

## Building Communities around Digital Highways

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In March 2009, the US Federal Communications Commission (FCC) published *Connecting America: The National Broadband Plan*, an effort to address the fact that only seven of ten households in the United States use the Internet. Beyond examining infrastructure requirements, the FCC plan recognized that ubiquitous, affordable high-speed broadband is essential in driving national competitiveness: broadband, as noted in the plan, enables advances in seven priority areas, including education, healthcare, energy and the environment, and civic engagement.<sup>1</sup>

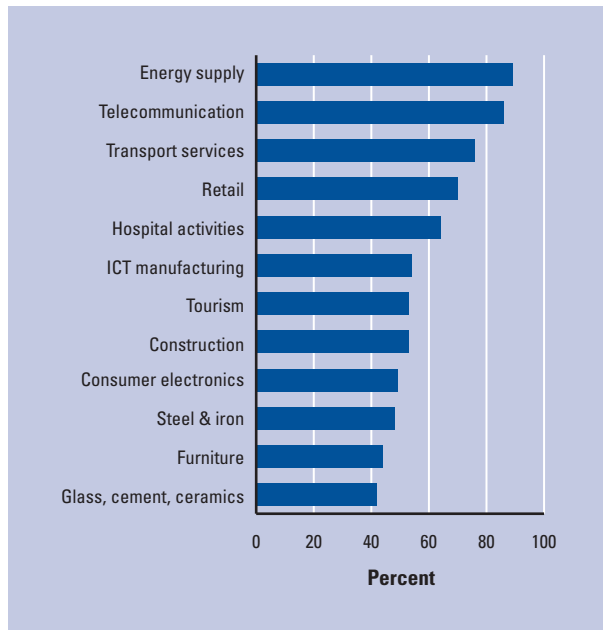
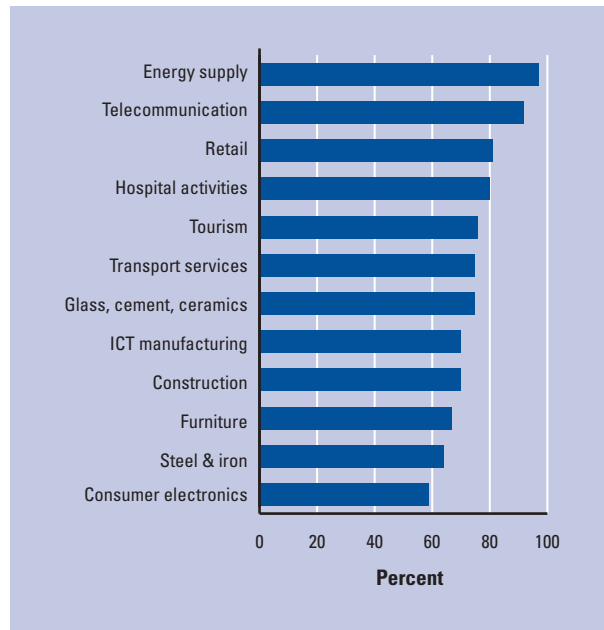
The United States is far from alone in its aspirations. Governments around the world are spending billions and setting ambitious targets as they recognize that a crucial foundation for many areas of socioeconomic development are digital highways—defined as nation-wide high-speed broadband enabled by a combination of fixed as well as wireless networks. Just as actual highways connect people and foster social and commercial activity, digital highways can facilitate the creation of virtual communities in vital areas. When policymakers and telecommunications operators collaborate with leaders in other sectors, such as health and education, they are laying the groundwork for profound improvements—boosting national competitiveness, innovation, economic productivity, and social inclusion.

Accelerating the deployment of digital highways and deriving their full benefits is not a simple task. It requires fundamental changes in vision and action throughout the entire broadband ecosystem. Policymakers and network operators first must look beyond broadband networks alone and facilitate the development of a host of related services and applications, then actively encourage citizens to use them. There is also a strong need for collaboration among other sector participants such as device manufacturers, application developers, and counterparts in adjoining sectors. Finally, the members of the broadband ecosystem must work with their counterparts in adjacent industries—such as health, energy, education, and transportation—to develop the applications that will help those sectors to reap broadband's benefits. Only when all of these stakeholders are fully engaged can digital highways reach their full potential and facilitate efficiency, competitiveness, and prosperity in the communities they serve.

After making the case for the need for digital highways and assessing their current development status, this chapter will explore the actions required from policymakers, networked operators, and other relevant stakeholders to facilitate broadband deployment as well as the opportunities ahead.

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**Figure 1: The role of ICT in innovation by industry, 2006–09****1a: Product and service innovation****1b: Process innovation**

Source: e-Business W@tch, 2010.

Note: The percentage is of the product and process innovation that is enabled by ICT in each sector. The methodology and metrics to assess both innovation and ICT contribution are defined by the e-Business W@tch study.

**The need for digital highways**

Widely accessible, high-speed broadband infrastructure is the foundation underlying all of these possibilities, and several trends are converging to underscore the need for these digital highways.

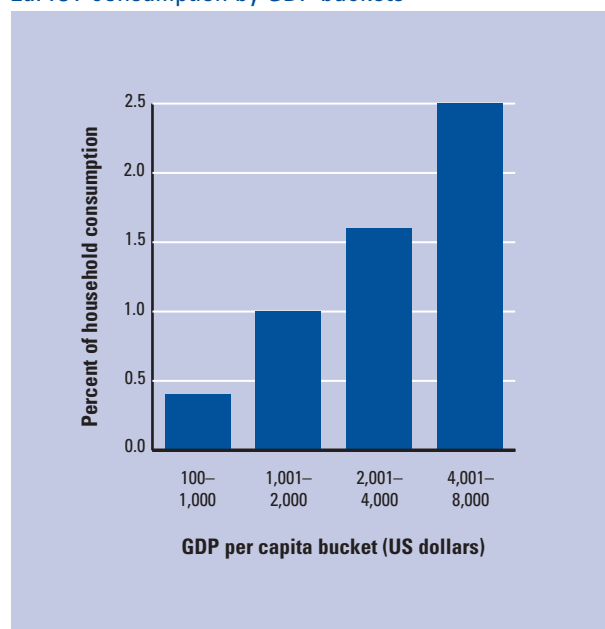
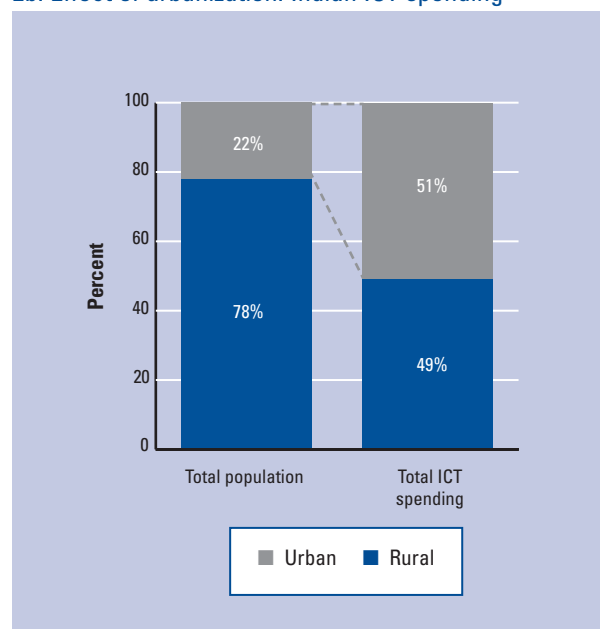
First, the proliferation of information and communications technologies (ICT) continues to have a strong impact on socioeconomic growth. Since the term entered the vernacular in 1997, consumers and businesses have recognized ICT as a source of productivity enhancement. As a result, enterprises have invested in the sector, particularly in developed markets, and ICT adoption has increased dramatically. There were 100 million personal computers in 1990 and 1.4 billion in 2010. The number of mobile phone users increased from 10 million to more than 5 billion over the same period, and the number of Internet users surged from 3 million to 2 billion. As adoption of ICT has made exponential gains, so has its role in fostering both product and process innovation across industry sectors (see Figure 1). All of these technologies rely, in one way or another, on broadband. Therefore, countries seeking to better their standard of living and competitiveness look to digital highways as a national imperative.

Another critical need for digital highways stems from changing consumer behavior. Around the globe, people are coming to expect constant immersion in the digital world to be able to fulfill their need for communication, information, and entertainment anywhere, at any time. What is more, they are not just consuming content but also creating it. This change, plus the

increasing digitization of enterprise and government services, has led to an explosion of digital content. A recent International Data Corporation (IDC) study estimates that the total digital content created in 2010 reached 1.2 zettabytes—that is 1.2 with 21 zeros, the equivalent of 75 billion fully loaded 16-gigabyte Apple iPads.<sup>2</sup> By 2020, IDC estimates digital content will have grown another 30-fold, to 35 zettabytes. Facing steep costs, enterprises are turning increasingly to cloud computing. IDC forecasts that the amount of data on the cloud will reach 15 percent of the digital data universe, or 5 zettabytes by the same date. Already major technology companies such as Microsoft, Google, and Amazon offer cloud services. The transmission of so much data will put additional strain on broadband networks.

Indeed, this proliferation of data has had a profound impact on the industry: a recent study by Ericsson highlighted the landmark moment in December 2009 when total mobile data surpassed voice traffic.<sup>3</sup> Data use will only continue to rise as smartphones become more common, and because smartphone users consume as much as 15 times more bandwidth than users of regular phones. Although successive generations of wireless technologies have improved the efficiency of the wireless spectrum, it is not sufficient to handle the data explosion: mobile operators will need to turn to fixed broadband networks to support their operations as the popularity of smartphones continues to surge.

Governments represent another source of network demand as they increasingly move toward e-government solutions to serve their citizens. The United Nations'

**Figure 2: Changes in ICT consumption patterns in emerging markets, 2007****2a: ICT consumption by GDP buckets****2b: Effect of urbanization: Indian ICT spending**

Sources: World Bank, 2010; World Resources Institute, 2007; Booz & Company analysis.

E-Government Survey estimates that only 2 percent of countries today do not have a government website.<sup>4</sup>

Emerging economies are also spawning demand for digital highways. In many growing economies, consumers are increasing their expenditures on ICT, creating demand for high-speed networks to handle surges in data traffic (see Figure 2). Emerging economies also see rapid growth in their urban centers: urban populations in emerging markets grew 3.4 percent between 1975 and 2005, compared with growth of 0.8 percent in developed countries over that same period. Such urbanization is usually accompanied by a host of challenges—traffic congestion and pollution, for example—that require ICT solutions, such as intelligent public transport systems. Further, emerging economies are investing in e-government platforms that require universal and affordable accessibility to be successful.

The proliferation of content and data usage from governments, businesses, and consumers, as well as the growing needs of both emerging and mature markets, underscore how crucial it is for countries to keep building their digital highways. The countries that embrace the need for affordable and ubiquitous national networks have proven to be more competitive in the global arena, as suggested by the high correlation existing between broadband penetration and the World Economic Forum's Global Competitiveness Index (see Figure 3). The take-away is clear: digital highways are an imperative for all nations, developed or emerging.

### The state of digital highways

Despite digital highways' socioeconomic impact and their importance as the foundation for digital communities, more than 83 percent of the world's population lacks connection to a broadband network (see Figure 4). High-speed broadband is available to just 6 percent of the global population. Notwithstanding the best efforts of governments and the private sector, the broadband digital divide persists as a significant challenge to inclusive and sustainable development, especially in emerging economies.

These gloomy statistics, however, fail to show the progress that countries *have* made in recent years (see Figure 5). Policymakers and network operators are taking major strides to accelerate the availability of national broadband networks.

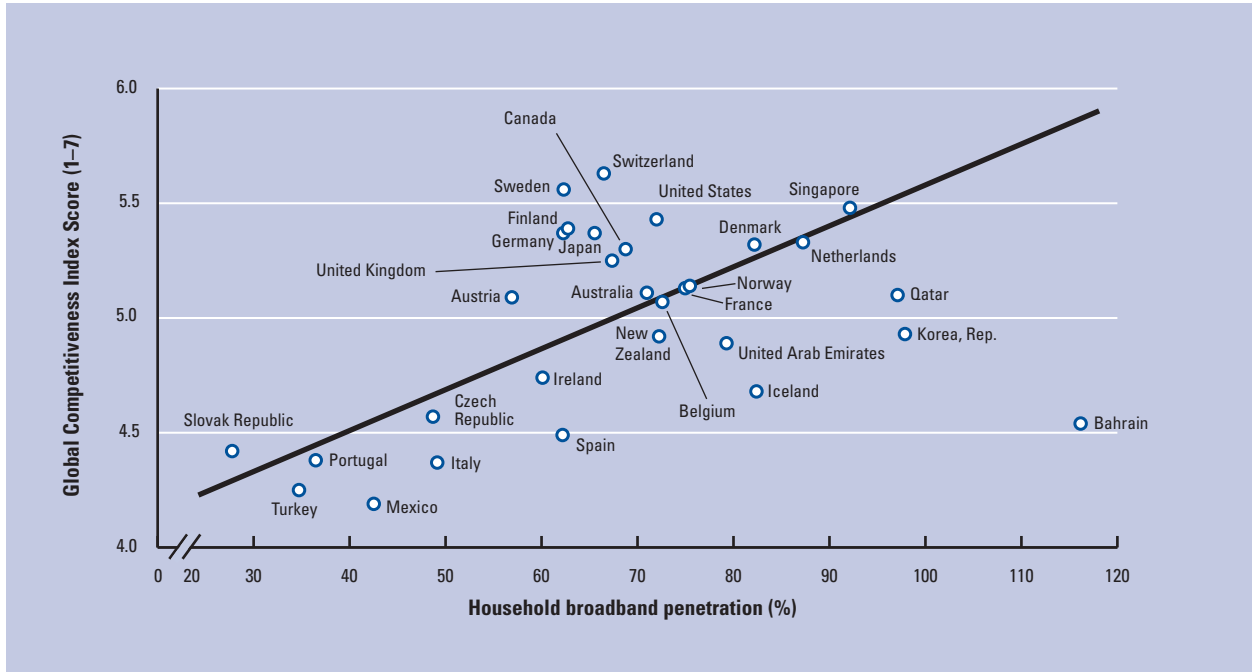
### Policymakers

Both in developed and developing markets, policymakers are considering the establishment of digital highways to be a national imperative, and they are introducing regulations and policy to ensure their rapid deployment.

In July 2010, for example, the Finnish government formally declared broadband to be a legal right and vowed to deliver high-speed access (100 MB/s) to every household in Finland by 2015.<sup>5</sup> The French assembly declared broadband to be a basic human right in 2009,<sup>6</sup> and Spain is proposing to give the same designation to broadband starting in 2011.<sup>7</sup>

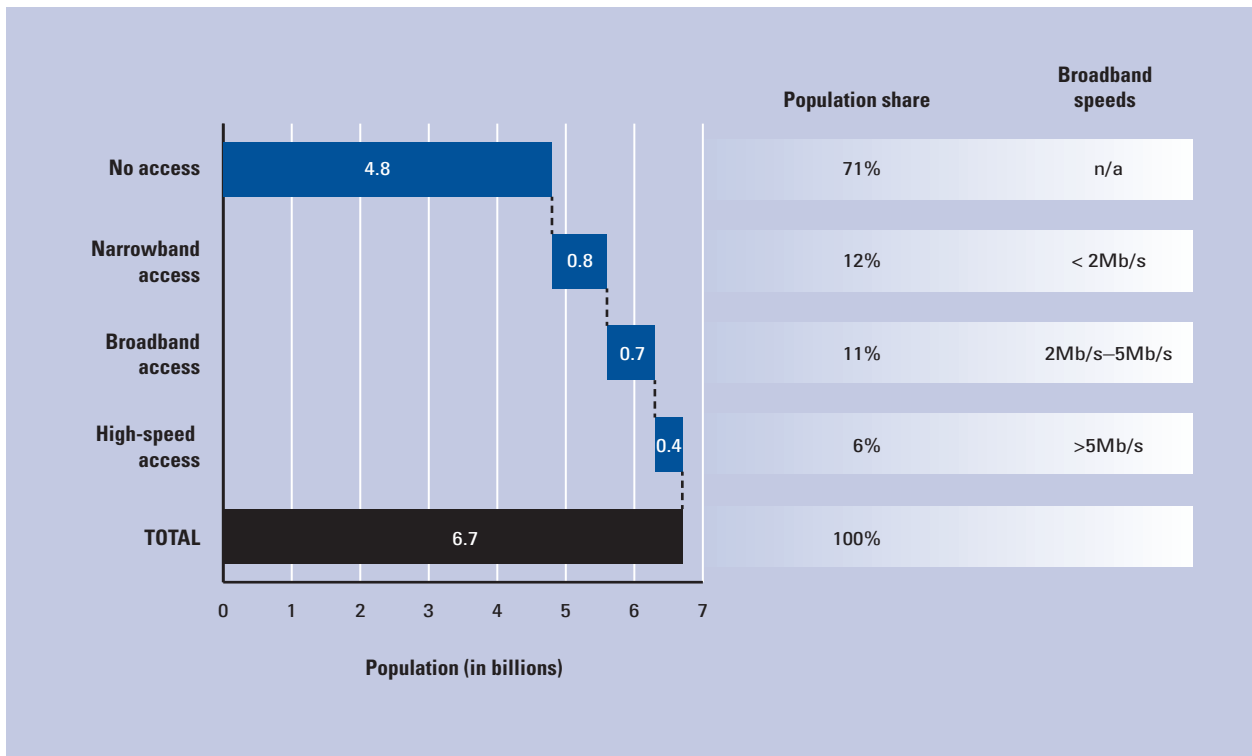
In some countries, policymakers are establishing comprehensive broadband policies. In the United States, the FCC's *Connecting America* plan outlines initiatives to

Figure 3: Competitiveness vs. broadband penetration, 2010

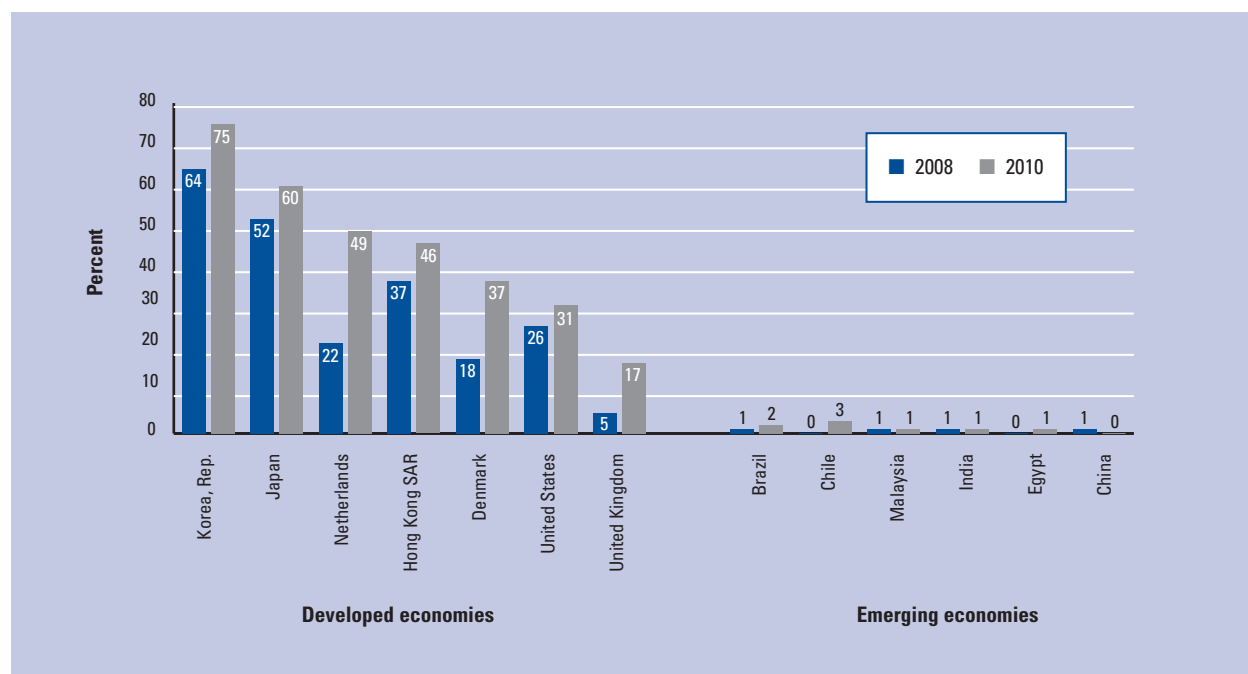


Sources: World Economic Forum, 2010; ITU, 2010; Booz & Company analysis.  
 Note: *Competitiveness* is defined by the World Economic Forum as the set of institutions, policies, and factors that determine the level of productivity of a country.

Figure 4: Global access to broadband, 2010



Sources: Akamai, 2010 Q1; Booz & Company analysis.

**Figure 5: Broadband connections faster than 5 Mb/s**

Sources: Akamai, 2010; Booz & Company analysis.

improve high-speed broadband adoption across sectors and industries, proposing a US\$9 billion fund to accelerate broadband deployment.<sup>8</sup> The UK government has committed £850 million to its broadband plan,<sup>9</sup> and Brazil has committed US\$7.3 billion over the next five years.<sup>10</sup> Other emerging economies are also stepping up their plans: Estonia said it will spend US\$500 million for a national broadband network,<sup>11</sup> and India has begun setting its National Broadband Plan.<sup>12</sup>

Policy initiatives have not been limited to infrastructure; some policymakers are investing in demand stimulation. Korea, Rep. (Korea) has put US\$65 million into a smart grid pilot on Jeju Island, operating a fully integrated smart grid for 600 households.<sup>13</sup> In the United States, the government has committed as much as US\$11 billion as part of its Recovery and Reinvestment Act to develop smart grids.<sup>14</sup>

Additionally, regulators are becoming more involved, encouraging rules to foster cooperation that would facilitate the buildout of national networks. The European Commission, for example, recently articulated regulatory recommendations to encourage partnerships among operators that will use next-generation fiber networks.<sup>15</sup>

### Network operators

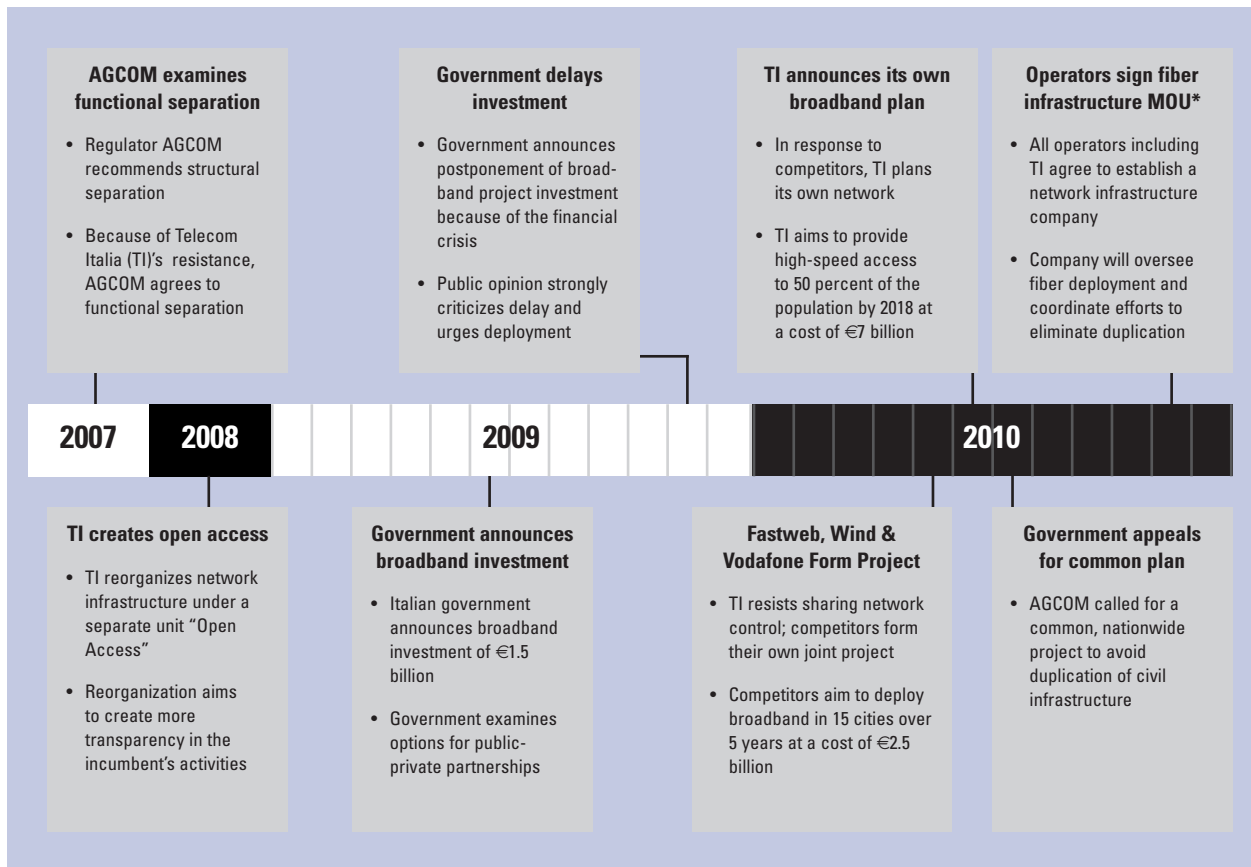
Along with policymakers, network operators are the dominant stakeholders in the sector, and they are increasingly playing an active role in the development of digital highways by adopting new business models that separate their network assets from services. These multi-layer business models allow operators to reduce

their focus, investment, and dependency on traditional revenue streams and instead position themselves to scale next-generation networks and related applications and services. Often policymakers and network operators work together to forge solutions beneficial to them both.

For example, Telstra, the incumbent operator in Australia, recently followed operators in Singapore and New Zealand in adopting a multi-layer network. Telstra will separate its wholesale business and its retail business and progressively decommission its copper network as the government-backed national broadband network rolls out. This was a difficult deal, as it upends the operator's entire approach to doing business; it required protracted negotiations, including, at one point, the position that the government would build an A\$43 billion network without Telstra. Ultimately, the operator agreed to accept A\$11 billion from the Australian government as an incentive to de-layer its services.

In 2007, Italy's telecommunications regulator, AGCOM, began seeking ways to boost the country's low broadband penetration rates. After lengthy negotiations, Italy's incumbent operator—Telecom Italia—agreed to delayer its networks by undergoing a functional separation to establish a new open-access entity, from which all operators would acquire wholesale services. Investment in fiber networks in the country still remained limited, however, until the Italian government announced a €1.5 billion injection into a fiber company in early 2009 to accelerate the deployment of next-generation infrastructure. That plan stalled until November 2010, when the Italian government worked with operators to

Figure 6: Italy's national broadband network history



Note: MOU means Memorandum of Understanding.

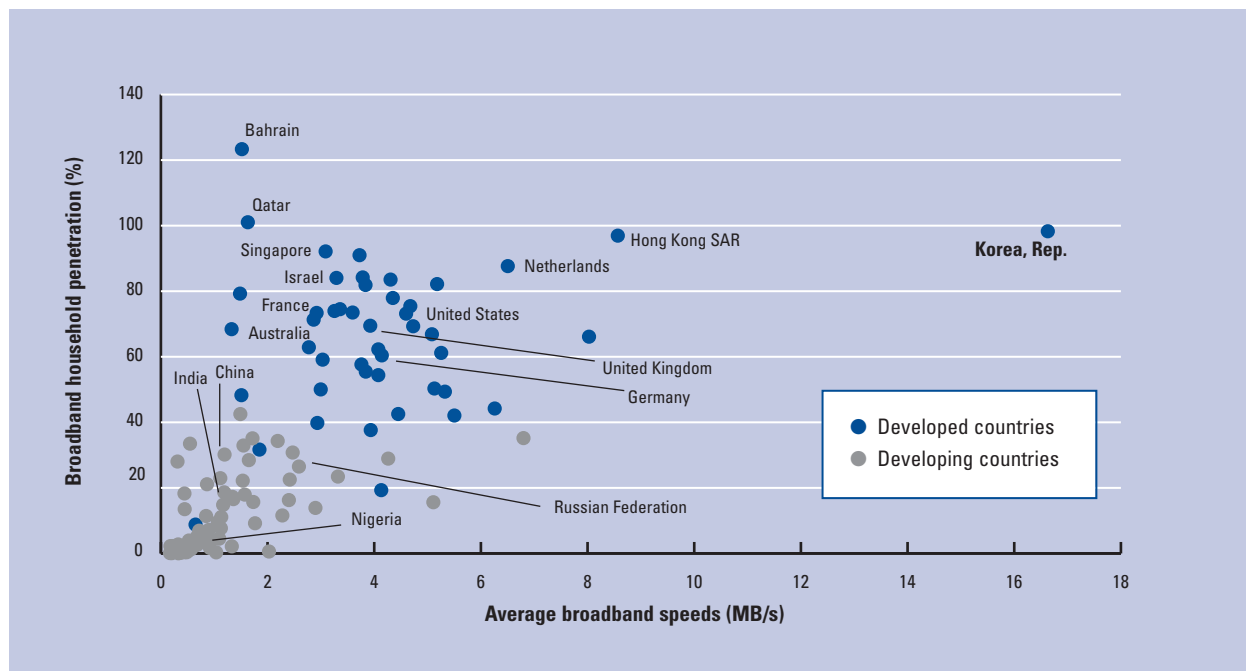
forge a plan that creates an infrastructure company run by representatives from major operators and the ministry of telecommunications (see Figure 6). Italy's model reflects similar evolutions in Australia and Singapore, where the incumbent was reluctant at first to be a part of the broadband company, but eventually joined in a national effort.

### Building communities around digital highways

With national broadband networks around the world on track for continued deployment, participants in the broadband sector are recognizing that the true value of digital highways does not reside in their construction alone. If broadband represents a digital highway, then the applications that are enabled by broadband are the communities that will grow alongside it—and they are critical to realizing the maximum socioeconomic benefits from broadband. Policymakers, operators, device manufacturers, and application developers are unlocking the true potential of digital highways by facilitating the creation of applications that deliver better services and boost national competitiveness. The possibilities enabled by broadband include, but are not limited to:

- **Enabling smart governments:** ICT today is playing a key role in helping governments maintain public service standards while they struggle with budget deficits and attempt to curb national spending. A study by the European Union revealed that European taxpayers could save more than €15 billion (US\$20 billion) if their governments were to switch to electronic invoicing systems.<sup>16</sup>
- **Enabling healthcare:** The number of citizens over the age of 60 is likely to double in developed countries over the next three decades. ICT is playing a vital role in enhancing the quality and reducing the cost of healthcare in these economies through applications such as electronic health records and e-health services. iData Research forecasts that the US patient monitoring market, including home telehealth and hospital wireless telemetry monitoring segments, will reach nearly US\$4 billion by 2017.<sup>17</sup>
- **Enabling sustainability:** The adoption of green ICT applications could result in a 15 percent reduction of global CO<sub>2</sub> emissions, or 7.8 gigatons by 2020, according to a Smart 2020 study.<sup>18</sup> These applications include elements such as smart grids, which received US\$3.4 billion in stimulus funding in 2009 in the United States.

Figure 7: Korea: A digital highway champion



Sources: Akamai, 2010; Booz & Company analysis.

Note: World Bank's classification is used for defining developed and developing countries; high-income countries (GNI per capita > US\$12,196) are classified as developed; the rest are classified as developing (situation as of December 2010).

In developing countries, in particular, national broadband networks offer a helping hand up the socio-economic ladder by enabling a few critical areas:

- **Enabling basic services:** Access to primary services such as healthcare and education is a challenge for most rural citizens in developing markets; ICT enables governments and nongovernmental organizations (NGOs) to broaden their provision of these vital services. A number of nonprofit organizations are using mobile networks to deliver m-health services, such as patient data collection and the dissemination of health information, to poor, rural populations throughout Africa. Similarly, in education, nonprofits and operators can collaborate to offer lessons, study tips, and quizzes via mobiles.
- **Enabling livelihoods:** Almost one-fourth of the world's population lives below the poverty line, on less than US\$1.25 per day. ICT can help governments and international nonprofit organizations improve the purchasing power of low-income groups. In the agriculture sector, for example, farmers can obtain instant weather information and market prices for their crops on their mobile phones—which could help them harvest at the right time and sell products for an appropriate price. This service also reduces reliance on middle men and overall market information asymmetry.

At this stage, most countries are still focusing on the deployment of broadband itself and are just beginning to explore the possibilities that arise when it becomes ubiquitous and affordable. For example, only 1.5 percent of facilities belonging to the American Hospital Association have comprehensive e-health systems, while smart meter penetration in the United States was estimated at 6 percent in 2009. Even in the public sector, with its wide range of e-government initiatives, adoption has been slow: indicatively, only 30 percent of individuals age 16–74 were using the Internet to interact with public authorities in the European Union in 2009.

But a few countries have already begun to envision the communities that can spring up around the digital highway; some have even begun to reap the benefits of building such communities. These countries show what is possible when members of the broadband ecosystem collaborate both with each other and with adjacent sectors to develop the applications that catalyze broadband's potential.

Korea, for example, is the global leader in both access speeds and the adoption of high-speed broadband services (see Figure 7). It has achieved this status through a series of sustained efforts over the last 15 years, starting with the Korea Information Infrastructure plan in 1995—the plan aimed to connect all households to a broadband network by 2005. Since then, Korea has continued periodically to reassess the availability and quality of its broadband network and set higher aims for itself. In 2009, Korea announced a government-backed initiative

Figure 8: FCC's broadband goals and performance dashboard sample

	2020 GOAL	SELECTED METRIC
Focused on <b>ACCESS</b>	<ul style="list-style-type: none"> <li>100 million US homes have affordable access to actual download speeds of at least 100 Mb/s, and actual upload speeds of at least 50 Mb/s</li> </ul>	<ul style="list-style-type: none"> <li>Average actual upload speeds: Nationwide and by provider</li> <li>Average actual download speeds: Nationwide and by provider</li> <li>Number of households with access to broadband networks with sufficient speed</li> <li>Minimum price for a broadband subscription: Nationwide and by provider</li> </ul>
	<ul style="list-style-type: none"> <li>Every American should have affordable access to robust broadband service and the means and skills to subscribe if they so choose</li> </ul>	<ul style="list-style-type: none"> <li>Percentage of Americans who subscribe to broadband services               <ul style="list-style-type: none"> <li>— Total</li> <li>— Socioeconomic segments</li> <li>— Demographic groups</li> </ul> </li> <li>Percentage of Americans with sufficient digital literacy skills</li> </ul>
Focused on <b>ADOPTION</b>	<ul style="list-style-type: none"> <li>To ensure the safety of the American people, every first responder should have access to a nationwide, wireless, interoperable broadband public safety network</li> </ul>	<ul style="list-style-type: none"> <li>Percentage of first responders using the nationwide public safety networks</li> </ul>
	<ul style="list-style-type: none"> <li>To ensure that America leads in the clean energy economy, every American should be able to use broadband to track and manage their real-time energy consumption</li> </ul>	<ul style="list-style-type: none"> <li>Percentage of American homes that have smart electric meters capable of communicating real-time energy information to consumers</li> </ul>

Source: FCC, 2010.

to boost average broadband access speeds to 1 Gb/s for all of its citizens by 2009.

In addition to access, policies have focused on applications: As early as 1999, Korea outlined plans to boost information technology (IT) applications and literacy under its Cyber Korea 21 plan; it took further steps in its 2006 E-Korea vision plan, which focused on the promotion of information applications.<sup>19</sup> Recently, the country announced a commitment of more than US\$500 million for cloud computing initiatives, with the objective of encouraging local businesses to export cloud services.

Operators, device manufacturers, and application developers in Korea have been instrumental in developing the country's digital highway, creating the next-generation applications that boost broadband adoption. For instance, SK Telecom—the leading mobile services provider—offers a “digital home” application that allows users to control and monitor home appliances, and a mobile radio-frequency identification (RFID) one that

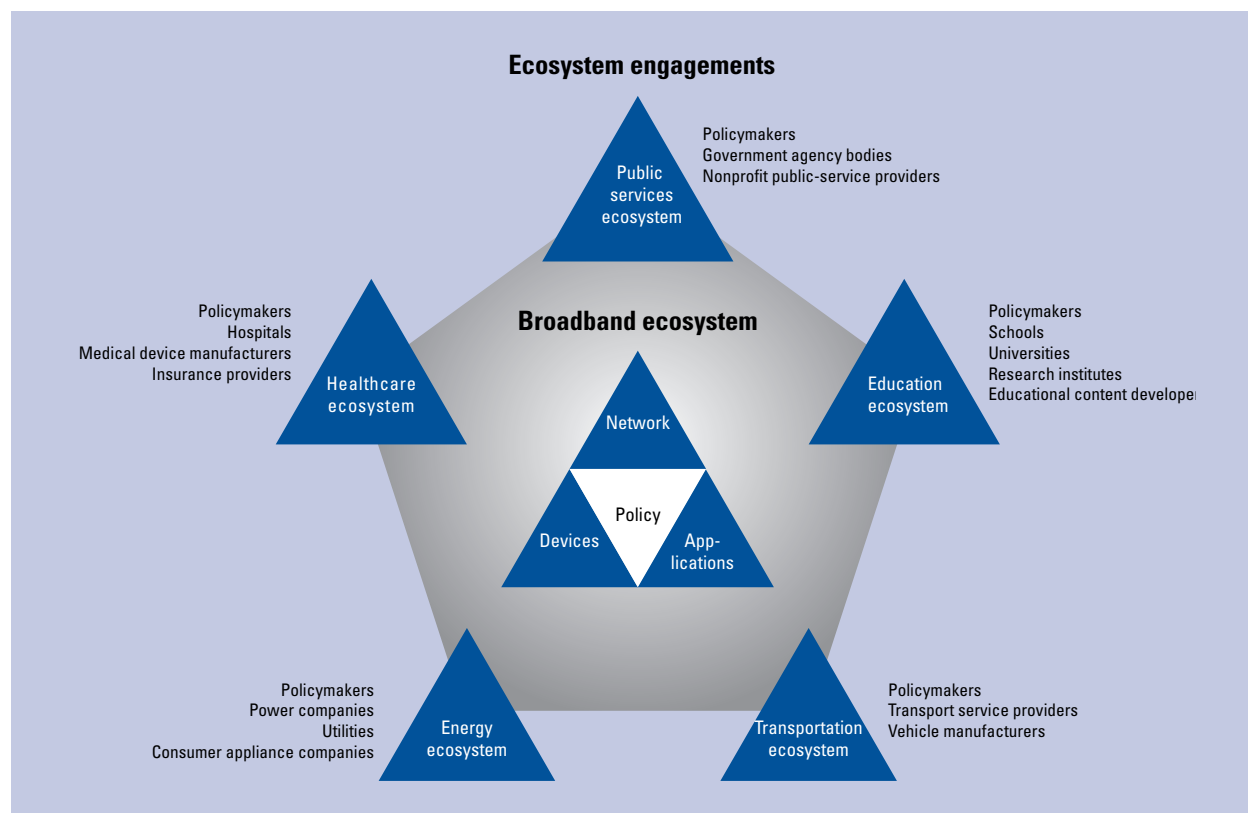
gives users vital information about products before purchase. Korea is also the global leader in online gaming services, with more than 30 percent of the population registered on online multi-player games.

Device manufacturers such as LG and Samsung have emerged as global market leaders in electronics, partially enabled by successful partnerships with local telecommunications players in which they built devices that allow for RFID solutions and micropayment tools. None of these manufacturers could have created these devices on their own; their development required extensive collaboration with ICT policymakers; policymakers in relevant industry sectors, such as finance; sector stakeholders, such as banks and retailers; application developers; and operators, which charge customers to use the applications made possible by these devices.

In combination, these initiatives have resulted in a number of competitive advantages for Korea. Between 2000 and 2007, the country more than tripled the number of patents filed in science and technology. ICT adds



Figure 9: Ecosystem approach



Source: Booz & Company.

more value to enterprise performance in Korea than in almost any other OECD country; and in public services, Korea has surpassed the United States and the European Union (EU) countries to rank highest on the UN's E-Government Development Index since 2008. Thanks also to the above, Korea has enjoyed one of the highest rates of GDP growth rates in the last 10 years among OECD countries.

These achievements are not out of reach for other countries—but they will require similar levels of dedicated effort. One way to boost the use of broadband applications is to generate a better understanding of their effectiveness. Some entities have taken early steps to do so. A study commissioned by the Internet Innovation Alliance shows that broadband is estimated to have generated net consumer benefits of US\$32 billion in 2008 in the United States, and higher speeds could continue providing consumers there with greater benefits, adding at least US\$6 billion in consumer benefits per year.<sup>20</sup> Additionally, new technologies such as smart grids could result in energy consumption savings in the United States of 5 percent in the residential sector and 2.5 percent in the industrial sector. Policymakers, such as the FCC, are also establishing tools to measure the impact of broadband: in a sample dashboard, the FCC has laid out a number of metrics focused on broadband access and adoption to track progress against its 2020 goals (see Figure 8).

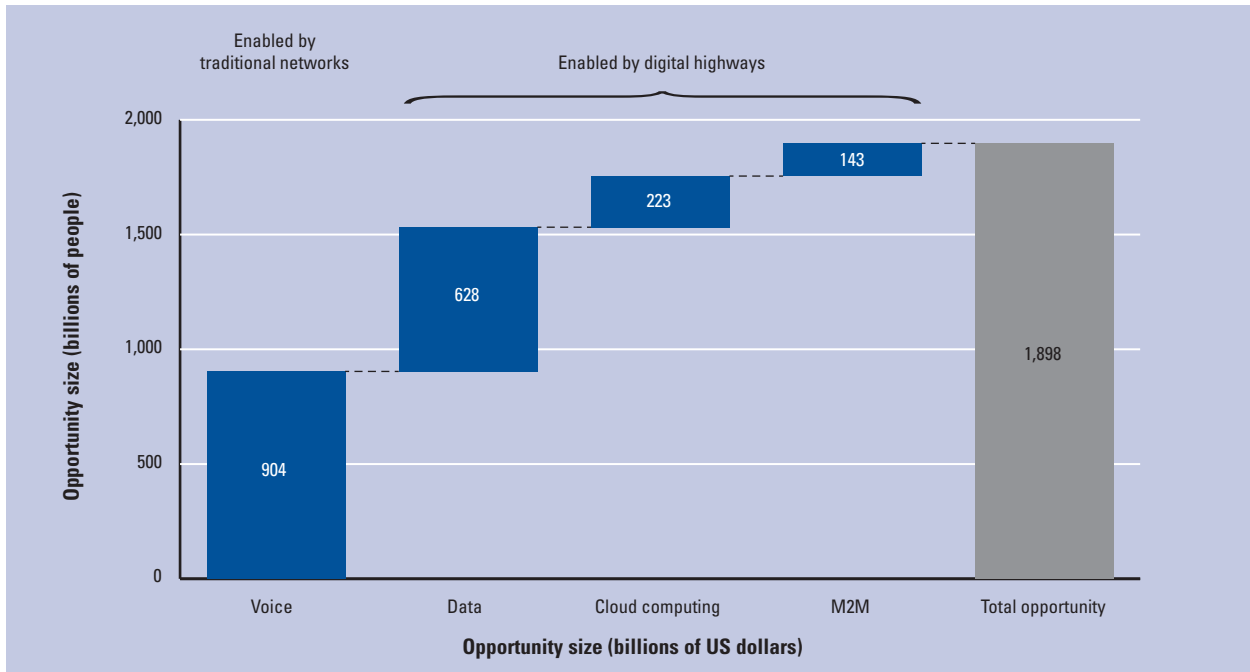
Thus far, however, attempts at quantifying the impact of broadband and the applications it enables have been isolated and limited. A standard global approach to understanding and measuring how broadband affects socioeconomic progress will be critical to unlocking its potential.

In the meantime, each member of the broadband ecosystem has a clear role in building communities around digital highways. Policymakers will need to adopt a holistic approach that encourages the development and use of applications. Operators will need to focus on the opportunities generated by this shift in direction and seek out new revenue streams accordingly. And device manufacturers and application developers will need to collaborate with each other as well as with operators on the propositions that will most appeal to users.

#### Policymakers: Adopting an ecosystem perspective

The widespread adoption of broadband applications depends on whether ICT policymakers can take an inclusive, collaborative view of the broadband ecosystem. Three initiatives for ICT policymakers are clearly necessary.

First, they must collaborate with policymakers in adjacent industries—such as healthcare, education, energy, and transportation—to develop sector-specific ICT policies (see Figure 9). Second, policymakers must stimulate development of digital highway applications, such as cloud computing, including selectively investing

**Figure 10: Projected opportunities enabled by digital highways, 2015**

Sources: ABI Research, 2010; ZTE, 2010; Booz & Company analysis.

in initiatives needed to drive their use. Finally, ICT policymakers need to move beyond simply tracking the availability and adoption of broadband services and establish tools for a holistic assessment of broadband's impact. Measuring the contribution of broadband applications to economic and societal progress can make their benefits more tangible, thereby driving more demand and stimulating the creation of even more applications. To do so, policymakers must identify the key metrics that allow for impact assessment, develop methods and tools for monitoring impact, and publish these results. Such metrics could include broadband's contribution to sector growth, effectiveness, cost savings and affordability, job creation, and overall quality of life.

The Infocomm Development Authority of Singapore (IDA) is an example of a policymaker that has taken such a broad view of ICT development. The IDA has developed an array of programs in health, education, financial services, enterprise, and government to support its master plan iN2015, which aims to grow the ICT sector as well as key economic sectors via ICT. Public-service initiatives are already reaping results: within a span of two years, Singapore climbed 12 places to rank 11th on the UN's E-Government Development Index. Similarly, in the Middle East, policymaker and sector developer ictQATAR has launched ICT2015, a five-year national ICT plan, which aims to develop ICT for government and society through four programs (e-education, e-health, e-government, and e-inclusion). It also fosters economic development through ICT by

building a digital content ecosystem for Qatar and driving innovation and entrepreneurship.<sup>21</sup>

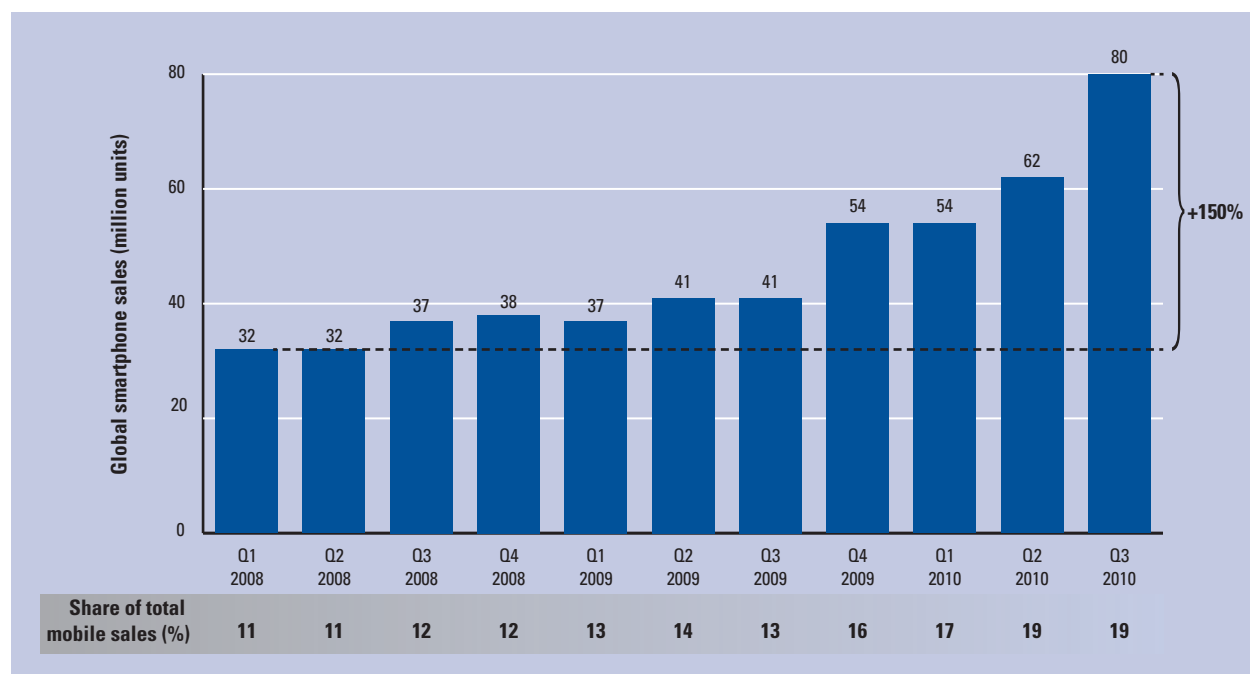
#### Operators: Building new capabilities for new opportunities

In the next five years, revenue opportunities for operators worldwide will continue to shift from those generated on traditional networks (mainly voice-driven) to services enabled by digital highways, such as data services and cloud computing. In 2015, such services could amount to a US\$994 billion opportunity for operators (see Figure 10). Operators that have been slow to invest in broadband, hoping to first get the full return on their investments in traditional services, will need to adapt to this shift to recognize the opportunities afforded by digital highways.

Operators around the world are already shifting their strategies accordingly; many have forged partnerships with application developers or other ecosystem stakeholders. For example, Vodafone Spain has collaborated with Microsoft to offer a suite of enterprise cloud services;<sup>22</sup> Vivo in Brazil has built partnerships with Ericsson and NGO Saúde e Alegria to provide isolated communities in the Amazon with access to a range of health and educational services.<sup>23</sup> Other operators, such as Orange, are developing capabilities in-house. Orange offers "M2M Connect" solutions for healthcare, transportation, and security businesses that want to monitor their assets in real time.<sup>24</sup>

Operators are also targeting opportunities in mobile application stores. Some, such as Airtel, are building their own;<sup>25</sup> some are collaborating with others to build

Figure 11: Smartphone ownership, Q1 2008–Q3 2010



Sources: Gartner, 2009; Booz & Company analysis.

application stores with a global scale. A group of 24 operators and three device manufacturers recently announced that they are planning to build a wholesale application community.<sup>26</sup>

However, delivering these solutions and serving these markets requires operators to build a different set of capabilities than those required in providing traditional telecommunication services. Many of these capabilities revolve around working with partners: a recent study from Harvard Business School and Esade Business School found that, although partnering on very simple products is overkill, and partnering on extremely complex products is likely to involve too many trade-offs as partners try to reach agreement, projects of some complexity—such as applications—benefit from the innovation boost that other companies can provide.<sup>27</sup>

First and foremost, therefore, operators need to enhance their ability to engage and incentivize large developer communities. Second, they need to build go-to-market partnerships that offer access to specialized skills. Finally, they need to move away from their traditional focus on network deployment to emphasize services and applications. Operators have traditionally operated closed networks and allowed new applications on a system only after intensive testing. Moving to an approach that allows for frequent new services requires operators to significantly scale up their service provisioning and delivery platforms. In addition, operators need to establish open platforms, which allow small developers to profitably develop applications for operators.

Selling specialist solutions such as smart metering, cloud computing, or machine-to-machine (M2M) communication requires operators to have access to hardware, software, and operational capabilities that may not be available in-house. Establishing partnerships with companies that are familiar with the relevant sectors and have relationships with sector stakeholders, such as power companies, is critical for operators to target these opportunities. Operators are already partnering with large IT and Internet firms such as Microsoft, Google, and Amazon to resell their cloud services to their current customers; they need to enhance their partnerships in other sectors to capitalize on digital opportunities.

Finally, although applications and services present attractive long-term opportunities for operators, they are unlikely to yield significant revenues immediately. Operators must ensure that short-term thinking does not cloud their vision. Although they will need to continue investing in traditional revenues opportunities, they must be sure that management focus and capital are being directed toward new sources of revenues as well.

#### Device manufacturers and application developers: Collaborating to appeal to users

Like operators, device manufacturers and application developers should collaborate with other ecosystem players to capitalize on the digital highways opportunity.

In light of consumers' and application providers' growing demand for data services, manufacturers are responding with smartphone devices that capitalize on upcoming digital highways. The number of smartphone

models has increased considerably, as have smartphone sales (see Figure 11). Markets such as the United States are already seeing smartphones capture 47 percent of market share in new handset sales.<sup>28</sup> Accordingly, the number of players in the market is set to grow rapidly over the coming five years, with electronics players such as Dell, Acer, and Huawei joining the fray.

In terms of contributing to socioeconomic development, device manufacturers can forge partnerships with public- and private-sector players to drive adoption of applications in key sectors and underpenetrated segments. For example, Nokia has partnered with Vodafone Group Foundation, the Pan-American Health Organization, and the Brazilian Department of Indigenous People's Health to develop MobiSUS, a mobile phone-based program that allows Brazilian healthcare workers operating in remote, challenging environments to collect health data more efficiently, thus improving the delivery of care. The project is being implemented in 18 of 34 Special Indigenous Health Districts, where the use of mobile technologies is replacing the current paper form-based system. Nokia has provided the handsets, software, and data-gathering platform for the program, which will be implemented on a national scale in cooperation with the Brazilian Ministry of Health.<sup>29</sup>

Device manufacturers can also play a central role in nurturing developer communities, which can drive the development and adoption of new broadband applications. Device manufacturers should team up with telecommunications operators, operating system providers, and application developers to enable open platforms and profitably bring new propositions to market.

Application developers too are playing a key role in broadband adoption. Many are teaming up with operators to push applications such as cloud computing; the global cloud computing market is estimated to be sized at US\$68 billion in 2009 and set to grow to US\$223 billion by 2015.<sup>30</sup> Application developers are also getting involved in developing infrastructure; for instance, Google is rolling out trial fiber networks in an initiative called "Think Big with a Gig."<sup>31</sup> Other ecosystem players, such as Apple, are encouraging the growth of a broadband application developer community; Apple offers software, technical support, and other resources for application development. Building on the success of its iPhone applications store, it has recently launched a Mac application store to offer desktop applications.<sup>32</sup>

Application developers should encourage the broader use of successful next-generation services such as cloud computing by scaling them across multiple platforms. In 2009, global spending on ICT services was close to US\$4 trillion across hardware, software, services, networks, and human resources; as part of this spending moves to the cloud, application developers can target a market currently dominated by large multinational firms such as Microsoft and IBM. Specifically,

there is a clear and increasing need to develop tools for search capabilities, information management and prioritized storage, and security and privacy protection. Targeting this opportunity requires application developers to effectively collaborate with both operators and device manufacturers.

M2M is the second key priority area for application development: it is one of the fastest-growing technology areas, and offers strong revenue opportunity for network operators and technology suppliers thanks to the emergence of end-user devices with M2M features. According to recent studies, the M2M market is estimated to increase to US\$19 billion in the coming years, with impressive growth from 75 million devices in 2009 to about 225 million devices in 2014.<sup>33</sup> The M2M market growth is being fueled in part by the arrival of end-user devices with M2M features, such as Amazon's Kindle.

M2M devices offer socioeconomic benefits as well. IBM Smart Cities and Cisco Intelligent Cities, for example, are using M2M technologies to deliver intelligent energy management for smart cities. In doing so, IBM and Cisco have had to collaborate with smart meter manufacturers, energy companies, and operators to build and deliver holistic platforms to end users.

## Conclusion

UN Secretary-General Ban Ki-moon recently said in an address to the Broadband Commission for Digital Development that broadband has extraordinary potential for human progress.<sup>34</sup> A campaign from that commission, a global NGO, calls for universal broadband with the slogan "B more."<sup>35</sup>

However, to deliver on the promise of broadband and to "B more," stakeholders across the ICT ecosystem need to take a holistic approach to its role in society. The future of digital highways rests on a collaborative, committed, and capable ecosystem, which not only delivers high-speed broadband but also builds vibrant communities around it. Communities that facilitate stakeholders' innovation, adoption, and collaboration will realize the extraordinary potential of broadband.

## Notes

- 1 FCC 2010.
- 2 IDC 2010.
- 3 Ericsson 2010b.
- 4 UN Public Administration Programme 2010.
- 5 BBC 2010a.
- 6 BBC 2010a.
- 7 Reuters 2009.
- 8 Schatz 2010. US\$9 billion refers to a fund for accelerating deployment in rural areas.
- 9 BBC 2010b.
- 10 Total Telecom 2010.

- 11 Broadband Prime 2009.
- 12 Telecom Regulatory Authority of India 2010.
- 13 IEC 2010.
- 14 Davidson 2009.
- 15 European Commission 2009.
- 16 European Commission 2005.
- 17 iData Research 2010.
- 18 Smart 2020 2008.
- 19 Atkinson et al. 2008.
- 20 Compass Lexecon 2009.
- 21 ictQATAR 2010.
- 22 Microsoft 2009.
- 23 Ericsson 2010a.
- 24 Orange 2010.
- 25 Airtel 2009.
- 26 WAC 2010.
- 27 Harvard Business Review 2010.
- 28 Gigaom Network 2010.
- 29 Vital Wave Consulting 2009.
- 30 Global Industry Analysts Inc. 2010.
- 31 Google 2010.
- 32 Apple 2010.
- 33 M2M Evolution 2010.
- 34 Broadband Commission for Digital Development 2010.
- 35 Broadband Commission for Digital Development 2010.

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