for significant market power operators and 0.50 percent for other operators. But following revision of the Telecommunications Act in 2008, that rate was reduced to 0.15 percent for significant market power operators and 0.10 percent for other operators.

## References

- BMI (Business Monitor International). 2008. *The Future of WiMAX in Asia: Winners and Losers*. London: BMI.
- Czernich, Nina, Oliver Falck, Tobias Kretschmer, and Ludger Woessmann. 2009. "Broadband Infrastructure and Economic Growth." Working Paper 2861, Center for Economic Studies and Ifo Institute for Economic Research, Munich.
- Ihlwan, Moon, Cliff Edwards, and Peter Burrows. 2005. "Honing Its Digital Game." *BusinessWeek*, July 18. [http://www.businessweek.com/magazine/content/05\\_29/b3943061.htm?chan=tc](http://www.businessweek.com/magazine/content/05_29/b3943061.htm?chan=tc).
- ITU (International Telecommunication Union). 2003. "Broadband Korea: Internet Case Study." ITU, Geneva. [http://www.itu.int/ITU-D/ict/cs/korea/material/CS\\_KOR.pdf](http://www.itu.int/ITU-D/ict/cs/korea/material/CS_KOR.pdf).
- ITU (International Telecommunication Union) and UNCTAD (United Nations Conference on Trade and Development). 2007. *World Information Society Report 2007: Beyond WSIS*. Geneva: ITU and UNCTAD. <http://www.itu.int/wisr>.
- Rogers, Everett. 1995. *Diffusion of Innovations*. 4th ed. New York: Free Press.

UNDP (United Nations Development Programme). 2009. *Human Development Report*. New York: Palgrave MacMillan. <http://hdr.undp.org/en/reports/global/hdr2009>.

World Bank. 2009. *Information and Communications for Development 2009*. Washington, DC: World Bank.

World Economic Forum. 2009. *The Global Competitiveness Report 2009–2010*. New York: Palgrave MacMillan. <http://www.weforum.org/en/initiatives/gcp/Global%20Competitiveness%20Report/>.



# 4

## Experiences of Other Broadband Leaders

In addition to the Republic of Korea, this book 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 third-generation (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 used by those countries to develop their broadband ecosystems. It concludes with an analysis of the common elements in those approaches.<sup>1</sup>

### 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, a part of the universal service obligation. From June 2010, when the law comes into force, each Finnish citizen can expect to have a minimum connection speed of 1 megabit per second (Mbps) available. Finland aims to cover 99 percent of households with 100 Mbps connectivity by 2015.<sup>2</sup> In June 2009, 30 percent of inhabitants had fixed broadband access,

and 34 percent had 3G services. Finland has a population of about 5 million people, with 63 percent in urban areas. It also has among the world's highest GDP per capita—\$51,062 in 2008.<sup>3</sup>

Finland's support for broadband development relies primarily on market forces, augmented by significant public sector intervention when necessary.<sup>4</sup> 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.<sup>5</sup> But even for such instances of market failure, the federal subsidy amount cannot exceed one-third, with additional European Union (EU) and municipal support capped at another one-third—thereby requiring private participants to invest at least one-third of the cost.<sup>6</sup>

Finland's telecommunications industry has relied on market competition to drive growth. This reliance 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.<sup>7</sup> 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 shorter- and longer-term access goals articulated in its 2008 national broadband strategy (Ministry of Transport and Communications Finland 2008, 17). Penetration of wireless telephony reached 50 percent in 1998, prompting an early and precipitous decline in fixed wireline subscriptions. The latest data suggest that digital subscriber line (DSL) connections are now also falling as a result of mobile broadband substitution. Today, Finland has a robust mobile telecommunications market, with TeliaSonera Finland, Elisa, and DNA Finland offering attractive prices for services, including mobile broadband.<sup>8</sup> Moreover, the presence of a major wireless manufacturer, Nokia, contributes to information and communication technology (ICT) use 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 (Rouvinen and Ylä-Anttila 2003).

The government anticipates fixed WiMAX (worldwide interoperability for microwave access) broadband service serving 5 percent of Finnish households by 2015 with connection rates of 5 to 40 Mbps, mobile WiMAX serving 60 percent with rates of 5 to 100 or more Mbps, and conventional wireless serving 93 percent with rates of 5 to 100 or more Mbps. The government expects to achieve its goals with a funding mechanism that involves private investment, federal subsidies, and funding from local governments and the EU.

The government's goal of reaching 99 percent of permanent residences with 100 Mbps connections by 2015 will push the universalization of broadband. The government expects to achieve this goal with a funding mechanism that combines private investment, federal subsidies, and funding from local governments and the EU. The government expects that market conditions will support the evolution of such access for 95 percent of the population.

## France

France pursues broadband deployment by balancing a long-standing 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 strategy means that the 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 (see, for example, Nora and Minc 1980). The government launched the Minitel

videotex service in 1982, offering information and e-commerce services well before Internet-based options became available (Arnold 2003). 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, thereby ensuring lower-cost deployment of new fiber-optic networks. Although the regulated prices for ducts are quite low, France Telecom claims not to have any maps showing their locations, creating bottlenecks to competitive market entry.

The 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 (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 (Paul Budde Communication 2009).

The Digital France 2012 plan proposes widespread and affordable access to broadband (Besson 2008). 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, it will augment

networks by setting monthly access costs at a maximum of €35 for at least 512 kilobits per second (kbps) connection speeds. The French government has also announced a new plan (Grand Emprunt) worth €4.5 billion (\$6 billion) that will provide loans to high-tech companies, with some funding going to new broadband (Abboud 2009).

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 percent increase since the first quarter of 2007, with 17 percent penetration. The government expects 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 (Long Term Evolution),<sup>9</sup> in late 2008 (Ericsson 2008).

## 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.<sup>10</sup> This achievement is in part because of the nation's strategy to support widespread fiber-optic cable deployment, including the replacement of copper-based DSL technology and compulsory shared access<sup>11</sup> to fiber lines.<sup>12</sup> 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. Yet despite having some of the world's fastest speeds and lowest prices for broadband, its penetration rate is still below the Organisation for Economic Co-operation and Development (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 privatization initiatives that reshaped the industry and fostered competitive

alternatives to the incumbent carrier Nippon Telegraph and Telephone.<sup>13</sup> Since 2000, 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, in the Basic Law on the Formation of an Advanced Information and Telecommunications Network Society, the government set a goal of creating a society that used advanced telecommunications networks, which reduced gaps in access to ICT.<sup>14</sup> The government has also considered broadband development in the larger context of promoting digital literacy.<sup>15</sup>

To achieve its goal of ubiquitous access to ICT, the government has established policies designed to facilitate complete national access to high-speed Internet services by 2010 (Government of Japan 2006, 2007; Japan IT Strategic Headquarters 2006; Study Group on Systems in Ubiquitous Network Society 2006). The government combines regulatory policies promoting competition and cooperation, additional spectrum for wireless broadband services, and subsidization of terrestrial and satellite broadband backbone networks with an emphasis on reaching unserved rural locations. Japan will likely achieve near ubiquitous broadband access by 2010 thanks to its mix of facilities-based competition and government involvement.

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 television (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 practices in its wireless broadband network services marketplace in such key features as bit rate;<sup>16</sup> price (OECD 2009a, 2009b); and features.<sup>17</sup> In February 2009, there were 107 million mobile subscribers in Japan, resulting in a penetration rate of 83 percent (Hishinuma 2009). 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 circumstance allowed the maximization of infrastructure investments. But the “beauty contest” approach to allocating spectrum has limited market entry, especially from foreign investors, and may have limited innovation in the marketplace. The government now aims to bolster broadband capacity, performance, and competition by licensing new BWA (broadband wireless access) systems in the 2.545 to 2.625 gigahertz (GHz) band. Telecommunications firm KDDI will provide WiMAX and next-generation Personal Handy-phone Service, offering download speeds of 20 to 30 Mbps and upload speeds of 10 Mbps.

## 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 was built 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 nondiscriminatory 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 (Eskelinen, Frank, and Hirvonen 2008). The government has supported this interest 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 (Swedish Post and Telecom Agency 2009a). Traffic for mobile data services jumped 526 percent between 2007 and 2008 (Swedish Post and Telecom Agency 2009b). 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 Mbps (Swedish Post and Telecom Agency 2007). The strategy is a blend of grants, regulatory refinements, and changes in industry structure. The Swedish Post and Telecom Agency, which regulates the industry, will invest €864 million in broadband infrastructure, half of which will come from EU sources.<sup>18</sup> Grant recipients will have to install networks that meet the bit stream minimum and operate the networks in an open and nondiscriminatory 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. The lack of government investment may be due to unreasonable expectations for private investment.<sup>19</sup> As a result, the government is reexamining regulation and considering public-private partnerships to develop infrastructure and enable facilities-based competition. In 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 United Kingdom was spurred by a combination of vigorous facilities- and service-based competition. In 2002, broadband subscriptions over cable TV networks exceeded those using DSL, though the ubiquity of telephone networks has led DSL to capture much of the market today. But the presence of multiple broadband wireless providers, aggressive cable TV network operators, and recent FTTH (fiber to the home) deployments promise continued facilities-based competition. Service-based competition in the form of LLU has 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 LLU for network services provided by BT.<sup>20</sup> BT's structural separation into wholesale and retail ventures also stimulated competition (Openreach 2008). The market has become so competitive that regulator Ofcom is considering complete deregulation of basic wireline telephone services.<sup>21</sup>

Ofcom recognizes that regulation must support private investment and promote competition wherever there are potential barriers to it (Ofcom 2008b). It 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 4.1). One major proposal is to impose a universal broadband service obligation on carriers, with a minimum speed of 2 Mbps. 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 provide high-speed broadband to unserved localities.

The United Kingdom has a robust wireless telecommunications market, with five 3G operators, market entry by virtual network operators, and the rollout of 3G wireless networks capable of providing an

#### **Box 4.1 Digital Britain**

In 2009, the U.K. government sought to expedite broadband development, recognizing its potential in helping the country recover from a severe economic downturn. The *Digital Britain* report (BIS and DCMS 2009a) seeks to do the following:

- Complement and assist the private sector in delivering modern communications infrastructure built on new digital technologies.
- Enable the United Kingdom 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.
- Ensure that people have the skills to flourish in the digital economy and that everyone can participate in a digital society.
- Modernize and improve government services to taxpayers through digital procurement and digital delivery of public services.

**Box 4.1 continued**

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

- Modernize and upgrade wired, wireless, and broadcasting infrastructure to sustain the United Kingdom's position as a leading digital economy.
- Provide a favorable climate for investment and innovation in digital content, applications, and services.
- Deliver a range of high-quality public service content, particularly in news.
- Develop the nation's digital skills at all levels.
- Secure universal access to broadband, increase its adoption, and use 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-rate payers, and voter registration.

Sources: BIS and DCMS 2009a, 2009b; Technology Strategy Board 2009.

expanded array of services. The government aims to promote mobile broadband by expanding available spectrum and fostering competitive alternatives to cellular telephone service. Initiatives include reallocating broadcast TV spectrum in the 800 megahertz (MHz) band to mobile broadband services (exploiting the digital dividend), releasing new spectrum suitable for next-generation mobile technologies, and liberalizing the second-generation spectrum (Ofcom 2009a, 2009c).<sup>22</sup>

The government also will permit wireless carriers to retain their 3G spectrum indefinitely if they start building networks capable of providing 50 Mbps 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 in broadband growth. Accordingly, the government has begun developing its first national broadband strategy. This step 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 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.<sup>23</sup> 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.<sup>24</sup>

The United States has two major advantages for broadband development: extensive research and development (R&D) for ICT and competition between DSL and cable networks, both of which have extensive coverage and 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 lines, and broadband over power lines. Lines connecting homes and

businesses to the Internet at transmission speeds exceeding 200 kbps in both directions increased from 80.3 million to 88.4 million in the first half of 2008 (FCC 2009).

The presence of major telecommunications and information technology 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 almost \$25 billion to rolling out fiber-optic services to homes and wireless broadband networks.<sup>25</sup> 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,<sup>26</sup> 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 that in turn lead to slow 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 (Communication Workers of America 2006). But the country maintained a deregulated approach, assuming that the market would build enough capacity to meet the demand (Windhausen 2008). 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 a 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.

This strategy, released in March 2010, aims to facilitate and expedite the development and use of high-speed broadband infrastructure (FCC 2010). The regulator, the Federal Communications Commission, developed the strategy in consultation with a large group of stakeholders and with attention to a range of issues. Those issues 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 the status of broadband deployment (including related grant programs), and using broadband to create jobs and advance economic growth.

## Analyzing the Approaches of Broadband Leaders

The chapter now turns to an analysis of the common elements in the approaches of broadband leaders.

### Outcomes: A Cross-Country Comparison

A cross-country comparison of selected performance indicators is useful in evaluating the success of the various strategies followed by the countries profiled in this volume. Perhaps the most obvious indicator to use is the penetration of broadband subscribers per 100 inhabitants. As described in chapter 3, Korea has high penetration of both wireline and wireless broadband services. In June 2009, it ranked fifth among OECD countries, with fixed broadband penetration of 33 subscribers per 100 inhabitants. Korea has had the highest fixed broadband penetration among the case study countries since 2000, though its lead has narrowed over time.

In addition to having the highest subscriber rate, Korea has the highest penetration of fiber and metro Ethernet subscribers. For this reason, among others, it has some of the fastest speeds and lowest unit prices. At the other extreme, U.S. consumers have the lowest speeds and pay the second-highest unit prices among the case study countries (table 4.1).

**Table 4.1 Average Broadband Prices and Speeds in Case Study Countries, September–October 2008**

Country	Monthly price per advertised Mbps <sup>a</sup> (US\$)	Average advertised broadband download speed (kbps)
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, Rep. of	0.85	80,800

Source: OECD's Broadband Portal, <http://www.oecd.org/sti/ict/broadband>.

Note: Mbps = megabits per second; kbps = kilobits per second.

a. Measured in terms of purchasing power parity.

To carry out a more thorough cross-country comparison, extending beyond broadband to consider other ICT, one must use composite indexes. Several are available to choose from in the ICT sector. Table 4.2 shows the performance of the case study countries on four of the main indexes:

- The International Telecommunication Union (ITU)–United Nations Conference on Trade and Development (UNCTAD) Digital Opportunity Index (DOI)
- The ITU ICT Development Index (IDI)
- The World Economic Forum (WEF) *Global Information Technology Report* (GITR)
- The Nokia Siemens Network (NSN) Connectivity Scorecard.

If one bears in mind the variations in the methodologies used, the number of countries included in each index, the different dates, and the different indicators used, it is perhaps not surprising that no clear pattern emerges. For instance, Korea scores high on the DOI and IDI (which is consistent with the analysis in chapter 3) but poorly on the GITR and the Connectivity Scorecard. The United Kingdom

**Table 4.2 Performance of Case Study Countries in Selected ICT Indexes**

Country	ITU-UNCTAD Digital Opportunity Index (DOI)		ITU ICT Development Index (IDI)		WEF Global Information Technology Report (GITR)		NSN Connectivity Scorecard
	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. of	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
Number of economies included	180	181	154	154	82	134	16

Sources: For the DOI, ITU and UNCTAD 2007; for the IDI, ITU 2009; for the GITR, Dutta and Mia 2009; and for the Connectivity Scorecard, Waverman, Dasgupta, and Brooks 2009.

shows improved performance on the DOI, but its performance has deteriorated according to the GITR. The United States has the top score in the Connectivity Scorecard but is sixth of the seven countries on the DOI and IDI.

### Different Approaches with Common Elements

The countries studied have followed a range of approaches, drawing on their political, economic, social, and industrial endowments. The role played by the public sectors in those 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. On the one hand, 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 public-private partnerships.

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 their broadband ecosystems. For one, broadband strategies are a common feature among the countries studied. More important, all of the 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: (a) broadband strategies, which lay out broad goals, vision statements, and frameworks and programs to achieve them, and (b) 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. First, they focus on promoting incipient markets through a range of supply- and demand-side policies. Those 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 to drive growth. During that stage, the government exercises oversight through competition policy. Finally, as markets move toward maturity, the focus shifts to universalizing broadband to include underserved or unserved populations and communities.

Chapter 5 focuses on the development of such strategies and the creation of the institutional base to implement them. Chapter 6 describes the policies and programs that support those strategies, focusing on the evolution of the market through the three stages.

## Notes

1. The complete case studies of these countries will be available at the Information for Development Program Web site, <http://www.infodev.org>.
2. According to the Ministry of Transport and Communications Finland (2008, 7), "The target will be set that by 31 December 2015, an optical fibre 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." It should be noted, however, that a service providing 100 Mbps to within 2 kilometers translates to barely 10 Mbps at the premises because of the attenuation of the digital subscriber line signal.
3. Data are from the World Bank's World Development Indicators database.
4. Eskilinen, Frank, and Hirvonen (2008, 412) write, "Sweden, one of the first-movers in this field, already launched its national [information and communication technology] infrastructure program in 2000, whereas Finland published its broadband strategy in 2003. They represent the classical dualism in the sense that the Finnish strategy emphasizes the role of markets and technological neutrality, whereas the Swedish case takes a more interventionist stance, relying more on the public sector."
5. The Ministry of Transport and Communications Finland (2008, 6) states, "The State will only contribute to those costs of regional plans vital to the achievement of the target level for 2015." The government first articulated a national broadband strategy in 2004 (Ministry of Transport and Communications Finland 2004).
6. According to the Ministry of Transport and Communications Finland (2008, 26), "Inasmuch as the target level for 2015 is not achieved commercially, business subsidies not to exceed 67 percent of the costs will be given to upgrade the public telecommunications network. The subsidies will consist of a State contribution (no more than 33 percent), a contribution by regions and municipalities (ca. 27 percent), and a contribution from EU structural funds (ca. 7 percent)."
7. The Ministry of Transport and Communications Finland (2003, 20) notes, "Due to the multi-operator structure . . . Finland had no difficulties in introducing effective competition. The only action needed was to remove the obstacles for operators to compete, i.e., extend the licences to cover the competitors' former licence areas and former monopoly services."

8. See Finnish Communications Regulatory Authority (2008), which found that Finland had the lowest mobile call prices and mobile broadband subscription rates in Europe; see also Finnish Communications Regulatory Authority (2009).
9. LTE went live in December 2009 in Stockholm and Oslo, from TeliaSonera. That event shows the technology is already in place and potentially ready for other markets (see Malik 2009).
10. Data are from the Organisation for Economic Co-operation and Development's Broadband Portal, <http://www.oecd.org/sti/ict/broadband>.
11. This sharing has been particularly difficult because of the topology of the network that Nippon Telegraph and Telephone rolled out. It is impossible to unbundle one subscriber at a time, so competitive operators have to pay for a block of customers. Operators are still complaining that the unbundling process is too expensive because they have to pay for lines to users who do not subscribe just to gain one additional subscriber.
12. Atkinson, Correa, and Hedlund (2008, D1) state, "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 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."
13. Those strategies include 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 Mori 2007, 2008).
14. The Basic Law on the Formation of an Advanced Information and Telecommunications Network Society entered force on January 6, 2001. For more information, see chapter 1, article 8 ("Correction of Gaps in Opportunities for Use, etc.") of the law at [http://www.kantei.go.jp/foreign/it/it\\_basiclaw/it\\_basiclaw.html](http://www.kantei.go.jp/foreign/it/it_basiclaw/it_basiclaw.html). See also the Outline of the First Follow-up of the Action Plan of the Basic Guidelines toward the Promotion of an Advanced Information and Telecommunications Society, dated May 19, 2000, at <http://www.kantei.go.jp/foreign/it/2000/0706outline.html>, and the Basic Guidelines toward the Promotion of an Advanced Information and Telecommunications Society, adopted in 1995, and revised in 1998, <http://www.kantei.go.jp/foreign/990209guideline-ait.html>.
15. The Ministry of Internal Affairs and Communications (n.d.) states, "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."

16. According to *Forbes* magazine, "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 (Schoenberger 2008).
17. Browne, Rogowski, and Geller (2007) state, "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."
18. Atkinson, Correa, and Hedlund (2008, viii) write, "The Swedish government aggressively used subsidies to spur broadband deployment, particularly in rural areas of the country. It allocated a total of more than \$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."
19. According to the U.K. Office of Telecommunications (2001, section 3.1), "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."
20. Ofcom (2008a, 201) acknowledges that "although 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." The monthly rental cost of an LLU line is currently £1.30 for DSL broadband services and £7.20 for voice and broadband (Ofcom 2008a).

21. Ofcom (2009b, section 1.26) states, "We are also proposing to remove regulation from parts of the wholesale narrowband market as well as all remaining retail narrowband obligations on BT."
22. Ofcom proposed to remove the technology restrictions that currently apply to these bands. In the first instance, Ofcom would allow 3G (Universal Mobile Telecommunications System) technology to be used in the 900 MHz and 1,800 MHz bands, and in the longer term, it would allow any technology that will not cause harmful interference to neighboring users to be deployed in both these bands and the 2.1 GHz band. It would allow spectrum in those bands to be traded so that users who can make best use of this spectrum have the opportunity to gain access to it through commercial negotiation rather than through regulatory intervention; require the current holders of the 900 MHz spectrum (Vodafone and O2) to give up a portion of the 900 MHz spectrum they hold ( $2.0 \times 2.5$  MHz each, out of a total of  $2.0 \times 17.4$  MHz each) to allow a third operator to have access to this particularly important spectrum. Finally, Ofcom would review the level of administered incentive pricing applied to the 900 MHz and 1,800 MHz spectrum so that in the future it reflects the full economic value of this spectrum after liberalization, to encourage its efficient use.
23. See, for example, Mueller (1997), who reports 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 to require the Federal Communications Commission to encourage the deployment, on a reasonable and timely basis, of advanced telecommunications capability to all inhabitants and to initiate a notice of inquiry to determine the availability of such services. See the Telecommunications Act of 1996, section 706, "Advanced Telecommunications Incentives," P.L. 104-104, 110 Stat. 56 (1996), codified at 47 U.S.C. §706 (2008).
24. The American Recovery and Reinvestment Act of 2009 allocates \$4.7 billion to the National Telecommunications and Information Administration and \$2.5 billion to the U.S. Department of Agriculture's Rural Utilities Service Telecommunications Program to encourage investment in and use of broadband services by awarding grants, loans, and loan guarantees.
25. Verizon has committed \$18 billion to its national fiber-optic network, has spent about \$5 billion acquiring spectrum, and expects to spend about \$1.3 billion on the rollout of an associated LTE network (Gibbs 2009; Higginbotham 2008; Raynovich 2006).
26. In 2007, the U.S. Federal Communications Commission wrote, "There is substantial competition in the provision of Internet access services," (FCC

2007, 5724–25). In 2008, it stated that “advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion” (FCC 2008, 9616). However, the OECD ranks the United States 15th among OECD nations in market penetration per 100 inhabitants (see OECD 2009c: table 1d). The Information Technology and Innovation Foundation (2008) also places the United States in the 15th position (see also Kelly 2009; Turner 2007).

## References

Abboud, Leila. 2009. “France May Inject up to S\$6 Bln in High-Tech, Fibre.” Reuters, November 17. <http://www.reuters.com/article/idUSLH57553920091117>.

Arnold, James. 2003. “France’s Minitel: 20 Years Young.” BBC News, May 14. <http://news.bbc.co.uk/2/hi/business/3012769.stm>.

Atkinson, Robert D., Daniel K. Correa, and Julie A. Hedlund. 2008. *Explaining International Broadband Leadership*. Washington, DC: Information Technology and Innovation Foundation. <http://www.itif.org/files/ExplainingBBLedership.pdf>.

Besson, Éric. 2008. “France Numérique 2012: Plan de Développement de l’Économie Numérique.” Paris: Government of France. <http://lesrapports.ladocumentationfrancaise.fr/BRP/084000664/0000.pdf>.

BIS (U.K. Department for Business, Innovation, and Skills) and DCMS (U.K. Department for Culture, Media, and Sport). 2009a. *Digital Britain*. London: Stationery Office. <http://www.culture.gov.uk/images/publications/digitalbritain-finalreport-jun09.pdf>.

———. 2009b. “Digital Britain: Implementation Plan.” BIS and DCMS, London. [http://www.culture.gov.uk/images/publications/DB\\_ImplementationPlanv6\\_Aug09.pdf](http://www.culture.gov.uk/images/publications/DB_ImplementationPlanv6_Aug09.pdf).

Browne, Jonathan, Ron Rogowski, and Steven Geller. 2007. *How Japanese Companies Guide Their Customers to Mobile Internet Experiences: Firms Use Embedded Device Capabilities to Improve Mobile Internet Usability*. Cambridge, MA: Forrester.

Communication Workers of America. 2006. “Speed Matters: Affordable High-Speed Internet for All.” Policy Paper, Communication Workers of America, Washington, DC. <http://files.cwa-union.org/speedmatters/SpeedMattersCWAPositionPaper.pdf>.

Dutta, Soumitra, and Irene Mia, eds. 2009. *The Global Information Technology Report 2008–2009*. Geneva: World Economic Forum. <http://www.weforum.org/en/initiatives/gcp/Global%20Information%20Technology%20Report/PastReports/>.

Ericsson. 2008. "Ericsson France Launches Pilot LTE Network." Press release, Ericsson, Stockholm. [http://www.ericsson.com/ericsson/news/archive/2008/081107\\_lte.shtml](http://www.ericsson.com/ericsson/news/archive/2008/081107_lte.shtml).

Eskelinen, Heikki, Lauri Frank, and Timo Hirvonen. 2008. "Does Strategy Matter? A Comparison of Broadband Rollout Policies in Finland and Sweden." *Telecommunications Policy* 32 (6): 412–20.

FCC (Federal Communications Commission). 2007. "AT&T Inc. and BellSouth Corporation Application for Transfer of Control, Memorandum Opinion and Order." *FCC Record* 22 (6): 5662–841.

———. 2008. "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. *FCC Record* 23 (11): 9615–90. [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/FCC-08-88A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-08-88A1.pdf).

———. 2009. "High-Speed Services for Internet Access: Status as of June 30, 2008." Industry Analysis and Technology Division, Wireline Competition Bureau, FCC, Washington, DC. [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/DOC-292191A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-292191A1.pdf).

———. 2010. *Connecting America: The National Broadband Plan*. Washington, DC: FCC. <http://www.broadband.gov/download-plan/>.

Finnish Communications Regulatory Authority. 2008. "Mobile Call Prices 2008: International Comparison." Finnish Communications Regulatory Authority, Helsinki. [http://www.ficora.fi/attachments/suomimq/5yXxCdGU9/Mobile\\_Call\\_Prices\\_2008\\_-International\\_Comparison.pdf](http://www.ficora.fi/attachments/suomimq/5yXxCdGU9/Mobile_Call_Prices_2008_-International_Comparison.pdf).

———. 2009. "Market Review 1/2009: The International Communications Markets." Finnish Communications Regulatory Authority, Helsinki. [http://www.ficora.fi/attachments/5i5K1R7Jv/2009\\_1\\_Market\\_review.pdf](http://www.ficora.fi/attachments/5i5K1R7Jv/2009_1_Market_review.pdf).

Gibbs, Colin. 2009. "Verizon Spearheads Effort to Pour \$1.3B into LTE." GigaOM Network, San Francisco, CA. <http://www.gigaom.com/2009/10/05/verizon-spearheads-effort-to-pour-1-3b-into-lte>.

Government of Japan. 2006. "Science and Technology: Basic Plan." Government of Japan, Tokyo. <http://www8.cao.go.jp/cstp/english/basic/3rd-Basic-Plan-rev.pdf>.

———. 2007. *Long-Term Strategic Guidelines: "Innovation 25."* Tokyo: Government of Japan. [http://www.kantei.go.jp/foreign/innovation/innovation\\_final.pdf](http://www.kantei.go.jp/foreign/innovation/innovation_final.pdf).

Higginbotham, Stacey. 2008. "Verizon and AT&T Score in 700MHz Auction." GigaOM Network, San Francisco. <http://www.gigaom.com/2008/03/20/verizon-and-att-score-in-700mhz-auction>.

Hishinuma, Hiroyuki. 2009. "ICT Policy in Japan: Broadband and Mobile." Presentation at the Ministry of Internal Affairs and Communications, Tokyo, April 16. [http://www.soumu.go.jp/main\\_sosiki/joho\\_tsusin/eng/presentation/pdf/090416\\_1.pdf](http://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/presentation/pdf/090416_1.pdf).

Information Technology and Innovation Foundation. 2008. "2008 ITIF Broadband Rankings." Information Technology and Innovation Foundation, Washington, DC. <http://www.itif.org/files/2008BBRankings.pdf>.

ITU (International Telecommunication Union). 2009. *Measuring the Information Society: The ICT Development Index*. Geneva: ITU. <http://www.itu.int/ITU-D/ict/publications/idi/2009/>.

ITU (International Telecommunication Union) and UNCTAD (United Nations Conference on Trade and Development). 2007. *World Information Society Report 2007: Beyond WSIS*. Geneva: ITU and UNCTAD. <http://www.itu.int/wisr>.

Japan IT Strategic Headquarters. 2006. "New IT Reform Strategy: Realizing Ubiquitous and Universal Network Society Where Everyone Can Enjoy the Benefits of IT." Japan IT Strategic Headquarters, Tokyo. <http://www.kantei.go.jp/foreign/policy/it/ITstrategy2006.pdf>.

Kelly, Tim. 2009. "International Lessons." Presentation at the Federal Communications Commission workshop on International Lessons for Broadband Policy, Washington, DC, August 18. [http://www.broadband.gov/docs/ws\\_int\\_lessons/ws\\_int\\_lessons\\_kelly.pdf](http://www.broadband.gov/docs/ws_int_lessons/ws_int_lessons_kelly.pdf).

Malik, Om. 2009. "Stockholm, Oslo First to Get Commercial LTE." GigaOM Network, San Francisco. <http://gigaom.com/2009/12/14/teliasonera-lte-4g/>.

Ministry of Internal Affairs and Communications. No date. "Digital Opportunity Site: Efforts in the Education Sector." Ministry of Internal Affairs and Communications, Tokyo. <http://www.dosite.go.jp/e/pj/education.html>.



Ministry of Transport and Communications Finland. 2003. *Finnish Telecom Policy*. Helsinki: Ministry of Transport and Communications Finland. <http://www.lvm.fi/filesserver/finnish%20telecom%20policy.pdf>.

———. 2004. *Government Resolution on Finland's National Broadband Strategy*. Helsinki: Ministry of Transport and Communications Finland. <http://www.laajakaistainfo.fi/english/strategy.php>.

———. 2008. "Making Broadband Available to Everyone: The National Plan of Action to Improve the Infrastructure of the Information Society." Ministry of Transport and Communications Finland, Helsinki. [http://www.lvm.fi/c/document\\_library/get\\_file?folderId=57092&name=DLFE-4311.pdf](http://www.lvm.fi/c/document_library/get_file?folderId=57092&name=DLFE-4311.pdf).

Mori, Kiyoshi. 2007. "Qualifying, Quantifying, and Meeting the Challenge of Internet Access Cost: Development of the Access Environment in Japan and Future Policy Themes." Presentation at the Second Internet Governance Forum Meeting, Rio de Janeiro, Brazil, November 13. [http://www.soumu.go.jp/main\\_sosiki/joho\\_tsusin/eng/presentation/pdf/071113\\_1.pdf](http://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/presentation/pdf/071113_1.pdf).

———. 2008. "ICT Research and Development by MIC." Presentation at the 2008 EU-Japan Cooperation Forum on ICT Research, Ministry of Internal Affairs and Communications, Tokyo, March 4. [http://www.soumu.go.jp/main\\_sosiki/joho\\_tsusin/eng/presentation/pdf/080304\\_1.pdf](http://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/presentation/pdf/080304_1.pdf).

Mueller, Milton L. 1997. *Universal Service Competition, Interconnection, and Monopoly in the Making of the American Telephone System*. Washington, DC: American Enterprise Institute Press.

Nora, Simon, and Alain Minc. 1980. *The Computerization of Society: A Report to the President of France*. Cambridge, MA: MIT Press.

OECD (Organisation for Economic Co-operation and Development). 2009a. "Mobile Broadband: Pricing and Services." Directorate for Science, Technology and Industry, Committee for Information, Computer and Communications Policy, and Working Party on Communication Infrastructures and Services Policy, OECD, Paris. <http://www.oecd.org/dataoecd/26/19/43280727.pdf>.

———. 2009b. "Mobile Phone Calls Lowest in Finland, Netherlands and Sweden, Says OECD Report." OECD, Paris. [http://www.oecd.org/document/20/0,3343,en\\_2649\\_34225\\_43471316\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/20/0,3343,en_2649_34225_43471316_1_1_1_1,00.html).

———. 2009c. "Penetration." OECD Broadband Portal, Paris. [http://www.oecd.org/document/54/0,3343,en\\_2649\\_34225\\_38690102\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/54/0,3343,en_2649_34225_38690102_1_1_1_1,00.html).

Ofcom. 2008a. *The Communications Market 2008*. London: Ofcom. <http://www.ofcom.org.uk/research/cm/cmr09/>.

———. 2008b. *Delivering Super-Fast Broadband in the U.K.: Setting the Right Policy Framework*. London: Ofcom. [http://www.ofcom.org.uk/consult/condocs/nga\\_future\\_broadband](http://www.ofcom.org.uk/consult/condocs/nga_future_broadband).

———. 2009a. *Application of Spectrum Liberalisation and Trading to the Mobile Sector*. London: Ofcom. <http://www.ofcom.org.uk/consult/condocs/spectrumlib/spectrumlib/>.

———. 2009b. "Impact of the Strategic Review of Telecoms." Ofcom, London. [http://www.ofcom.org.uk/telecoms/btundertakings/impact\\_srt/impact\\_srt\\_full\\_doc.pdf](http://www.ofcom.org.uk/telecoms/btundertakings/impact_srt/impact_srt_full_doc.pdf).

———. 2009c. *Mostly Mobile: Ofcom's Mobile Sector Assessment, Second Consultation*. London: Ofcom. <http://www.ofcom.org.uk/consult/condocs/msa/msa.pdf>.

Openreach. 2008. "Keeping the U.K. Connected." Openreach, London. [http://www.openreach.co.uk/orpg/aboutus/Downloads/web\\_corp\\_brochure.pdf](http://www.openreach.co.uk/orpg/aboutus/Downloads/web_corp_brochure.pdf).

Paul Budde Communication. 2009. *France: Broadband Market Overview, Statistics, and Forecasts*. Sydney: Paul Budde Communication. <http://www.budde.com.au/Research/France-Broadband-Market-Overview-Statistics-Forecasts.html>.

Raynovich, R. Scott. 2006. "Verizon to Pump \$18B into FiOS by 2010." *Light Reading*, September 27. [http://www.lightreading.com/document.asp?doc\\_id=104704](http://www.lightreading.com/document.asp?doc_id=104704).

Rouvinen, Petri, and Pekka Ylä-Anttila. 2003. "Case Study: Little Finland's Transformation to a Wireless Giant." In *The Global Information Technology Report 2003–2004*, ed. Soumitra Dutta, Bruno Lanvin, and Fiona Paua, 87–108. New York: Oxford University Press.

Schoenberger, Chana R. 2008. "Japan's Fastest Wireless Network." *Forbes*, March 24. <http://www.forbes.com/forbes/2008/0324/062.html>.

Study Group on Systems in Ubiquitous Network Society. 2006. "Aiming to Develop Frameworks That Use Vigor and Creativity, and That Provide Security." Ministry of Internal Affairs and Communications, Tokyo. [http://www.soumu.go.jp/main\\_sosiki/joho\\_tsusin/eng/pdf/ubi\\_report1.pdf](http://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/pdf/ubi_report1.pdf).

Swedish Post and Telecom Agency. 2007. *Proposed Broadband Strategy for Sweden*. Report PTS-ER-2007:7. Stockholm: Swedish Post and Telecom Agency. [http://www.pts.se/upload/Documents/EN/Proposed\\_broadband\\_strategy\\_eng.pdf](http://www.pts.se/upload/Documents/EN/Proposed_broadband_strategy_eng.pdf).

———. 2009a. “Mobile Broadband and Fibre Are Showing Rapid Growth in the Broadband Market.” Press release, Swedish Post and Telecom Agency, Stockholm, June 9. <http://www.pts.se/en-gb/News/Press-releases/2009/Mobilt-bredband-och-fiber-snabbvaxare-pa-bredbandsmarknaden/>.

———. 2009b. “The Swedish Telecommunications Market 2008: PTS-ER-2009:21.” Press release, Swedish Post and Telecom Agency, Stockholm, June 9. <http://www.pts.se/en-gb/Documents/Reports/Telephony/2009/The-Swedish-Telecommunications-Market-2008---PTS-ER-200921>.

Technology Strategy Board. 2009. “Our Strategy for ‘Digital Britain.’” Technology Strategy Board, Swindon, U.K. [http://www.innovateuk.org/\\_assets/pdf/Corporate-Publications/TSB\\_DigitalBritainstrategy.pdf](http://www.innovateuk.org/_assets/pdf/Corporate-Publications/TSB_DigitalBritainstrategy.pdf).

Turner, S. Derek. 2007. “‘Shooting the Messenger’: Myth vs. Reality: U.S. Broadband Policy and International Broadband Rankings.” Free Press, Washington, DC. [http://www.freepress.net/files/shooting\\_the\\_messenger.pdf](http://www.freepress.net/files/shooting_the_messenger.pdf).

U.K. Office of Telecommunications. 2001. “Delivering a Competitive Broadband Market: Oftel’s Regulatory Strategy for Broadband.” U.K. Office of Telecommunications, London. <http://www.ofcom.org.uk/static/archive/oftel/publications/broadband/other/stratb1201.htm>.

Waverman, Leonard, Kalyan Dasgupta, and Nicholas Brooks. 2009. “Connectivity Scorecard 2009.” Nokia Siemens Networks, Espoo, Finland. <http://www.connectivityscorecard.org/images/uploads/media/TheConnectivityReport2009.pdf>.

Windhausen, John Jr. 2008. “A Blueprint for Big Broadband.” White Paper, EDUCAUSE, Washington, DC. <http://net.educause.edu/ir/library/pdf/EPO0801.pdf>.



# 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. On the basis of 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 in 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 a government's role should be in expanding broadband diffusion. Traditionally, the public sector has played two roles in promoting information and communication technology (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 an early stage in a few advanced countries, would also grow under minimal government intervention, 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 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 Organisation for Economic Co-operation and Development (OECD) report states, “[T]he private sector should take the lead in developing well-functioning broadband markets, but there are clearly some circumstances in which government intervention is justified” (OECD 2008, 12).

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, those plans suggest that the question is no longer whether public investment has a role but rather how such programs should be designed and implemented.

As the country surveys in chapter 4 of this book show, governments are playing a greater role in broadband market development through a range of strategies and policies. Six of the seven countries studied stimulated supply, demand, or both. Only the United States did not have an explicit broadband strategy, instead relying primarily on market forces. But that too has changed, with a U.S. broadband strategy issued in March 2010.

Hence, the 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 early stage of market development, aggressive policies to generate demand, expand networks, and reach underserved areas and communities are needed. Yet the basic principle remains the same: governments should intervene only on the basis of sound economic principles, when the benefits of intervention outweigh the costs.

Government roles in broadband should include developing national strategies—as many middle-income countries are doing (box 5.1)—and that framework should aim to promote efficiency and equity,

### **Box 5.1 Broadband Strategies in Middle-Income Countries**

#### **Chile**

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 the demand sides. Four WiMAX (worldwide interoperability for microwave access) operators include regional providers, and to introduce a new operator, the regulator plans to award additional spectrum for a third-generation 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 Web sites. In June 2009, Chile's fixed broadband penetration was 10 percent, while mobile broadband penetration was 2 percent.

#### **Turkey**

Turkey 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 2006–10 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

*(continued)*

**Box 5.1 continued**

of broadband fixed wireless access networks in the 2.4 and 3.5 gigahertz bands. In June 2009, Turkey had penetration rates of 9 percent for fixed broadband and 4 percent for mobile broadband.

**Malaysia**

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, third-generation, and FTTH (fiber to the home) 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. In that deal, the government will invest RM 2.4 billion (\$700 million) in the project over 10 years, with Telekom Malaysia covering the remaining costs. The scheme has an expected total cost of RM 11.3 billion (\$3.3 billion).

*Sources:* For Chile, the Ministry of Economy's Digital Strategy database and TeleGeography's GlobalComms database. For Turkey, State Planning Organization 2006. For Malaysia, MyICMS 2006.

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 typically have formulated vision statements and established 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, 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 5.2).

Even market economies that initially resisted public broadband strategies have changed their minds. 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 (BIS and DCMS 2009). Similarly, in the United States—after 10 years of debate, during which the country fell from 2nd to 15th in OECD broadband rankings (Kelly 2009)—the Obama administration announced the development of a national broadband plan coordinated by the regulator, the U.S. Federal Communications Commission (FCC).<sup>1</sup>

Those national broadband strategies share some common elements. In line with the traditional goals of government, the 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 early stages of market development. Countries are also beginning to evaluate the environmental impacts of broadband.

## Making Markets Work More Efficiently

Because private companies have supplied most broadband networks, services, and applications, some people might argue no failures have

### **Box 5.2 Using Strategies Strategically: Raising Awareness and the Profile of Broadband**

Governments use broadband strategies to detail goals on what the economy and society will look like after broadband adoption, bringing broadband onto 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. Doing so brings broadband to the attention of citizens, who will use broadband and reap its benefits.

This approach strengthens the position of broadband in the national agenda, with ICT policy makers and agencies raising the awareness of high-level political actors such as the head of state, legislature, and ministries. Support from those entities is essential to implement policy. To obtain such support, ICT policy makers 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 when restructuring is complete, the policies will gain much more momentum and efficiency.

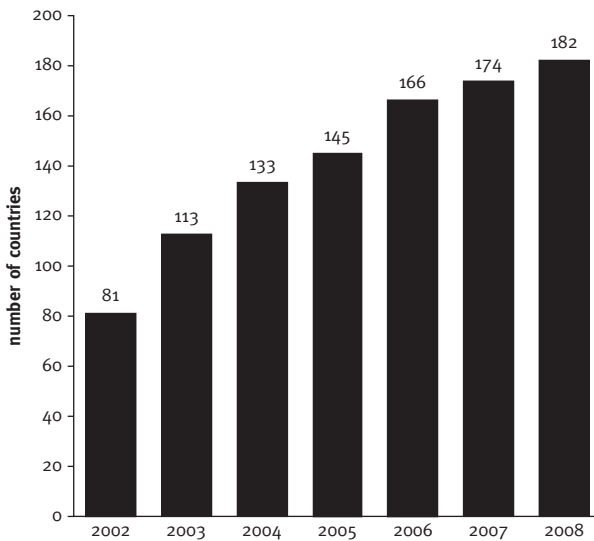
One of the key success factors for Korea's broadband policy implementation was convincing the president and National Assembly of the importance of the information society and broadband adoption. Once national leaders became champions of broadband, they generated a strong will to expand the market and made efforts to persuade 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.

*Source:* Authors' analysis.

occurred in the broadband market. In 2008, broadband services were available in 182 countries (figure 5.1), and by the end of 2009, there were more than 1 billion fixed and mobile broadband users.

But just as failures occur in other markets for public infrastructure, market failures occur 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 developing effective competition in the broadband market.

**Figure 5.1 Number of Countries with Commercially Available Broadband, 2002–08**



Source: International Telecommunication Union data.

Note: Broadband is defined as speeds of at least 256 kilobits per second.

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 those market failures. For example, a competition-friendly authorization regime alone is not sufficient if the interconnection or spectrum assignment regime is anticompetitive or favors a small group of service providers.

Governments around the world have recognized those 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.

Competition between services or networks will always be the basic requirement for successful broadband markets. Every country surveyed for this book has policy and regulatory frameworks that promote competition. Though approaches differ—some use facility-based competition, while others have chosen 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 of this book, 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 the case with other types of ICT, provision of broadband—for instance, using digital subscriber line (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 because of discrimination based on location.

This challenge has led governments to consider a more active approach to ensuring that broadband is available throughout their territories. As table 5.1 suggests, broadband strategies typically include goals for broadband coverage, access, and service quality (Li and Losey 2009).

Korea and Singapore have set goals of reaching connection speeds of at least 1 gigabit per second (Gbps) by 2012. Korea has also adopted a comprehensive broadband strategy focused on providing operators with financial incentives to invest in their networks (see, for example, ITU 2003). European countries such as France (Williams 2008) and Sweden (Atkinson, Correa, and Hedlund 2008) have used a mix of demand aggregation, public-private partnerships, and universal service obligations to ensure the widespread availability of broadband. Norway 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 (OECD 2008). 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).

**Table 5.1 Broadband Strategies and Service Goals in the Surveyed Countries**

<b>Country</b>	<b>National broadband strategy (year)</b>	<b>Broadband service goals</b>
Finland	Broadband National Strategy (2008)	By 2010, all citizens will have the legal right to 1 Mbps access at affordable levels. By the end of 2015, 99% of permanent residences should have access, within 2 kilometers, to a fiber-optic or cable network delivering 100 Mbps service.
France	Digital France 2012 (2008)	By 2012, there will be ubiquitous access to 512 kbps service at monthly rates of €35 or less.
Japan	eJapan strategy (2001, updated at intervals)	By 2010, a self-sustaining ICT society will exist with ubiquitous high-speed broadband services and ultra-high-speed service in urban locales.
Korea, Rep. of	U-Korea Master Plan (2006)	By 2010, there will be 20 million subscribers (40% of the population) with 50–100 Mbps service. A plan for 1 Gbps connectivity is being prepared (Malik 2009).
Sweden	Broadband Strategy for Sweden (2007)	By 2010, there will be near ubiquitous access to 2 Mbps service.
United Kingdom	Digital Britain (2009)	By 2012, 2 Mbps service will be available to all households (proposed).
United States	National Broadband Plan (2010)	By 2020, at least 100 million U.S. homes should have affordable access to actual download speeds of at least 100 Mbps and actual upload speeds of at least 50 Mbps.

Source: Authors' compilation from various sources.

Note: Gbps = gigabits per second; kbps = kilobits per second; Mbps = megabits per second.

As noted, broadband investment has also recently been featured in fiscal stimulus plans around the world. Broadband is seen as providing a quick win in those 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 discussed earlier, 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 (access to networks and services) and the demand (adoption by businesses, government, and households) for it. As a result, demand facilitation is 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, especially in rural and remote areas. Hence, governments need to assist development by raising public awareness and stimulating demand.

Demand can be facilitated in several ways (see chapter 6). One way is for government or public agencies to become anchor tenants for broadband services, thereby 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 the government to use in efforts to increase demand among users (table 5.2). 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 have to fill only the remaining gaps (such as training for people with disabilities or the elderly or access for schools in remote areas).

## Addressing 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 to 3 percent of global greenhouse gas emissions, and this share is likely to increase. The problem is caused in part by the use of always-on services such as broadband, as well as the trend toward devices and networks with higher power consumption.

**Table 5.2 The Three Pillars of Facilitating Broadband Demand among Users**

<b>Accessibility</b>	<b>Affordability</b>	<b>Attractiveness</b>
<ul style="list-style-type: none"> <li>■ Setting up broadband access centers, telecenters, kiosks, and other public access points</li> <li>■ Connecting educational institutions to broadband networks</li> <li>■ Providing wireless Internet services in public spaces such as airports and business districts</li> <li>■ Training all citizens to access and use broadband through digital literacy programs</li> </ul>	<ul style="list-style-type: none"> <li>■ Lowering the cost of user terminals by reducing import duties and other taxes or providing targeted subsidies</li> <li>■ Subsidizing broadband equipment used in educational institutions</li> <li>■ Providing consumers with information on providers, pricing options, and available technology</li> </ul>	<ul style="list-style-type: none"> <li>■ Supporting local, relevant Internet content in local languages</li> <li>■ Putting government and public information online and creating e-government and other e-applications (such as those for health, education, and agriculture)</li> <li>■ Providing a legal framework for e-commerce and other applications</li> <li>■ Educating citizens about the benefits of broadband</li> <li>■ Promoting broadband use to businesses and communities</li> </ul>

Source: Authors' compilation.

The transmission capacity of different generations of network access technology is doubling about every year. All factors 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 (Humphrey 2006). 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 the market is unlikely to pursue this path without government pressure or incentives. The European Union has developed power-saving codes for digital television set-top boxes, external power supplies, uninterruptible power supplies, 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 (Climate Group 2008). Again, some government guidance might be needed to achieve this reduction, such as incentives for telecommuting or support for remote collaboration.

## Tracking the Evolution of Broadband Strategies

Strategies set the stage for policies, programs, and regulatory measures that implement the vision. In that respect, strategies 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, those strategies will also have to be revised and different policies enacted. As discussed earlier, 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. But in later stages, 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 Mbps (megabits per second) to service at 1 Gbps. As the range of applications and types of content available increase with such qualitative transformations, so too must the approach of government change 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.** In the early stage, 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 barriers to market entry). 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, thereby allowing 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 early stage of broadband adoption.

The demand-side focus promotes broadband adoption and use and also enables wider inclusion of otherwise underserved or unserved 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; to guard against monopolistic, oligopolistic, and unfair practices; and to 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, a government's role moves to creating an online environment that is safe for businesses, households, and children.

**Universalization.** Universalization policies address economic goals but also contain social elements based on equity. As broadband markets mature, 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. Those 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 various programs and policies. Some of those institutions might be obvious, such as ICT industry regulators, whereas new agencies may implement specific programs. But other agencies could also have a role in implementing broadband strategies. For instance, competition regulators, trade ministries, and finance departments might support broadband development by ensuring level playing fields, easing restrictions on equipment imports, and providing tax breaks. And line ministries such as health, agriculture, education, and public administration may play a role in supporting content development, bringing their services online, and 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, in which a single organization took the entire responsibility for implementing policy, thereby 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 cooperation from the ministries involved.

But political circumstances often restrain 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 this separated management of policies, those organizations have maintained efficiency through their capacity for policy coordination.

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

## Note

1. The American Recovery and Reinvestment Act of 2009 was signed into law by President Barack Obama on February 17, 2009. The FCC is currently working in coordination with the National Telecommunications and Information Administration to perform its role under the act. Specifically, in conjunction with the Broadband Technology Opportunities Program established by the act, the FCC was tasked with creating a National Broadband Plan by February 17, 2010. The FCC released its plan in March 2010. See <http://www.broadband.gov> for more information.

## References

Atkinson, Robert D., Daniel K. Correa, and Julie A. Hedlund. 2008. *Explaining International Broadband Leadership*. Washington, DC: Information Technology and Innovation Foundation. <http://www.itif.org/files/ExplainingBBLeadership.pdf>.

BIS (U.K. Department for Business, Innovation, and Skills) and DCMS (U.K. Department for Culture, Media, and Sport). 2009. *Digital Britain*. London: Stationery Office. <http://www.culture.gov.uk/images/publications/digitalbritain-finalreport-jun09.pdf>.

Climate Group. 2008. "Smart 2020: Enabling the Low Carbon Economy in the Information Age." Creative Commons, San Francisco, CA. <http://www.smart2020.org>.

Humphrey, Les. 2006. "Opportunities and Techniques for Power Saving in DSL." Presentation at the International Telecommunication Union SQ15 Low Power Tutorial Session, Geneva, February 14. [http://www.itu.int/dms\\_pub/itu-t/oth/09/05/T09050000010003PDFE.pdf](http://www.itu.int/dms_pub/itu-t/oth/09/05/T09050000010003PDFE.pdf).

ITU (International Telecommunication Union). 2003. "Broadband Korea: Internet Case Study." ITU, Geneva. [http://www.itu.int/ITU-D/ict/cs/korea/material/CS\\_KOR.pdf](http://www.itu.int/ITU-D/ict/cs/korea/material/CS_KOR.pdf).

Kelly, Tim. 2009. "International Lessons." Presentation at the Federal Communications Commission workshop on International Lessons for Broadband Policy, Washington, DC, August 18. [http://www.broadband.gov/docs/ws\\_int\\_lessons/ws\\_int\\_lessons\\_kelly.pdf](http://www.broadband.gov/docs/ws_int_lessons/ws_int_lessons_kelly.pdf).

Li, Chieh-yu, and James Losey. 2009. "100 Megabits or Bust! An Overview of Successful National Broadband Goals from around the Globe." New America Foundation, Washington, DC. [http://wirelessfuture.newamerica.net/publications/policy/100\\_megabits\\_or\\_bust](http://wirelessfuture.newamerica.net/publications/policy/100_megabits_or_bust).

Malik, Om. 2009. "By 2012, Koreans Will Get 1Gbps Broadband Connections." GigaOM Network, San Francisco, CA. <http://gigaom.com/2009/02/01/by-2012-koreans-will-get-a-gigabit-per-second-broadband-connection>.

MyICMS (Malaysian Communications and Multimedia Commission). 2006. "MyICMS 886 Strategy." Ministry of Energy, Water, and Communications, Kuala Lumpur.

OECD (Organisation for Economic Co-operation and Development). 2008. *Broadband Growth and Policies in OECD Countries*. Paris: OECD. [http://www.oecd.org/document/1/0,3343,en\\_2649\\_34223\\_40931201\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/1/0,3343,en_2649_34223_40931201_1_1_1_1,00.html).

State Planning Organization. 2006. "Turkey Information Society Strategy (2006–2010)." Prime Ministry, Ankara.

Williams, Mark. 2008. "Broadband for Africa: Policy for Promoting the Development of Backbone Networks." World Bank, Washington, DC. [http://site.resources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/Broadband\\_for\\_Africa-backbone\\_policy.pdf](http://site.resources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/Broadband_for_Africa-backbone_policy.pdf)



# 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 6.1 summarizes key policies, regulatory tools, and programs that the surveyed countries have used to develop their broadband ecosystems.

The policies and regulatory tools in table 6.1 support the operation of a competitive, efficient market and seek to expand access to all. They also include demand-side policies and programs. Many of these measures would have little or no implications for government budgets. Some could be funded through contributions from the broadband industry, and others would be self-sustaining from service fees (as with e-government programs) or cost savings (as with infrastructure sharing).

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, whereas others, such as Japan, the Republic of Korea, and Sweden, have had public-private partnerships and a more active role for the state earlier on.

**Table 6.1 Key Policies and Programs for Building the Broadband Ecosystem**

<b>Component</b>	<b>Early stage: Promote</b>	<b>Mass market: Oversee</b>	<b>Universal service: Universalize</b>
Networks	<ul style="list-style-type: none"> <li>■ Develop an enabling environment through policies and regulations that promote investment and market entry.</li> <li>■ Reduce administrative burdens and provide incentives and subsidies for research and development, pilots, and network rollout.</li> <li>■ Create certification systems for cyber buildings.</li> <li>■ Allocate and assign spectrum for wireless broadband services.</li> </ul>	<ul style="list-style-type: none"> <li>■ Consider infrastructure sharing, including unbundling the local loop.</li> <li>■ Reallocate spectrum to increase bandwidth.</li> </ul>	<ul style="list-style-type: none"> <li>■ Undertake, using public-private partnerships as appropriate, deployment of open access broadband networks in high-cost or remote areas.</li> <li>■ Coordinate access to rights of way.</li> </ul>
Services	<ul style="list-style-type: none"> <li>■ Provide broadband networks to schools, government agencies, and the like (using the government as an anchor tenant).</li> <li>■ Standardize and monitor service quality.</li> </ul>	<ul style="list-style-type: none"> <li>■ Create an enabling environment for intra- and intermodal competition.</li> <li>■ Ensure nondiscriminatory access for service, application, and content providers.</li> </ul>	<ul style="list-style-type: none"> <li>■ Consider expanding universal service obligations to include broadband.</li> </ul>



Applications	<ul style="list-style-type: none"> <li>■ Undertake government-led demand aggregation, with government agencies as early adopters and innovators.</li> <li>■ Provide e-government and education applications.</li> <li>■ Promote creation of digital content.</li> <li>■ Develop local content and hardware sectors.</li> </ul>	<ul style="list-style-type: none"> <li>■ Support secure, private, and reliable e-commerce transactions.</li> <li>■ Implement intellectual property protection.</li> </ul>	<ul style="list-style-type: none"> <li>■ Develop advanced e-government programs.</li> <li>■ Offer grants to community champions and broadband demand aggregators.</li> </ul>
Users	<ul style="list-style-type: none"> <li>■ Provide low-cost computers and other user devices (for instance, in education).</li> <li>■ Develop digital literacy programs for citizens.</li> </ul>	<ul style="list-style-type: none"> <li>■ Establish ethical guidelines for information use.</li> </ul>	<ul style="list-style-type: none"> <li>■ Expand universal service programs to underserved communities.</li> <li>■ Create community access centers.</li> <li>■ Subsidize user devices for poor households.</li> </ul>

Source: Authors' compilation.

Today, though, all the countries surveyed have moved firmly toward spurring broadband growth through public-private collaborations. Countries such as the United Kingdom and the United States that once shied away from developing national broadband strategies have either prepared strategies 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 (Universal Service Fund of Pakistan 2008). In 2007, the Dominican Republic's Telecommunications Institute (Instituto Dominicano de las Telecomunicaciones, or Indotel), the industry regulator, launched a tender aimed at installing broadband connections in 500 rural communities under an output-based aid scheme (Muenste-Kunigami and Navas-Sabater 2010). Increasing media convergence will put pressure on universal service funds to evolve from a focus on voice-centric networks 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 for including it in universal service programs.

## **Promote: Policies as a Pump Primer**

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

### **Supply-Side Promotion Policies**

Supply-side policies induce investment in the broadband network. Some possible policies are described.

**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 (digital subscriber line), 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. Furthermore, governments should manage their radio spectrum appropriately to reduce entry barriers, promote competition, and enable the introduction of innovative technologies.

An important consideration for spectrum policy is which frequencies should be allocated for broadband services and how. The critical choice is whether countries want to maximize their up-front earnings through spectrum sales but reduce potential investments, or whether 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—thus allowing the companies to maximize infrastructure investments.

The move toward digital television is providing an opportunity to use the parts of the television (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 (Arghire 2009; Cox 2009; Weinschenk 2009), 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. They should implement management policies that are based on market principles, encourage efficient use, and shift spectrum from low-value uses to services such as broadband (Wellenius and Neto 2007). Spectrum managers should also keep in mind the effect of their spectrum allocations on business economics: higher bands make mobile communication more difficult and more expensive. In addition, spectrum managers should look toward newer management models—such as the spectrum-as-commons approach that has been a key factor in the success of Wi-Fi networking—to encourage spectrum sharing and innovation (Bar and Galperin 2004, 45–54).

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, they will diminish the utility of the broadband service and undermine the business case for the service provider (Singh and Raja 2008, 22–28).

### **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 the 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.

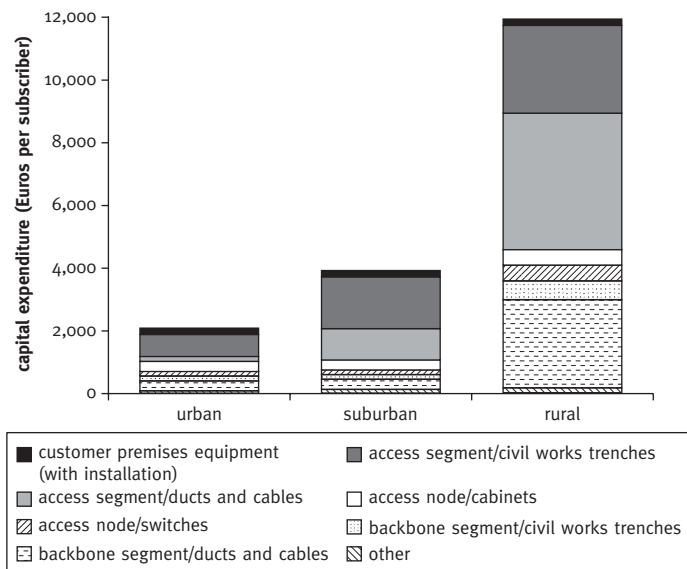
Businesses might initially avoid investing in backbone networks because they are unsure of the returns on their investments. Governments can provide up-front support to reduce risks or act as an anchor tenant to induce investment. Numerous policy options are available for countries looking to develop their backbone connectivity (Williams 2008).

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 this regard can serve as a reference for many other countries. It is also appropriate that the 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 (for example, trenches, ducts, and cables) are the biggest fixed and sunk cost in broadband network construction in both the access and the backbone segments of fiber-optic networks (figure 6.1). They also play a major role in increasing the cost of network deployment for new service providers as well as incumbents.

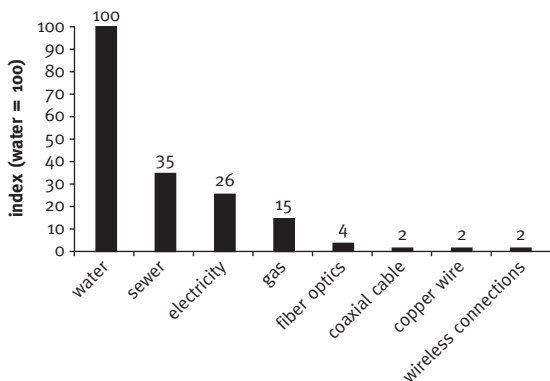
The costs of backbone network construction can be cut by establishing legal grounds for open access to the passive infrastructure (conduits, ducts, and poles) of other services (roads, railways, and power supply facilities). This approach can significantly lower the cost of rolling out telecommunications networks, because adding communications equipment (such as cables) to other infrastructure projects is relatively cheap (figure 6.2).

**Figure 6.1 Cost Analysis for a Fiber-to-the-Home (FTTH) Deployment, Greenfield Scenario**



Source: ICT Regulation Toolkit, based on data from European Commission 2006.

**Figure 6.2 Average Cost of Infrastructure Installation per Kilometer**



Source: Reprinted with permission, OECD 2008, 62 ([www.oecd.org/sti/ict/broadband/growth](http://www.oecd.org/sti/ict/broadband/growth)).

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

Finally, governments can permit or facilitate joint construction of backbone and subscriber networks among providers. 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 users' benefits (such as lower prices and improved service choice and quality). Thus, implementing such a policy requires careful consideration.

## **Demand-Side Promotion Policies**

Demand-side policies raise citizen awareness about broadband benefits and ease subscription barriers. An outline of such policies follows.

**Promote digital literacy.** To raise public awareness of 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, Korea provided free or low-cost training in the early 2000s to 10 million citizens who lacked access to information and communication technology (ICT).

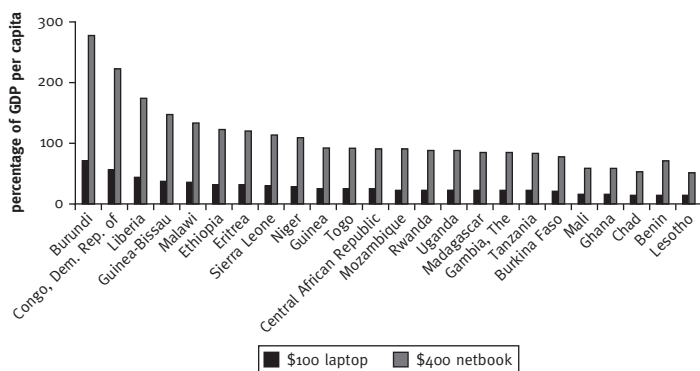
This training contributed substantially to the rapid and widespread penetration of broadband. In the short run, such extensive training generates demand. It is also a step toward universal service, because the program mainly targeted underserved groups (women, military personnel, and prisoners). Korea 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 African countries. The so-called \$100 laptop costs more than one-third of GDP per capita in four Sub-Saharan African countries (figure 6.3).

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

**Figure 6.3 Cost of User Devices Relative to GDP per Capita in Selected Sub-Saharan African Countries**



Source: Authors' representation.



poor and rural households (box 6.1; see also Guermazi and Satola 2005; Lemon and Fletcher 2009; Zawaydeh 2003).

**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 are essential. E-government encourages citizens

### Box 6.1 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 Austria, Italy (PC for Youth Scheme), and Sweden. Sweden subsidizes PC purchases by allowing companies to provide them on a pretax basis to employees.

Korea has implemented such programs. The 10 Million People Internet Education Project provided free or subsidized computer training for groups such as 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 ICT with a PC and discounted Internet access. The government also subsidizes companies to provide computer training for older workers. Finally, the government 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. Through a post office program, it leases computers to low-income families on a four-year lease with free full support for broadband for five years.

*(continued)*

**Box 6.1 continued**

The United Kingdom's Home Access Task Force set up a £300 million program in September 2008 to give Home Access Grants to children eligible for free school meals. The grants provide free computers and one year's Internet use. The aim is to help more than 270,000 households by March 2011.

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

*Sources:* e-Learning Foundation 2009; He and Ye 2009; Kelly 2009.

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, insofar 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 preselection of network operators.

**Develop online content and media.** Online content and media involve two key challenges. Much online content is in English or other international languages that are 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 the development of locally relevant content and media in local languages. In Korea, content development policies have been a critical

component of the overall approach and have evolved in line with market developments.

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 (Guerhazi and Satola 2005). 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 the degree to which such rights should balance the interests of creators with the larger goals of enabling knowledge sharing, fair use, and adaptation.<sup>1</sup> A key debate related to development is whether IPR protection should benefit a few rights holders (primarily from high-income countries) or whether a balance can be struck that 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 provide a benefit to 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). More recently, systems such as Creative Commons licenses allow creators to specify which rights they wish to reserve, thereby allowing a range of possibilities between full copyright and the public domain (Creative Commons 2009).

**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 effect 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 to encourage businesses to participate in e-commerce. Improvements in information security, including encryption technologies and antihacking 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 the need 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 a 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 policy making.

## **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. Hence, policies that facilitate competition are the most typical—yet important—policies. Thus, they must be implemented consistently and compellingly from the initial stage to maturity 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, 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 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 (Fransman 2006, 28–32).<sup>2</sup> Powerful competitors joining the early 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 because of 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 a government should focus on facility- or service-based competition depends on which is more appropriate for new providers to become and remain competitive in a short period. The decision may depend on country conditions, including the size of the communications network, the status of competition, and the structure of regulation. Another influential factor is whether alternative networks (cable broadband, wireless broadband, and so on) cover the entire country.

Facility-based competition makes providers compete in the retail market while also constructing a network. It brings competition to network improvement by expanding investment. But it can also result in redundant investments.

Service-based competition allows new providers to use the network of the dominant facility operator. This approach cuts the time to market for new entrants and reduces up-front 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. However, service-based competition can also create many opportunities if new providers enter the market smoothly, attract subscribers at the early 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 early stage of the broadband market because of deregulation and the development of cable TV networks. Thus, services were diffused quickly. But by the time the market reached maturity, dependence on only facility-based competition was considered insufficient. Therefore, service-based competition was adopted through local loop unbundling (box 6.2).

In France, by contrast, cable TV network development was relatively weak because of the development of satellite broadcasting. Furthermore, cable TV providers, also serving as communications service providers, had little desire to start a broadband business. Hence, France

### Box 6.2 Local Loop Unbundling

One 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 directly 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- and services-based competitors.

The main advantage of LLU is that it permits much faster market entry than would be possible if entrants were obliged to construct their own networks. The main disadvantage is that it can be a disincentive to fresh infrastructure investment by the incumbent operator (for instance, in deployment of a fiber-optic network). Most European economies and some Asian members of the Organisation for Economic Co-operation and Development now have laws on LLU, with New Zealand and Switzerland both introducing policies in 2008. But other countries, such as the United States, have considered but not mandated LLU (leaving it instead to the market) or, like Mexico, have not developed a policy.

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

*Source:* OECD 2009.

adopted powerful service-based competition from the early 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, adopting both service- and facility-based competition would be more effective 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. Governments 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 the Broadband Market Grows**

A farsighted policy maker 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. Policy makers must maximize market competition through stable and efficient policies and expand service coverage as much as possible with minimal government intervention (Navas-Sabater, Dymond, and Juntunen 2002).

### **Provide Financial Support for Network Rollout in Rural and Underserved Areas**

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. Governments require the dominant incumbent to develop a nationwide network that provides services to rural areas and underserved groups.

This first approach is usually implemented in parallel with the second, under which the government offers subsidies or compensation. In Korea, 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 U.S. Department of Agriculture's Rural Utilities Service Telecommunications Program facilitates local providers' network construction in underserved areas (U.S. Department of Agriculture 2010). Many developing countries, especially Latin American countries and recently Pakistan, also use these types of policies.

The third type of policy—used in France, Sweden, and some U.S. states—involves local governments, the central government, or public organizations directly in network construction and service delivery (Cava-Ferreruela and Alabau-Muñoz 2006). 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 6.1); might build Internet access centers in remote areas and schools; and might deliver digital literacy or training programs to underserved groups, such as the rural poor, the elderly, people with disabilities, and minorities.

## Notes

1. For different views on these debates, see Benkler (2002a, 2002b); *Independent* (2007); and Lessig (2004).
2. *Disruptive competitors* are newly entered operators that are so aggressive with their pricing that they do not cover their costs and, instead, incur short-run losses.

## References

Arghire, Ionut. 2009. "Verizon Touts LTE Network Advantages, Speeds." Softpedia, Bucharest. <http://news.softpedia.com/news/Verizon-Touts-LTE-Network-Advantages-Speeds-129165.shtml>.

Bar, François, and Hernan Galperin. 2004. "Building the Wireless Internet Infrastructure: From Cordless Ethernet Archipelagos to Wireless Grids, Communications, and Strategies." *Communications and Strategies* 54 (2): 45–68.

Benkler, Yochai. 2002a. "Coase's Penguin, or, Linux and *The Nature of the Firm*." *Yale Law Journal* 112 (December): 369–446.

———. 2002b. "Intellectual Property and the Organization of Information Production." *International Review of Law and Economics* 22 (1): 81–107.

Cava-Ferreruela, Inmaculada, and Antonio Alabau-Muñoz. 2006. "Broadband Policy Assessment: A Cross-National Empirical Analysis." *Telecommunications Policy* 30 (8–9): 445–63.

Cox, John. 2009. "Verizon Confirms Details of U.S. LTE Deployment." Network World, Framingham, MA. <http://www.networkworld.com/news/2009/021809-mwc-verizon.html>.

Creative Commons. 2009. "What Is CC?" Creative Commons, San Francisco, CA. <http://creativecommons.org/about/what-is-cc>.

e-Learning Foundation. 2009. "Parent's Information: Government's Home Access Programme." e-Learning Foundation, Surrey, U.K. <http://www.e-learningfoundation.com/home-access-programme>.

European Commission. 2006. "Broadband in Europe for All: A Multidisciplinary Approach." Draft report by Broadband in Europe for All (BREAD) project consortium. <http://www.viskan.net/..%5Cpublications%5CBREAD-Deliverable-D24-D34-draft.pdf>

Fransman, Marin, ed. 2006. *Global Broadband Battles: Why the U.S. and Europe Lag While Asia Leads*. Stanford, CA: Stanford University Press.

Guermazi, Boutheina, and David Satola. 2005. "Creating the 'Right' Enabling Environment for ICT." In *e-Development: From Excitement to Efficiency*, ed. Robert Schwabe, 23–46. Washington, DC: World Bank.

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

ICT Regulation Toolkit. *infoDev* / ITU (International Telecommunication Union). A live online resource available at <http://www.ictregulationtoolkit.org/> (accessed June 2, 2010).

*Independent*. 2007. "The Cult of the Amateur, by Andrew Keen: Is the Internet Eroding Knowledge, Wisdom, Expertise, and Culture? A Dotcom Apostate Says Yes." *Independent*, July 29. <http://www.independent.co.uk/arts-entertainment/books/reviews/the-cult-of-the-amateur-by-andrew-keen-458834.html>.

Kelly, Tim. 2009. "International Lessons." Presentation at the Federal Communications Commission workshop on International Lessons for Broadband Policy, Washington, DC, August 18. [http://www.broadband.gov/docs/ws\\_int\\_lessons/ws\\_int\\_lessons\\_kelly.pdf](http://www.broadband.gov/docs/ws_int_lessons/ws_int_lessons_kelly.pdf).

Lemon, Sumner, and Owen Fletcher. 2009. "China Offers Computer Subsidy for Farmers." *PCWorld*, March 5. [http://www.pcworld.com/businesscenter/article/160750/china\\_offers\\_computer\\_subsidy\\_for\\_farmers.html](http://www.pcworld.com/businesscenter/article/160750/china_offers_computer_subsidy_for_farmers.html).

Lessig, Lawrence. 2004. *Free Culture: How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity*. New York: Penguin Press. <http://www.free-culture.cc>.

Muente-Kunigami, Arturo, and Juan Navas-Sabater. 2010. "Options to Increase Access to Telecommunications Services in Rural and Low-Income Areas." Working Paper 178, World Bank, Washington, DC. [http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1208273252769/Options\\_to\\_Increase\\_Access\\_to\\_Telecommunications\\_Services\\_in\\_rural\\_and\\_Low-Income\\_Areas.pdf](http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1208273252769/Options_to_Increase_Access_to_Telecommunications_Services_in_rural_and_Low-Income_Areas.pdf).

Navas-Sabater, Juan, Andrew Dymond, and Niina Juntunen. 2002. *Telecommunications and Information Services for the Poor: Toward a Strategy for Universal Access*. Washington, DC: World Bank.

OECD (Organisation for Economic Co-operation and Development). 2008. *Broadband Growth and Policies in OECD Countries*. Paris: OECD. [http://www.oecd.org/document/1/0,3343,en\\_2649\\_34223\\_40931201\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/1/0,3343,en_2649_34223_40931201_1_1_1_1,00.html).

———. 2009. *OECD Communications Outlook 2009*. Paris: OECD.

Pyramid Research Group. 2007. "The Next Billion: How Emerging Markets Are Shaping the Mobile Industry." Pyramid Research Group, Cambridge, MA.

Singh, Rajendra, and Siddhartha Raja. 2008. "Convergence in ICT Services: Emerging Regulatory Responses to Multiple Play." Working Paper, World Bank, Washington, DC. [http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/Convergence\\_in\\_ICT\\_services\\_Emerging\\_regulatory\\_responses\\_to\\_multiple\\_play.pdf](http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/Convergence_in_ICT_services_Emerging_regulatory_responses_to_multiple_play.pdf).

Universal Service Fund of Pakistan. 2008. "Broadband Programme." Universal Service Fund of Pakistan, Islamabad. <http://www.usf.org.pk/Broadband-Programme.aspx>.

U.S. Department of Agriculture. 2010. "Welcome to the Rural Development Telecommunications Program." U.S. Department of Agriculture, Washington, DC. <http://www.usda.gov/rus/telecom>.

Weinschenk, Carl. 2009. "Verizon Wireless Chooses a National Plan." IT Business Edge, NarrowCast Group, Louisville, KY. <http://www.itbusinessedge.com/cm/blogs/weinschenk/verizon-wireless-chooses-a-national-plan/?cs=37986>.

Wellenius, Björn, and Isabel Neto. 2007. "Managing the Radio Spectrum: Framework for Reform in Developing Countries." World Bank, Washington, DC. <http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/Wellenius-Neto.pdf>.

Williams, Mark. 2008. "Broadband for Africa: Policy for Promoting the Development of Backbone Networks." World Bank, Washington, DC. [http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/Broadband\\_for\\_Africa-backbone\\_policy.pdf](http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/Broadband_for_Africa-backbone_policy.pdf).

Zawaydeh, Serene. 2003. "Tunisia Internet and Datacomm Landscape Report." Arab Advisors Group, Strategic Research Service, Amman. <http://www.arabadvisers.com/files/reports/TOC-%20Comm/Tunisia%20Internet%20&%20Datacomm%20Landscape%202007%20-%20TOC.pdf>.



# 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—mainly mobile but also fixed—over the past decade. Indeed, the market penetration of fixed broadband in the developing world is already at the same level as telephony in the early 1980s (figure 7.1), suggesting a 25-year lag, though this lag is growing shorter.

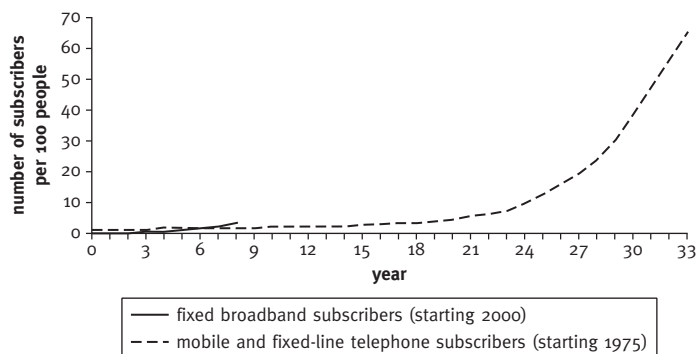
The experiences of the countries surveyed in this volume suggest three successful building blocks to support the development of the broadband ecosystem. As noted, governments should approach broadband holistically, taking into account all four components of the ecosystem: networks, services, applications,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

These building blocks will not always work everywhere: one size does not fit all. Local political economy and sociocultural 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

**Figure 7.1    Telephony and Fixed Broadband Subscribers in Developing Countries**



Source: Data are from the World Bank's Development Data Platform database.

goals informed by consultations with the entire range of stakeholders—government agencies, the wider public sector, private investors, and the public—that 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 Korean 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, though it has now begun rethinking that strategy. Thus, being flexible is important.



Flexibility is also needed as the market develops. The three types of policy discussed in this book—promotion, oversight, and universalization—are all essential in broadband deployment, but the focus is likely to shift as the broadband market develops. That is, a government would focus more on promotional policies to generate demand and expand supply during the early 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.

In turn, 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, a government's role is even more important in promoting and accelerating growth of the broadband market. A key lesson from the countries surveyed 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, and others on 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 aided in 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 research and development 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 in part 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 a 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 information and communication technology (ICT) in research and education.

However, such a government role should not replace or substitute for the normal operation of market mechanisms. Instead, the government should facilitate or support the private sector. In every case, public-private partnerships should be designed transparently and focus on encouraging, rather than replacing, private innovation and investment. The government must be capable of developing and promoting timely policies that are 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, and research or public kiosks) is widespread and widely used, regulatory and legal frameworks can be revised to support broadband service provision into 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 during the early days of broadband, when 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 move beyond network rollout and include research, manufacturing promotion, user awareness, ICT skill development, and digital literacy. The Korean experience also highlights the possibilities for sector growth to be based on long-term interventions focused predominantly on opportunity generation rather than direct public investment.

## Implications for Developing Countries

Across the developing world, countries are looking to increase access to and use of broadband. As this book proposes, it is useful to conceptualize broadband as an ecosystem and focus on developing a national broadband strategy, promoting competition, and facilitating demand. The implications of these findings for developing countries are considered briefly as follows.

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

This variation makes it unwise to propose universal approaches for expanding broadband ecosystems. Instead, this book suggests policies and programs outlined in a strategic framework that allows specific solutions tailored to country circumstances. The findings of this book will therefore have different implications for different countries. In some cases, the challenge will be to create incentives so that widespread networks can be used to offer broadband services. In other countries, the challenge will be to roll out networks capable of broadband. Every country also faces unique resource constraints, requiring broadband strategies to be tailored to each country's ability 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 provide emerging good practices that are likely to be useful everywhere. Three important factors stand out. 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 earlier, this book identifies policies and programs that support private investments and call for only specific, limited, well-justified public funding interventions in exceptional circumstances. For example, countries such as France and Korea implemented policies that had limited immediate fiscal effect 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

book provides emerging good practices for each stage of market growth, while stressing the need for overall strategic thinking.

Third, contrary to the perception that governments in the surveyed markets “threw money” at broadband, policy makers in those countries have been creative and have sought to maximize the influence of limited investments rather than simply spend their way to broadband ubiquity. Consequently, developing countries might identify ways in which they can leverage limited resources to maximize effect, prioritizing programs according to demand and market evolution, rather than shying away from policy reform altogether. To help countries in these efforts, the forthcoming broadband strategies toolkit will offer more detail on how to convert the broad strategic and policy ideas in this book to practical instruments used in policy making, regulation, and implementation of broadband network development.<sup>1</sup>

## Note

1. As resources are developed during 2010–12, the toolkit will be posted at the Web site of the Information for Development Program (*infoDev*), <http://www.infodev.org>. An existing toolkit for ICT regulation is available at the ICT Regulation Toolkit Web site, <http://www.ictregulationtoolkit.org>.



# Index

Boxes, figures, notes, and tables are indicated by *b*, *f*, *n*, and *t*, respectively.

## A

accessibility, as pillar of demand  
    facilitation, 105, 106<sup>t</sup>  
actual versus advertised broadband  
    speeds, 20<sup>b</sup>  
ADSL (asymmetric digital subscriber  
    line), 23, 37, 44–45, 56<sup>t</sup>  
affordability, as pillar of demand  
    facilitation, 105, 106<sup>t</sup>  
Akamai, 19  
American Recovery and  
    Reinvestment Act of 2009,  
    87<sup>n</sup>24, 110<sup>n</sup>1  
applications  
    in ecosystem approach to  
        broadband, 24–25  
    in Korea, 49–50, 55–58  
attractiveness, as pillar of demand  
    facilitation, 105, 106<sup>t</sup>  
Australia, 23<sup>f</sup>; 96, 131  
Austria, 123<sup>b</sup>

## B

backbone policies and programs, 9,  
    118–19, 130  
Baidu.com, 5  
banking, online, 50, 51<sup>f</sup>

barriers to entry, reducing, 117, 127  
BcN (Broadband convergence  
    Network), 56–57  
Booz & Company, 4–5, 22  
Brazil, 18  
BRIC countries, 18  
broadband access and use,  
    expanding, ix–xi, xxi–xxvii,  
    1–14  
backbone policies and programs, 9,  
    118–19, 130  
building blocks for, xxiii–xxvi, 9,  
    137–43. *See also* building  
    blocks for broadband  
business performance and, 28, 126  
cost considerations affecting. *See*  
    cost considerations  
current connectivity status, xxi,  
    1–4, 2<sup>t</sup>, 3<sup>t</sup>, 101<sup>f</sup>; 137, 138<sup>f</sup>  
developing countries, implications  
    for, xxvi–xxvii, 141–43  
economic effects of, 4–6, 5<sup>f</sup>; 28,  
    41–42  
ecosystem approach to, x,  
    xxi–xxii, 8, 15–33. *See also*  
    ecosystem approach  
Internet traffic statistics, 23<sup>f</sup>  
limitations of study, 9–10

- policies and programs for, xxii–xxiii, 8–9, 83, 113–35. *See also* policies and programs
    - public and private sectors, roles of, x–xi. *See also* public and private sectors
    - social benefits of, 6–7, 7*f*, 28, 41–42
    - in specific countries. *See* specific countries by name
    - strategies for, xxii–xxiii, 8, 83, 95–111. *See also* strategies for building broadband
    - toolkit, development of, xxvi–xxvii, 10, 11*n*8, 12*n*10, 143
  - Broadband Building Certification System, Korea, 126
  - Broadband convergence Network (BeN), 56–57
  - Broadband Technology Opportunities Program, U.S., 110*n*1
  - BT, 75
  - building and construction
    - industry, 126
  - building blocks for broadband, xxiii–xxvi, 9, 137–41
    - competition used to promote market growth. *See* competition and market growth
    - demand facilitation. *See* demand facilitation
    - flexibility and vision, combining, xxiii, 137–39
  - Bulgaria, 3
  - business performance and broadband access, 28, 126
- C**
- Caisse des Dépôts et Consignations, 70
  - Canadian Radiotelevision and Telecommunications Commission, 18
  - Canon, 72
  - CDMA EV-DO services, 48
  - Chile, 97*b*
  - China, 5, 18, 122–23, 124*b*
  - competition and market growth, xxiii, 139–40
    - disruptive competitors, 127, 133*n*2
    - facility-based and service-based competition policy, 127–30
    - in Finland, 68
    - in France, 70
    - in Japan, 72, 127
    - as key requirement, 102
    - in Korea, 37–39, 60–62, 127, 140
    - limited capital markers, market failures due to, 102
    - new market entries, 117, 127
    - public and private sectors, role of, 140
  - construction and building, 126
  - content sector
    - development of, 124–25
    - in Korea, 49–50, 58–60, 59*f*, 59*t*, 124–25
  - cost considerations
    - affordability, as pillar of demand facilitation, 105, 106*t*
    - declining prices, 23, 26*b*
    - equitable access concerns, 102–3
    - investment costs for providers, reducing, 119–21, 120*f*
    - as limitation on broadband expansion, 7–8
    - low-cost devices and terminals, providing, 122–23, 122*f*, 123–24*b*
  - Costa Rica, 142
  - Creative Commons licenses, 125
  - Croatia, 142
  - cross-country comparisons, 80–83, 81*t*, 82*t*. *See also* specific countries by name
  - Cyber Korea 21, 54, 64
  - Czech Republic, 20*b*



**D**

Dacom, 60  
 Daum, 50, 51*t*  
 demand facilitation, x, xxiii–xxvi, 141  
   in Korea, 39, 141  
   as strategy for building broadband, 105  
   three pillars of (accessibility, affordability, attractiveness), 105, 106*t*  
 demand for bandwidth, 22–23  
 demand-side policy  
   in Korea, 62–63  
   promotion policies and strategies, 121–26  
 Denmark, 99  
 developing countries, expanding  
   broadband access and use  
   in, xxvi–xxvii, 141–43  
*Digital Britain* report, 19, 76–77*b*, 99  
 digital divide, xxi, 1–4, 2*t*, 3*t*  
 Digital France 2012, 70–71  
 digital inclusion programs, 132  
 digital literacy initiatives, 62, 63, 121–22  
 digital multimedia broadcasting (DMB), 59  
 Digital Opportunity Index (DOI), 81–82, 82*t*  
 digital subscriber line access modules (DSLAMs), 45  
 digital subscriber lines (DSLs)  
   broadband connectivity statistics, 2, 3*t*  
   in Finland, 68  
   in Japan, 71  
   in Korea, 45  
   strategies and policies, 103, 106, 117  
   in United Kingdom, 75, 86*n*20  
   in United States, 78, 79  
 digital TV, 117–18  
 disruptive competitors, 127, 133*n*2  
 DMB (digital multimedia broadcasting), 59

DNA Finland, 68

DOI (Digital Opportunity Index), 81–82, 82*t*

Dominican Republic, 116

Dreamline, 44

DSLAMs (digital subscriber line access modules), 45

DSLs. *See* digital subscriber lines

**E**

e-commerce, 49, 62, 63, 70

e-government, 25, 49, 62

E-Government Readiness Index, 43

e-learning, 49, 50, 62, 63

e-working, 63

East Asian financial crisis in Korea, 35, 42

Eastern Europe, broadband  
   connectivity statistics for, 3

ecological concerns, 105–7

economic effects of broadband access  
   and use, 4–6, 5*f*, 28, 41–42

economies of scale, 102

ecosystem approach, x, xxi–xxii, 8, 15–33

  advantages of, 16–17

  applications, 24–25

  graphic presentation of, xxii*f*, 16*f*

  Korea, holistic approach of, 36–39, 38*f*

  networks, 18–21

  services, 21–23, 23*f*

  users and user devices, 25–29, 26–27*b*

EDUNET, 50

eJapan strategy, 99

Electronics and Telecommunications  
   Research Institute (ETRI), 47

Elisa, 68

entry regulations, 117, 127

environmental concerns, 105–7

equitable access concerns, 102–4, 104*t*.

*See also* universalization  
   strategies and policies

- ETRI (Electronics and Telecommunications Research Institute), 47
- European Commission, State Aid Rules, 10, 11–12*n*9
- European Union/Western Europe  
broadband connectivity in, 1, 2  
funding from, 68, 69  
institutional framework in, 109  
Internet traffic statistics, 23*f*  
rural and underserved  
areas, financial support  
for, 132
- F**
- Facebook, 24–25, 30*n*10
- facility-based competition policy,  
127–30
- Federal Communications Commission  
(FCC), U.S., 18–19, 29*n*3,  
80, 87–88*n*26, 87*n*23, 99,  
110*n*1
- fiber to the home (FTTH), 37, 39, 46,  
56*t*, 75, 98*b*
- Finland, 116  
analysis of broadband  
development in, 67–69  
broadband penetration, trajectory  
of, 40*f*, 41*f*  
coherent national strategy,  
recognized need for, 99  
competition used to promote  
market growth in, 68  
cross-country comparisons, 81*t*,  
82–83, 82*t*  
DSLs, 68  
equitable access concerns, 103, 104*t*  
public and private sectors in, 68,  
113, 116  
3G services in, 68  
flexibility and vision, combining, xxiii,  
137–39
- France  
analysis of broadband  
development in, 69–71  
broadband penetration, trajectory  
of, 40*f*, 41*f*  
competition used to promote  
market growth in, 70  
cross-country comparisons, 81*t*,  
82*t*, 83  
equitable access concerns, 103, 104*t*  
facility-based and service-based  
competition policy in,  
128–29  
LLU, 70, 129*b*  
public and private sectors in,  
113, 142  
rural and underserved areas,  
financial support for, 132  
3G services in, 69, 71  
France Telecom, 70  
FTTH (fiber to the home), 37, 39, 46,  
56*t*, 75, 98*b*
- G**
- gaming, online, in Korea, 49, 125
- GITR (*Global Information  
Technology Report*), WEF,  
81–82, 82*t*
- Global Competitiveness Index, 43
- Global Information and  
Communication  
Technologies Department,  
World Bank, xxvi–xxvii, 10  
*Global Information Technology Report*  
(GITR), WEF, 81–82, 82*t*
- GNI (gross national income) per  
capita in Korea, 42, 43*f*
- Google, 5, 24, 50, 51*t*
- Grand Emprunt, 71
- Greece, 96
- green concerns, 105–7
- gross national income (GNI) per  
capita in Korea, 42, 43*f*
- H**
- Hanaro, 44–45, 60
- Hardy, Quentin, 29

Hessel, Evan, 29  
 high-speed downlink packet access  
   (HSDPA) technologies,  
     41, 48–49, 56*t*, 64*n*6  
 high-speed packet access (HSPA)  
   networks, 11*n*2, 27  
 Home Access Task Force, U.K., 124*b*  
 Hong Kong, China, 23*f*  
 HSDPA (high-speed downlink packet  
   access) technologies, 41,  
     48–49, 56*t*, 64*n*6  
 HSPA (high-speed packet access)  
   networks, 11*n*2, 27  
 Hulu, 22  
 Human Development Index, 43

## I

ICT Development Index (IDI),  
   81, 82*t*  
 IDI (ICT Development Index),  
   81, 82*t*  
 India, 18, 19, 142  
 Indotel (Instituto Dominicano de  
   las Telecomunicaciones),  
   Dominican Republic, 116  
 industrial support policies in Korea,  
   60  
*info*Dev, 10, 12*n*10  
 Information, Communications, and  
   Multimedia Services  
   (MyICMS) 886, Malaysia,  
   98*b*  
 Information Society Index, 43  
 Information Society Strategy for  
   2006–10, Turkey, 97*b*  
 Informatization Promotion Fund and  
   Act, Korea, 58  
 infotainment, 25, 30*n*11  
 infrastructure development  
   backbone policies and programs, 9,  
     118–19, 130  
   investment costs for providers,  
     reducing, 119–21, 120*f*  
   in Korea, 55–58, 56*t*, 57*t*  
 institutional framework, 109–10

Instituto Dominicano de las  
   Telecomunicaciones  
   (Indotel), Dominican  
   Republic, 116  
 Intel, 27*b*  
 intellectual property rights (IPR), 125  
 International Telecommunication  
   Union (ITU), 18, 43, 47,  
   81, 82*t*  
 Internet & American Life Project,  
   Pew Research Center, 6–7,  
   25, 28  
 Internet protocol television (IPTV),  
   21–22, 42, 59  
 Internet traffic statistics, 23*f*  
 investment costs for providers,  
   reducing, 119–21, 120*f*  
 IP-based broadband networking,  
   21–22  
 iPhone, 5  
 IPR (intellectual property rights), 125  
 IPTV (Internet protocol television),  
   21–22, 42, 59  
 Ireland, 23, 129*b*  
 Italy, 123*b*, 132  
 ITU (International  
   Telecommunication  
   Union), 18, 43, 47, 81, 82*t*

## J

Japan  
   analysis of broadband  
     development in, 71–73  
   broadband penetration, trajectory  
     of, 40*f*, 41*f*  
   coherent national strategy,  
     recognized need for, 99  
   competition used to promote  
     market growth in, 72, 127  
   cross-country comparisons, 81*t*,  
     82*t*, 83  
   DSLs, 71  
   equitable access concerns, 104*t*  
   institutional framework in, 109  
   Internet traffic statistics, 23*f*

public and private sectors in, 113  
 regulatory environment in, 72  
 spectrum frequency policies, 117  
 3G services in, 71

## K

KDDI, 73

Khalil, Mohsen A., xi

KISDI (Korea Information Society  
 Development Institute), 47

KONEPS (Korea Online  
 E-Procurement System),  
 49–50

Korea Information Infrastructure  
 project, 55–56, 57, 64

Korea Information Society  
 Development Institute  
 (KISDI), 47

Korea Online E-Procurement System  
 (KONEPS), 49–50

Korea, Republic of, 8, 35–66  
 applications in, 49–50, 55–58  
 backbone construction in, 119  
 Broadband Building Certification  
 System, 126  
 broadband connectivity statistics  
 in, 36, 39, 64*n*5  
 broadband market in, 43–50  
 applications, services, and  
 content, 49–50, 51*f*  
 fixed broadband, 44–47, 45*f*, 47*f*  
 mobile broadband, 48–49

coherent national strategy,  
 recognized need for, 99,  
 100*b*

competition used to promote  
 market growth in, 37–39,  
 60–62, 127, 140

content sector in, 49–50, 58–60,  
 59*f*, 59*t*, 124–25

cross-country comparisons, 80, 81,  
 81*t*, 82*t*, 83

definition of broadband network  
 in, 19

demand facilitation in, 39, 141  
 digital literacy initiatives, 62, 63,  
 121–22

DSLs, 45

East Asian financial crisis in, 35, 42  
 equitable access concerns, 103, 104*t*  
 evaluation of broadband

development in, 63–64

facility-based and service-based  
 competition policy in, 128

flexibility and vision, combining,  
 138

GNI per capita, 42, 43*f*

holistic approach taken in,  
 36–39, 38*f*

ICT4D, 8

industrial support policies, 60

informatization master strategies,  
 54–55

institutional framework in, 109

Internet traffic statistics in, 23

local companies, dominance of, 50,  
 51*t*, 58

low-cost devices and terminals,  
 providing, 122, 123*b*

new market entry, encouraging, 127

online banking in, 50, 51*f*

policies and programs, 50–54

demand-side policy, 62–63

infrastructure and application

development, 55–58,

56*t*, 57*t*

summary of, 52–53*t*

supply-side policy, 55–62

profile of, 42–43

public and private sectors in, 57*t*,  
 113, 142

rapid growth of broadband in,  
 39–41, 40*f*, 41*f*

regulatory environment, 52–53*t*,  
 60–62, 61*t*

rural and underserved areas,

financial support for, 132

services, 49–50, 56

socioeconomic aspects of

broadband expansion in,  
 41–42  
 3G services in, 36, 40, 41*f*, 48, 64*n*5  
 universalization strategies and  
 policies, 131  
 Korea Trust Fund on Information  
 and Communication  
 Technology for  
 Development, 8  
 Korean Communications  
 Commission, 58  
 KT, 45, 48, 60, 61, 132

## L

latency, 22  
 Latin America and Caribbean  
 business performance and  
 broadband access, link  
 between, 28  
 rural and underserved areas,  
 financial support for, 132  
 Linux, 125  
 local loop unbundling (LLU), 45, 70,  
 75, 86*n*20, 128, 129*b*  
 Long Term Evolution (LTE), 27, 71

## M

Malaysia, 98*b*, 138  
 market failures, addressing, 99–102  
 market growth, competition used to  
 promote. *See* competition  
 and market growth  
 McKinsey & Company, 4, 6  
 middle-income countries, national  
 strategies in, 96, 97–98*b*  
 Minitel, 69–70  
 Mitsubishi, 72  
 monopoly-type structures, market  
 failure due to, 101  
 Mozilla Firefox, 125  
 MyICMS (Information,  
 Communications, and  
 Multimedia Services) 886,  
 Malaysia, 98*b*

## N

National Home Appliance Subsidy  
 Program, China, 124*b*  
 National Telecommunications  
 and Information  
 Administration, U.S.,  
 110*n*1  
 Naver, 50, 51*t*  
 netbooks, 27*b*  
 Netherlands, 99  
 networks, 18–21  
 new market entries, 117, 127  
 New Zealand, 103, 129*b*  
 Next Generation Fund, U.K., 76  
 Nintendo, 72  
 Nokia, 27*b*, 68  
 Nokia Siemens Network (NSN)  
 Connectivity Scorecard,  
 81–82, 82*t*  
 North America, broadband  
 connectivity in, 1, 2  
 Norway, 99, 103  
 NSN (Nokia Siemens Network)  
 Connectivity Scorecard,  
 81–82, 82*t*

## O

Obama administration, 99, 110*n*1  
 OECD (Organisation for Economic  
 Co-operation and  
 Development), 18, 20*b*, 22,  
 29, 64*n*5, 71, 96, 99  
 Ofcom, 20*b*, 75, 86–87*n*20–22  
 online banking, 50, 51*f*  
 online gaming in Korea, 49, 125  
 Onse, 44  
 open source movement, 125  
 Organisation for Economic  
 Co-operation and  
 Development (OECD), 18,  
 20*b*, 22, 29, 64*n*5, 71, 96, 99  
 oversight strategies and policies,  
 126–30. *See also* regulatory  
 environment

evolution of, 108  
 facility-based and service-based  
     competition policy,  
     127–30  
 new market entry, supporting, 127  
 unfair practices, 130

## P

Pakistan, 116, 132  
 Panasonic, 72  
 Partnership for Measuring ICT for  
     Development, 18  
 PC for Youth Scheme, Italy, 123*b*  
 Peru, 23  
 Pew Research Center, 6–7, 25, 28  
 Plan for Promoting ICT Use and  
     Distributing PCs to  
     Children of Low-Income  
     Families, Korea, 123*b*  
 policies and programs, xxii–xxiii, 8–9,  
     83, 113–35  
     backbone construction, 9, 118–19,  
     130  
     customizing, 126, 142  
     institutional base for, 109–10  
     key types, 114–15*t*  
     in Korea. *See under* Korea,  
     Republic of  
     oversight. *See* oversight strategies  
     and policies  
     promotion. *See* promotion  
     strategies and policies  
     public and private sectors,  
     involvement of, 113–16  
     reasons why broadband is a policy  
     issue, 4–8, 5*f*, 7*f*  
     stages of, xxiv–xxv*t*  
     universalization. *See*  
     universalization strategies  
     and policies  
 private sector. *See* public and private  
     sectors  
 promotion strategies and policies,  
     116–26

demand-side, 121–26  
 evolution of, 107–8  
 supply-side, 116–21  
 public and private sectors, x–xi  
     balancing involvement of,  
     9–10, 142  
     coherent national strategy,  
     recognized need for, 99,  
     100*b*  
     competition used to promote  
     market growth, role  
     in, 140  
     demand facilitation, public sector  
     role in, 141  
     equitable access concerns, 102–4,  
     104*t*  
     in Finland, 68, 113, 116  
     in France, 113, 142  
     in Japan, 113  
     in Korea, 57*t*, 113, 142  
     middle-income countries,  
     national strategies in, 96,  
     97–98*b*  
     in policies and programs for  
     building broadband,  
     113–16  
     strategic role of public sector,  
     evolution of, 95–98,  
     97–98*b*  
     in Sweden, 74, 113  
     in United Kingdom, 75, 113, 116  
     in United States, 78–80, 96, 99,  
     113, 116  
 Pyramid Research Group, 27*b*

## Q

Qiang, Christine, 10

## R

regulatory environment  
     entry regulations, 117, 127  
     in Korea, 52–53*t*, 60–62, 61*t*  
     LLU, 45, 70, 75, 86*n*20, 128, 129*b*  
     unfair practices, 130

Republic of Korea. *See* Korea,  
 Republic of  
 Romania, 142  
 rural areas, financial support for,  
 131–32  
 Russian Federation, 16

## S

### services

competition policy, service-based,  
 127–30  
 in ecosystem approach to  
 broadband, 21–23, 23*f*  
 equitable access concerns, 102–4,  
 104*t*  
 in Korea, 49–50, 56  
 Singapore, 1, 103  
 SK Broadband, 44  
 SKT, 44, 46, 48  
 Skype, 22  
 small and medium-size enterprises  
 (SMEs), 126  
 smartphones, 26–27*b*  
 SMEs (small and medium-size  
 enterprises), 126  
 social benefits of broadband access  
 and use, 6–7, 7*f*, 28, 41–42  
 social networking, 24–25, 28–29  
 Sony, 72  
 South Asia, broadband connectivity  
 in, 2  
 Spain, 132  
 spectrum frequency policies, 117–18  
 speed of connectivity, 20*b*, 22  
 Sprint, 27*b*  
 strategies for building broadband,  
 xxii–xxiii, 8, 83, 95–111  
 coherent national strategy,  
 recognized need for,  
 99, 100*b*  
 demand facilitation, 105  
 environmental concerns, 105–7  
 equitable access concerns, 102–4,  
 104*t*

evolution of, 107–8  
 institutional base for, 109–10  
 Korea  
 informatization master plans,  
 55–56  
 summary of strategies in,  
 52–53*t*  
 market failures, addressing,  
 99–102  
 oversight. *See* oversight strategies  
 and policies  
 promotion. *See* promotion  
 strategies and policies  
 public sector, evolving role of,  
 95–98, 97–98*b*  
 toolkit, development of, xxvi–xxvii,  
 10, 11*n*8, 12*n*10, 143  
 universalization. *See*  
 universalization strategies  
 and policies

### Sub-Saharan Africa

broadband connectivity in, 2,  
 3, 19  
 low-cost devices and terminals,  
 providing, 122*f*  
 supply of bandwidth, 22–23  
 supply-side policy  
 in Korea, 55–62  
 promotion policies and strategies,  
 116–21

### Sweden

analysis of broadband  
 development in, 73–74  
 broadband penetration, trajectory  
 of, 40*f*, 41*f*  
 coherent national strategy,  
 recognized need for, 99  
 cross-country comparisons, 81*t*,  
 82*t*, 83  
 equitable access concerns, 103,  
 104*t*  
 low-cost devices and terminals,  
 providing, 122, 123*b*  
 public and private sectors in,  
 74, 113

rural and underserved areas,  
     financial support for, 132  
 3G services in, 73  
 Swedish Post and Telecom Agency,  
     74  
 Switzerland, 103, 129*b*

## T

Telekom Malaysia, 98*b*  
 Teliasonera Finland, 68  
 10 Million People Internet Education  
     Project, Korea, 123*b*  
 3G services  
     countries serving as major markets  
         for, 67  
     in Finland, 68  
     in France, 69, 71  
     in Japan, 71  
     in Korea, 36, 40, 41*f*, 48, 64*n*5  
     statistics regarding use of, 2, 3*t*, 18  
     in Sweden, 73  
     in United Kingdom, 75, 76, 78,  
         87*n*22  
     in United States, 78  
 Thrunet, 44  
 toolkit, development of, xxvi–xxvii, 10,  
     11*n*8, 12*n*10, 143  
 Toshiba, 72  
 Trust Fund on Information and  
     Communication  
     Technology for  
     Development (ICT4D),  
     Republic of Korea, 8  
 Tunisia, 122–23  
 Turkey, 3, 23, 97–98*b*  
 Twitter, 28, 30*n*15

## U

Ultra Broadband convergence  
     Network (UBcN), 57–58  
 UNCTAD (United Nations  
     Conference on Trade and  
     Development), 18, 43,  
     81, 82*t*

underserved areas, financial support  
     for, 131–32  
 UNDP (United Nations Development  
     Programme), 43  
 United Kingdom  
     actual versus advertised broadband  
         speeds, 20*b*  
     analysis of broadband  
         development in, 75–78  
     broadband connectivity statistics, 3  
     broadband penetration, trajectory  
         of, 40*f*, 41*f*  
     cross-country comparisons, 81–83,  
         81*t*, 82*t*  
     *Digital Britain* report, 19,  
         76–77*b*, 99  
     DSLs, 75, 86*n*20  
     equitable access concerns, 103, 104*t*  
     LLU in, 75  
     low-cost devices and terminals,  
         providing, 124*b*  
     public and private sectors in, 75,  
         113, 116  
     3G services in, 75, 76,  
         78, 87*n*22  
     universalization strategies and  
         policies, 131  
 United Nations Conference on  
     Trade and Development  
     (UNCTAD), 18, 43,  
     81, 82*t*  
 United Nations Development  
     Programme (UNDP), 43  
 United States  
     actual versus advertised broadband  
         speeds, 20*b*  
     analysis of broadband  
         development in, 78–80  
     broadband connectivity statistics, 3  
     broadband penetration, trajectory  
         of, 40*f*, 41*f*  
     coherent national strategy,  
         recognized need for, 99  
     cross-country comparisons, 80,  
         81*t*, 82–83, 82*t*



- digital TV and spectrum
    - frequency policies, 117–18
  - DSLs, 78, 79
  - equitable access concerns, 104*t*
  - FCC, 18–19, 29*n*3, 80, 87–88*n*26, 87*n*23, 99, 110*n*1
  - flexibility and vision, combining, 138
  - importance of home-based
    - broadband access in, 28
  - institutional framework in, 109
  - Internet traffic statistics, 23*f*
  - netbooks and mobile broadband
    - connectivity in, 27*b*
  - public and private sectors in, 78–80, 96, 99, 113, 116
  - rural and underserved areas,
    - financial support for, 132
  - 3G services in, 78
  - universalization strategies and policies, 131–32
    - digital inclusion programs, 132
    - equitable access concerns, 102–4, 104*t*
    - evolution of, 108
    - inclusion of broadband in
      - universal service programs, 116
    - rural and underserved areas,
      - financial support for, 131–32
  - user-created content, 29
  - users and user devices, 25–29, 26–27*b*, 122
- V**
- VDSL (very-high-speed digital subscriber line), 46, 56*t*
  - Verizon, 86*n*16, 87*n*25
  - very-high-speed digital subscriber line (VDSL), 46, 56*t*
  - video capture and sharing, 25, 29
  - vision and flexibility, combining, xxiii, 137–39
- W**
- W-CDMA (Wideband Code Division Multiple Access)
    - services, 11*n*2, 41, 48, 56*t*, 64*n*6
  - Web 2.0, 23, 24
  - Web TV, 59
  - Webmail, 24
  - WEF (World Economic Forum), 43, 81
  - Western Europe. *See* European Union/Western Europe
  - WiBro, 48–49, 59
  - Wideband Code Division Multiple Access (W-CDMA)
    - services, 11*n*2, 41, 48, 56*t*, 64*n*6
  - WiFi, 49, 118
  - WiMAX
    - in Chile, 97*b*
    - ecosystem approach to broadband and, 18, 27, 28
    - in Finland, 69
    - in Japan, 73
    - in Korea, 40, 48
    - in Malaysia, 98*b*
  - wireless local area network (WLAN) services, 46, 48
  - wireless versus wireline broadband services, 19, 21*t*
  - WLAN (wireless local area network) services, 46, 48
  - World Bank, xxvi–xxvii, 3, 4, 10
  - World Bank Group, ix
  - World Economic Forum (WEF), 43, 81
  - worldwide interoperability for microwave access. *See* WiMAX
- Y**
- Yahoo!, 50, 51*t*
  - YouTube, 21–22, 28–29, 30*n*15

## ECO-AUDIT

### *Environmental Benefits Statement*

The World Bank is committed to preserving endangered forests and natural resources. The Office of the Publisher has chosen to print ***Building Broadband: Strategies and Policies for the Developing World*** on recycled paper with 50 percent postconsumer fiber in accordance with the recommended standards for paper usage set by the Green Press Initiative, a nonprofit program supporting publishers in using fiber that is not sourced from endangered forests. For more information, visit [www.greenpressinitiative.org](http://www.greenpressinitiative.org).

#### Saved:

- 5 trees
- 2 million Btu of total energy
- 498 lb. of net greenhouse gases
- 2,399 gal. of waste water
- 146 lb. of solid waste





Access to broadband connectivity is a country's passport to the global information society and knowledge economy—the future. However, the adoption and use of broadband technology today remains extremely uneven and threatens to create a new digital divide. At the end of 2009, countries in North America and the European Union accounted for more than 50 percent of the world's 1 billion fixed and mobile broadband subscriptions, but South Asia and Sub-Saharan Africa together accounted for less than 3 percent. The experience with mobile telephony though shows the potential for growth in the information and communication technology sector in developing countries. Almost 75 percent of the world's mobile telephone subscriptions are in low- and middle-income countries, which have also promoted exciting innovations and realized significant economic development benefits.

In fact, a growing number of countries are seeking to spur broadband development. To aid governments as they design their own programs, this volume offers examples and ideas from some of the most successful broadband markets: particularly the Republic of Korea, but also Finland, France, Japan, Sweden, the United Kingdom, and the United States. *Building Broadband* does not suggest a universal solution but rather provides a long list of policies and programs organized within a strategic framework that allows solutions tailored to country circumstances. The essential building blocks identified are useful everywhere because they focus on improving incentives and the climate for private investment. This is a policy that even countries with very limited resources will be able to exploit.

ISBN 978-0-8213-8419-0



THE WORLD BANK

SKU 18419