

PART I—
INNOVATION
AND INVESTMENT

BROADBAND IS CHANGING MANY ASPECTS OF LIFE—increasing business productivity, improving health care and education, enabling a smarter and more efficient power grid and creating more opportunities for citizens to participate in the democratic process. It is also fueling large global markets for high-value-added goods and services and creating high-paying jobs in important sectors such as information and communications technology (ICT).

BOX I-1:**Broadband as a Transformative General Purpose Technology**

Technological progress drives long-term economic growth.¹ As economists Timothy Bresnahan and Manuel Trajtenberg explained in a 1995 paper, “Whole eras of technical progress and economic growth appear to be driven by a few key technologies, which we call General Purpose Technologies (GPTs). The steam engine and the electric motor may have played such a role in the past, whereas semiconductors and computers may be doing as much in our era. GPTs are characterized by pervasiveness (they are used as inputs by many downstream sectors), inherent potential for technical improvements, and innovational complementarities, meaning that the productivity of R&D in downstream sectors increases as a consequence of innovation in the GPT. Thus, as GPTs improve they spread throughout the economy, bringing about generalized productivity gains.”² The report continued, “As use of the GPT grows, its effects become significant at the aggregate level, thus affecting overall growth.”³

The Internet has the characteristics of a GPT.⁴ Businesses of all kinds and sizes use it to improve their processes, from procurement to supply chain management, market research to sales and asset management to customer support. It has driven performance improvements; for example, the average U.S. broadband connection speed has grown more than 20% per year for the last several years. These improvements are driving technology and business innovation in several other sectors, including health care,⁵ education,⁶ energy,⁷ online commerce⁸ and the government.⁹

The U.S. must lead the world in broadband innovation and investment and take all appropriate steps to ensure all Americans have access to modern, high-performance broadband and the benefits it enables. Broadband has been a main driver of growth and innovation in the ICT industry, generating demand for semiconductors, consumer and enterprise software, computers, devices, applications, networking equipment and many different types of services. A world-class broadband ecosystem will help ensure that America’s ICT sector continues to lead the world—creating jobs, tapping American ingenuity and allowing American consumers to receive the substantial benefits that flow from the evolution of ICT.

Today’s broadband ecosystem is vibrant and healthy in many

ways. In numerous communities, consumer demand is strong. Service providers are investing in upgrades of fixed and mobile networks. New devices, and even new device categories—such as e-book readers, tablets and netbooks—are being created. New applications keep emerging, and more and more content is available online. However, there are some areas where America can and should do better. Government policies and actions can foster innovation and investment across the ecosystem in four key areas:

- *Enacting policies to foster competition.* Competition is a major driver of innovation and investment, and the Federal Communications Commission (FCC) and other agencies have many tools to influence competition in different areas of the broadband ecosystem. These tools are best applied on a fact-driven, case-by-case basis. Therefore, continuous collection and analysis of detailed data on competitive behavior must be the linchpin of effective competition policy. This plan establishes a process for such collection and, in addition, proposes several specific actions that will foster competition.
- *Freeing up more spectrum.* The federal government controls and influences the availability and cost of spectrum. Spectrum plays an important role in the economics of broadband networks. By ensuring spectrum is allocated and managed as efficiently as possible, the government can help reduce the costs borne by firms deploying network infrastructure, thus encouraging both competitive entry and increased investment by incumbent firms. The plan highlights actions that the FCC, the National Telecommunications and Information Administration and Congress can take to enable more productive uses of spectrum and make more spectrum available for broadband.
- *Lowering infrastructure costs.* Government also controls and influences the availability and cost of other resources, such as pole attachments and rights-of-way. As with spectrum, ensuring these assets are allocated and managed as efficiently as possible can reduce the costs borne by firms and foster competition and investment. The plan outlines infrastructure policies that lower the cost of network deployment.
- *Investing directly through research and development.* Government should invest directly in areas where the return on

investment to society as a whole is greater than the return for individual firms. Research and development (R&D) is one of these areas, as the effects of R&D often extend beyond those anticipated by its funders in unanticipated ways.¹⁰ The plan contains specific recommendations for the creation of a broadband R&D agenda, including development of ultra-high-speed testbeds to drive new innovations in broadband and applications.

Since the Telecommunications Act of 1996, U.S. policy has embraced competition as the best means to bring the fruits of investment and innovation—including lower prices, new services and features, higher service quality and choice—to the American people. This plan follows in that tradition. The four chapters that comprise Part I of the National Broadband Plan contain more than 40 recommendations that directly spur competition. But the plan as a whole helps to promote competition in other areas. A small sampling of the pro-competition, pro-consumer initiatives outside of Part I include:

- Enable competition in digital educational content by setting standards for content created by the federal government and proposing sharing of procurement information among local education agencies (see Chapter 11).
- Ensure greater competition and innovation in broadband-enabled Smart Grid information services and related devices by providing secure access to digital electric information for consumers and authorized third parties (see Chapter 12).
- Ensure first responders reap the benefits of competition in choosing handsets and wireless broadband technology, allowing them to take advantage of advances in the commercial wireless ecosystem (see Chapter 16).

Part I of the plan (Innovation and Investment) begins with Chapter 4, which contains recommendations to drive innovation through competition in networks, devices and applications. Chapters 5 and 6 contain recommendations to lower the cost of inputs such as spectrum and infrastructure and to maximize private sector investment and competitive entry. Chapter 7 proposes a process to create an agenda for government-sponsored R&D to support broadband.

PART I ENDNOTES

-
- 1 See, e.g., Paul Romer, *Endogenous Technological Change*, 98 J. POL. ECON. S71 (1990).
 - 2 Timothy Bresnahan & Manuel Trajtenberg, *General Purpose Technologies "Engines of Growth?"* 1 (Nat'l Bureau of Econ. Research, Working Paper No. W4148, 1995), available at <http://www.nber.org/papers/w4148.pdf>.
 - 3 Elhanan Helpman & Manuel Trajtenberg, *A Time to Sow and a Time to Reap: Growth Based on General Purpose Technologies*, in GENERAL PURPOSE TECHNOLOGIES AND ECONOMIC GROWTH 55–84 (1998).
 - 4 See, e.g., Richard G. Harris, *The Internet as GPT: Factor Market Implications*, in GENERAL PURPOSE TECHNOLOGIES AND ECONOMIC GROWTH 145–66 (1998); RICHARD G. LIPSEY ET AL., ECONOMIC TRANSFORMATIONS: GENERAL PURPOSE TECHNOLOGIES AND LONG TERM ECONOMIC GROWTH 133 (2005).
 - 5 See, e.g., *infra* Chapter 10.
 - 6 See, e.g., *infra* Chapter 11.
 - 7 See, e.g., *infra* Chapter 12.
 - 8 See, e.g., *infra* Chapter 13.
 - 9 See, e.g., *infra* Chapters 14–16.
 - 10 David B. Audretsch & Maryann Feldman, *R&D Spillovers and the Geography of Innovation and Production*, 86 AMER. ECON. REV. 630, 630 (1996).