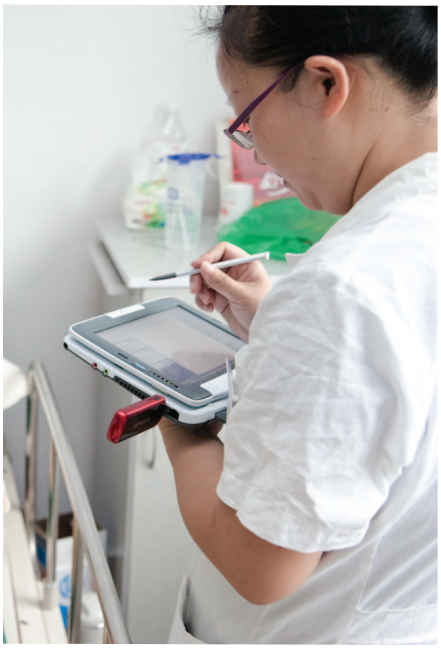
WHITE PAPER
Intel World Ahead

Realizing the Benefits of Broadband

National plans and programs help countries achieve the economic and social benefits of broadband



INTRODUCTION

Governments around the world increasingly view broadband as the "fourth utility" alongside water, heating and electricity.[1] The power of broadband has been confirmed by recent research, which shows that broadband fosters GDP growth, creates jobs and stimulates innovation, while also enabling improvements in education, health care and other social services.

To realize the many benefits of broadband, governments around the world are implementing comprehensive nationwide plans, as well as more tightly focused broadband programs. When combined with strategies that ensure the availability and affordability of ICT, these efforts help countries reap the benefits of broadband more quickly and provide broadband services to more citizens at an affordable price.

"Broadband is not just an infrastructure. It is a general-purpose technology that can fundamentally restructure an economy."

World Bank, 2009

DEFINING BROADBAND

Broadband can be defined in many ways, but is generally understood to be a service that enables reliable, high-speed transfer of data, voice and video over the Internet. The connectivity afforded by broadband is an essential element in a larger effort to make ICT resources available, affordable and reliable for individuals and businesses worldwide.

Broadband speeds

Broadband speeds vary greatly depending on technology, location, applications and other factors. Because of this, it may be more helpful to focus on "acceptable broadband" speeds, which are the speeds necessary to meet the particular demands of any given market segment, such as schools, homes, businesses or medical centers.

In emerging markets, Intel recommends that countries ensure that most citizens can achieve download speeds during peak hours of at least 1 to 3 megabits per second (Mbps). Although this is currently an acceptable minimum, by 2012, developing countries should aim for much higher speeds of 3 to 6 Mbps, and up to 15 Mbps soon after 2012.

Broadband services

Broadband networks can be accessed through a variety of wired and wireless services, each of which offers unique advantages in speed, reliability and affordability. Wired, or fixed, broadband services (ADSL, cable, etc.) tend to be faster than wireless alternatives, but often cannot reach geographically remote areas. Wireless broadband networks, which can be accessed via cell phones, satellite, WiMAX and Wi-Fi signals, provide advantages in mobility and convenience.

Users can access broadband services through a range of equipment, including desktop computers, notebooks, netbooks, tablets, cell phones and smartphones. The access speeds for these devices vary greatly, with download speeds as low as 200 Kbps for wireless, entry-level 3G cell-phone services. Other wireless broadband options such as WiMAX can deliver higher speeds, less latency, and in many cases, lower costs.

Region	Fixed & Wireless Broadband* Subscribers (million)	Market Penetration Rate (per 100 population)
Africa	24.4	2.4
China	103.0	7.7
Rest of Asia & Pacific	292.7	12.0
Eastern Europe	55.0	16.2
Latin America	62.6	10.8
Middle East	42.4	13.4
U.S. & Canada	174.9	51.4
Western Europe	262.1	64.3
Grand Total	**1,017.1**	**15.0**

Figure 1. Broadband subscribers and penetration rate, end of 2009[2]

*Broadband is defined as a fixed network service having a downlink speed of 256kbps or greater or a 3G/4G service over next-generation cellular networks belonging to the UMTS and CDMA2000 family of technologies.

THE CURRENT STATE OF BROADBAND

More than 1 billion broadband subscriptions exist worldwide, and that number is expected to triple by 2013.[3] However, as shown in Figure 1, even among slower 3G wireless broadband subscribers, a profound "digital divide" separates the developing world from developed regions such as Western Europe.

According to the ITU, the broadband penetration rate in developed economies is 23 percent, compared to 4 percent in developing economies — and just 2 percent if China is excluded.[4] The gap is widest for mobile broadband penetration, which is nearly 39 percent in developed economies and only 3 percent in developing economies.

Broadband penetration is increasing worldwide, but growth rates are generally much higher in developed economies. For instance, Eastern Europe added 19.5 million fixed broadband subscribers between 2005 and 2008, and increased its market penetration to 7.5 percent. During the same period, African countries added 2.4 million fixed broadband subscribers, bringing market penetration up — but only to 0.36 percent.[5]

THE ECONOMIC BENEFITS OF BROADBAND

For more than a decade, a variety of case studies, anecdotes and qualitative studies have detailed the economic benefits of broadband networks in developed economies. More recently, quantitative research and empirical analyses have gone further — firmly establishing the fact that broadband networks support GDP growth and many other economic benefits in both developed and developing economies.

GDP growth

An analysis by the World Bank found that in developing economies, every 10 percent increase in broadband penetration accelerates economic growth by about 1.38 percentage points — more than the increase of 1.21 percentage points for developed economies, and more than the increases seen for other telecommunications services (Figure 2).

Additional research by Booz & Company suggests that countries in the top tier of broadband penetration have exhibited 2 percent higher GDP growth than countries in the bottom tier.[6]

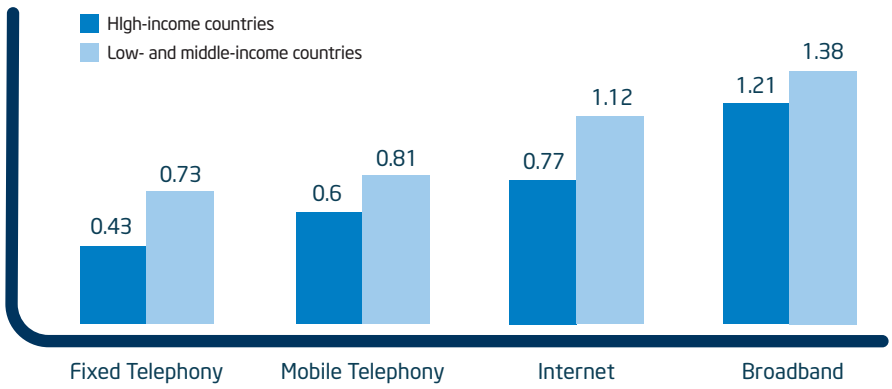


Figure 2. Growth impact of telecommunications[7]
(GDP percentage point increase due to 10 percentage-point increase in penetration)

WHY BROADBAND?

Compared to narrowband connections, broadband networks provide unique benefits that enable emerging economies to enter and compete in world markets. When combined with other ICT resources, broadband delivers benefits including:

- **Ubiquitous access.** Broadband networks are always on and always available for usage.
- **Enhanced multimedia applications.** Broadband speeds enable ready access to online video content, interactive applications, gaming and other multimedia resources.
- **Cost reductions.** Web browsing, e-mail and other online activities can increase labor productivity and lower the cost of gathering market intelligence.
- **Improved communication.** Broadband networks enable real-time communication through e-mail, instant messaging, Voice-over-Internet Protocol (VoIP) and more, enabling businesses to communicate more frequently and at a lower cost with suppliers, customers and business partners worldwide.
- **Energy efficiencies.** Broadband reduces travel demands and leads to lower carbon emissions and greater overall energy efficiency.

BROADBAND TECHNOLOGY: NOW MORE ACCESSIBLE AND AFFORDABLE

In the past, the benefits of broadband were not available in many countries. This was especially true in rural and remote areas, where broadband solutions such as digital subscriber lines (DSL) and cable broadband access often proved too expensive or difficult to deploy in inaccessible regions or those with low population densities.

Fortunately, in recent years, broadband technology has become more available, reliable and cost-effective, as well as easier to deploy. Universal Service Funds, targeted subsidies and ICT tax reductions have helped increase broadband/ICT access and adoption worldwide.

WiMAX is a wireless broadband solution that provides particularly attractive last-mile connectivity options because the technology is designed to deliver ubiquitous, high-throughput broadband wireless services at a low cost to remote and rural areas. WiMAX installation costs are lower for a wireless infrastructure based on 802.16 than for today's wired solutions, and WiMAX covers wider metropolitan and rural areas. WiMAX also allows for the integration of voice and data.

Wireless technology can be deployed incrementally to serve growing demand, without need for expensive network-wide upgrades. Fixed wireless solutions using WiMAX, as well as Wi-Fi, are particularly suitable for areas with population densities of just a few people per square kilometer.

Learn more about WiMAX broadband wireless technology access at www.intel.com/go/wimax

"We must ... recognize that access to affordable, high-speed broadband is just as important in today's economy as access to a paved road, to a telephone line or to reliable electricity."

David A. Paterson[8]
U.S. Governor, State of New York

Job growth

Along with its direct and positive impact on GDP, research has repeatedly shown that increased broadband penetration leads to significant job growth. It is conservatively estimated that increasing broadband penetration in Latin America from 5.5 percent to 7.7 percent would generate 378,000 new jobs.[9] In the United States, the Information Technology and Innovation Foundation estimates that a stimulus package spurring or supporting $10 billion of investment in broadband networks would support nearly 500,000 new or retained jobs.[10]

Other economic benefits

Other proven economic effects of broadband include trade creation and facilitation, lower costs for international communications and greater access to foreign markets.[11, 12] Broadband can also help countries attract, train and retain a valuable "creative class" of workers, and the presence of broadband leads to new business models and new business opportunities to employ those and other workers.[13]

Mobile communications in general, and broadband in particular, have an especially strong impact on the economies of rural areas, which are home to nearly three out of four of the world's poor.[14] Expanding broadband networks to rural areas leads to new opportunities for nonagricultural employment, better-paying agricultural jobs and greater overall productivity. Access to broadband also fosters small-business growth, allows citizens in remote areas to work from home, provides greater access to crop market prices and enables rural businesses to compete more effectively in world markets.[15]

THE SOCIAL BENEFITS OF BROADBAND

The social benefits of broadband are difficult to quantify, but they are nonetheless an essential part of the overall value of broadband. By connecting citizens to each other — as well as to businesses, governments and social services — broadband helps people become more informed and more active in their communities, leading to a better quality of life, and richer personal and business opportunities.

The benefits and opportunities broadband creates for all people — regardless of location, lifestyle or income — can help nations cross the digital divide. As broadband access becomes more available and less expensive, citizens and businesses in rural and remote areas can engage more directly in the national economy. Broadband is a cultural equalizer with the potential to allow all citizens to access essential government services and take advantage of new economic opportunities such as working from home.

Broadband networks also provide a more efficient and less expensive way to deliver essential public services such as health care, education, public safety and emergency services. Broadband-enabled telemedicine provides better access to specialized care, reduces unnecessary travel, and facilitates rapid diagnosis and treatment.[16] Mobile health workers, who deliver health care to remote regions around the globe, often rely on mobile broadband to communicate their findings and patient concerns with regional clinics.

Although not broadband-specific, studies have shown that household Internet access is also associated with better educational performance.[17] Numerous examples demonstrate that broadband-specific education creates valuable educational opportunities that can help countries develop a competitive, technology-literate workforce. Students with access to broadband connectivity become entrepreneurs, employers and employees with the skills and experience necessary to compete and succeed in the 21st-century global economy.

SOCIAL BENEFITS OF BROADBAND: EASING URBANIZATION

One of the social benefits of broadband is its effect on urbanization. Urbanization is one of the most powerful forces affecting developing economies, as the rural population rapidly moves into metro centers in search of employment and an overall better standard of living.

In China, for example, 55% of the population lives outside cities. By 2025, experts predict mass urbanization will more than double China's energy demand in urban areas, and increase demand for water by 70% to 100%. As a result, health care, education and other social services will be severely strained, and the loss of arable land and growing demands on natural resources will profoundly effect China's natural environment.[18]

Broadband can ease the damaging effects of urbanization in several ways:

1. **Increase economic opportunities in rural areas.** Broadband gives citizens in rural and remote areas new job opportunities, including the ability to work from home, which reduces travel time, traffic congestion and air pollution.
2. **Reduce urban desire.** Affordable broadband access can improve the economies of rural areas, driving up incomes, improving lifestyles, and reducing the need and desire to move to cities.
3. **Improve skills and education.** Broadband access increases educational opportunities in rural areas and supports development of ICT skills. This preparation enables rural citizens to work from home or find better employment in urban areas, reducing the strain on social services.
4. **Improve urban life.** In conjunction with other technologies, broadband can facilitate decentralized work environments that improve productivity while also reducing energy demands, noise pollution, vehicle emissions and other forms of pollution.

Intel is working with numerous countries to identify ways to use broadband to reduce the harmful effects of urbanization while encouraging economic development in both urban and rural areas.

"A fast Internet connection is now seen by most of the public as an essential service, as indispensable as electricity, gas and water."

Former U.K. Prime Minister Gordon Brown[19]

THE VALUE OF BROADBAND PROGRAMS AND PLANS

Governments worldwide now recognize the extensive social and economic benefits of broadband, as well as the risk of falling behind and missing the many opportunities it presents. The challenge is to identify the best strategies not only to realize all the benefits of broadband, but also to realize those benefits quickly and for the benefit of most or all citizens.

Broadband programs

Many countries around the world have implemented targeted programs that make broadband and ICT more available and affordable.

As the following four examples show, such programs can improve the lives of citizens and deliver both immediate and long-term economic benefits:

Morocco

Morocco's government recognized that the country's teachers needed greater Internet access and training in the use of ICT in the classroom. Through public-private partnerships and innovative funding models, a program called NAFID@ helped more than 105,000 of Morocco's teachers afford new mobile (3G) or fixed (ADSL) broadband connections. Of the teachers who now have broadband access, 77 percent use their connections to access online training, including an e-Learning platform and an online media library.

Nigeria

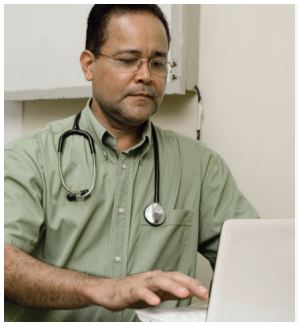
In more than 800 villages across Nigeria, citizens have little or no access to primary health care services. The Ministry of Health lacked public health information about these villages, and was therefore unable to optimize its allocation of health care resources.

In response, Nigeria's government worked with Intel and other partners to develop Project Mailafia,[20] which sends teams of mobile health care providers to remote villages, where they treat patients and collect health data and metrics that support better public health decision-making and resource allocation. The mobile health workers collect the data on ruggedized netbooks, and transfer the data to area clinics. The clinics then upload the data to a central database using WiMAX and Wi-Fi broadband technologies.

Pakistan

To spread broadband networks beyond a very limited group of citizens in Pakistan, the technology had to be made more affordable. To that end, Intel helped facilitate partnerships that eventually resulted in an amazing offer: free installation and free WiMAX broadband connectivity for two months with every PC purchase.

Developing and implementing the president's Rozgar Scheme, which reached thousands of citizens in four provinces, required collaboration among numerous government and industry groups. The Bank of Punjab provided low-interest loans, WaTeen (a telecom provider) lowered its costs and offered technical support, and the Commission for Higher Education allowed the program to be promoted at 16 universities.



Panama

Through Panama's Universal Internet Access (PUIA) initiative, the country provides free Internet access to 80 percent of its population. The government launched the initiative by inviting telecommunications companies to participate in a public bidding process. The USD 25.5 million contract was awarded to Liberty Technologies, a Panamanian company that worked with Intel to complete the ambitious network in just six months. The deployment includes a combination of WiMAX and Wi-Fi technologies in 22 cities.

	Program	Key Partners	Purpose	Results
Morocco	NAFID@	Government, telecom operators, hardware/ software manufacturers, banks, Intel	Enhance teachers' ICT skills and use of online training	More than 105,000 teachers have broadband access; 77% access online training tools
Nigeria	Project Mailafia	Government, Intel	Extend better health care to 800+ remote villages	Mobile health workers have treated thousands of villagers and gathered essential public health data
Pakistan	President's Rozgar Scheme	Government, bank, telecom operator, Intel	Make broadband more affordable	Two months of free WiMAX service now offered in four provinces
Panama	Panama Universal Internet Access (PUIA) initiative	Government, telecom operator, Intel	Provide free Internet access to 80% of population	Free Internet access now available in 22 cities, serving 2.3 million people (80% of population)

Broadband plans

For developing economies to bridge the digital divide, individual programs like those described above are only part of the solution. Broader strategies, or plans, are needed to support program rollout and ensure programs are properly funded and targeted.

Broadband plans, which are sometimes part of larger ICT or stimulus plans, establish a nationwide vision for broadband expansion, and include the ideas, strategies, partnerships and public-policy solutions to make that vision a reality. National plans can help countries coordinate a long-term and sustainable national strategy, mobilize the public-private leadership and ecosystem, and ensure timely follow-through on programs and other initiatives.

Comprehensive plans are now in place in many countries, including Costa Rica, Malaysia, Mexico, Singapore and the U.S. The plans differ in the specifics of form and content, but they share a broad acknowledgement of the benefits of increased broadband penetration, and of the need to define objectives, establish metrics, implement supportive policies, and build partnerships to make broadband and ICT more affordable and accessible.[21]

For more detailed information about broadband plans — including best practices and a suggested plan structure — Intel offers a white paper titled "Developing National Broadband Plans."

"Whether [broadband's] great potential to contribute to growth and competitiveness is realized will depend on whether governments understand the opportunity and ensure that supportive conditions are in place through regulatory and policy reforms as well as strategic investments and public-private partnerships."

World Bank, 2009

CONCLUSION

Recent research firmly establishes broadband as an essential part of the global information society. Broadband fosters GDP growth, creates new jobs, spurs innovation and improves public services. However, countries must be proactive to achieve these benefits and become more competitive in the global marketplace. Governments can lead the way by working with partners to develop plans and programs that encourage the rapid and strategic expansion of broadband and ICT.

Delivering affordable, reliable and accessible broadband to more citizens will help countries bridge the digital divide — and it can help all countries become stronger, more competitive and more prepared for continued growth in the years and decades to come.

Achieve Your Vision

Intel can help you achieve your vision of a growing national economy supported by widespread broadband deployments. To learn more, contact your local Intel representative, or visit us online at **www.intel.com/intel/worldahead**.

INTEL® WORLD AHEAD PROGRAM

For years, the Intel World Ahead program has worked with governments, development organizations, community groups and other technology leaders to develop sustainable, comprehensive approaches to ICT and broadband deployment in emerging markets.

Through hands-on expertise and extensive resources, the Intel World Ahead program helps countries develop comprehensive plans and targeted programs that make broadband and ICT more affordable, reliable and accessible.

[1] See, for instance, prepared remarks by U.S. FCC Chairman Julius Genachowski, on March 10, 2010: "In terms of transformative power, I think broadband is most akin to the advent of electricity" (www.fcc.gov/Daily_Releases/Daily_Business/2010/db0311/DOC-296808A1.txt).

[2] Data from research by TeleGeography, ©2010 PriMetrica, Inc.

[3] Yongsoo Kim, Tim Kelly, and Siddhartha Raja. "Building broadband: Strategies and policies for the developing world," Global Information and Communication Technologies (GICT) Department, World Bank, January 2010.

[4] ITU, "Measuring the Information Society," 2010

[5] Data from TeleGeography GlobalComms, 2009.

[6] Booz & Company, Digital Highways: The Role of Government In 21st-Century Infrastructure, 2009, p. 5

[7] Qiang, Christine Z., 2009. "Telecommunications and Economic Growth." Unpublished paper. World Bank, Washington, D.C.

[8] New York State Universal Broadband Strategic Roadmap, New York State Council for Universal Broadband, June 2009.

[9] Dr. Raul L. Katz, "Estimating broadband demand and its economic impact in Latin America," Sept. 4, 2009.

[10] Robert D. Atkinson, Daniel Castro and Stephen J. Ezell. "The Digital Road to Recovery: A Stimulus Plan to Create Jobs, Boost Productivity and Revitalize America," The Information Technology & Innovation Foundation, January 2009.

[11] ITU, "Measuring the Information Society," 2010.

[12] World Bank, "Information and Communication for Development: Extending reach and increasing impact," 2009.

[13] Dutta, Soumitra, and Irene Mia. 2008. The Global Information Technology Report 2006-2007: Connecting to the Networked Economy. Basingstoke, U.K.: Palgrave Macmillan.

[14] World Bank, "Information and Communication for Development: Extending reach and increasing impact," 2009.

[15] Ibid.

[16] Ibid.

[17] ITU, "Measuring the Information Society," 2010.

[18] Janamitra Devan, Stefano Negri and Jonathan R. Woetzel, "Meeting the challenges of China's growing cities," The McKinsey Quarterly, 2008 (3).

[19] Remarks by U.K. Prime Minister Gordon Brown, June 16, 2009 (www.timesonline.co.uk/tol/comment/columnists/guest_contributors/article6506136.ece).

[20] www.fctmdgmailafiya.org

[21] Intel actively supports countries seeking to develop broadband plans. See the "Developing National Broadband Plans" white paper for best practices and additional information.

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