Beyond Broadband Access: Developing Data-Based Information Policy Strategies

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CHAPTER

1 Beyond Broadband Access: What Do We Need to Measure and How Do We Measure It?

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Abstract

This chapter considers what needs to be measured when it comes to Internet and broadband access and how to measure it. Around the world, claims that broadband infrastructure is central to the development of the knowledge economy are becoming indisputable. However, a gap exists between the discourses linking broadband deployment with the development of a knowledge-based society and the ability to deliver the desired outcomes. The chapter assesses existing information society measures like the International Telecommunication Union's ICT Development Index and the World Economic Forum's Networked Readiness Index, suggesting that while they provide a useful starting point for comparing national information and communications technology (ICT) indicators, they fail to offer sufficiently detailed metrics upon which to formulate policy related to the development and use of broadband networks. It proposes more nuanced approaches to understanding whether, and how, citizens actually benefit from access to broadband technologies, and offers suggestions for the development of new, policy-relevant metrics of ICT usage.

Keywords: broadband access, Internet access, knowledge economy, information society, information and communications technology, metrics, broadband networks, broadband technologies, ICT Development Index, Networked Readiness Index

Subject: Museums, Libraries, and Information Sciences

Around the world, claims that broadband infrastructure is central to the development of the knowledge economy are becoming indisputable. Many governments are taking steps to ensure their regulatory environments encourage private sector investment in broadband,[1] consistent with Organisation for Economic Cooperation and Development (OECD) recommendations to rely on competition to the maximum extent possible as a means of building broadband infrastructure.[2] In instances where the private sector cannot establish a business case for broadband deployment, governments are committing public funds to extend the reach of broadband networks, justified by the widely held belief that broadband access is essential infrastructure for an information society.

Investment in broadband infrastructure is premised on the dual assumptions that broadband networks enable the information society and the knowledge economy, and, by providing citizens with access to broadband, citizens will participate in, and reap the benefits of a knowledge-based economy and society.[3] However, Preston, and Cawley observe that broadband development is often driven by "supply-side, technology-focused policies" that do not explicitly consider the needs of users.[4] Deployment of broadband infrastructure is expected to encourage the creation and uptake of "socially useful" applications, but this is

not guaranteed. Indeed, at present there is a gap between the discourses linking broadband deployment with the development of a knowledge-based society and the ability to deliver the desired outcomes. This chapter explores this gap.

p. 10 A central motivation for investing in broadband is that *providing citizens with access to broadband connectivity will allow them to engage in the information society*. But there are three problematic parts of this statement: 1) access to broadband does not ensure that broadband is used, or that it is useful for the user; 2) all broadband networks are not the same, meaning that the potential benefits of broadband access may not be equal for all broadband users; and 3) there is uncertainty as to exactly how to recognize the broadband-enabled benefits of engagement in the information society.

Although there is a great deal of research activity regarding broadband and the information society, this chapter argues that there is a need for better research questions, improved analytical approaches and more sophisticated and wider-ranging data collection in order to fully assess the extent to which broadband networks actually do enable citizens to become participants in the information society. The chapter begins with a consideration of the nature of broadband networks, followed by a discussion of how broadband can enable engagement in the information society. The availability and analysis of data on broadband use is then explored, and suggestions for improved data analysis approaches are offered. The chapter concludes with a brief discussion of the challenges of developing more advanced measures.

All Broadband Connections are not the Same

Many claims are made about the benefits of broadband. As more evidence is compiled demonstrating the positive returns on investment in broadband, it is important to consider exactly what is encompassed in this term so as to better understand the type of investment (and resultant infrastructure) that enables positive outcomes.

What is available to citizens? National and pan-national (e.g., European Union) statistical agencies do not apply a common definition of broadband, nor do they collect data in a consistent format. Some differences in approach are explained below, highlighting the need to understand speeds and network characteristics.

Statistics Canada's Canadian Internet Use Survey (CIUS) collects data on the type of household Internet connection. Those reporting cable or satellite connections are recorded as having high-speed access. Respondents with telephone connections are asked if their connection is a high-speed connection. No definition of high speed is offered, but it is assumed that respondents in this category would describe their Internet as high speed if they were not using a dial-up connection. In total, the 2009 CIUS data indicate that 92 percent of Canadians with Internet access at home (70 percent of the total population) have a high-speed connection.[5]

p. 11 The term *broadband* is not applied to these data by Statistics Canada, but data reported by the CRTC (the Canadian telecommunications regulator) differentiates between "high-speed" and "broadband" networks, using *broadband* to describe connections with download speeds greater than 1.5 Mbps.[6] The CRTC reports that 93 percent of Canadian home Internet users had high-speed Internet connections in 2008, but only 70 percent of these were broadband connections. Taking into account the nonusers, this means that just over 50 percent of Canadian households had Internet connections that provided access at speeds greater than 1.5 Mbps, a number that is quite different than the 70 percent of households with high-speed connections reported by Statistics Canada.

In Australia, as of December 2009, 89 percent of Internet subscriptions were for broadband services, defined as providing downloads at speeds greater than 256 Kbps.[7] If applying the same minimum as the Canadian data (i.e., > 1.5 Mbps), only 60 percent of subscriptions would be categorized as broadband. But while the Australian Bureau of Statistics considers speeds above 256 Kbps as broadband, the Australian government has embarked on a program to offer speeds of up to 100 Mbps to homes, orders of magnitude faster than speeds currently experienced by many Australians.[8]

2010 Eurostat data[9] show that 64 percent of households have a broadband connection, defined as "connectable to an exchange that has been converted to support xDSL-technology, to a cable network upgraded for Internet traffic, or to other broadband technologies."[10] OECD data show that European countries are now the international broadband leaders,[11] thus it is interesting to note that across fifteen

European countries not quite two-thirds of households have broadband connectivity. After years of promoting the benefits of the information society, it seems that many citizens are yet to be convinced that they require broadband access.

More than 50 percent of Japanese broadband subscribers are connected by fiber networks that can provide download speeds of 100 Mbps or more, and several other OECD countries have extensive fiber uptake.[12] In countries with competition among broadband technologies, cable companies are upgrading their networks to offer download speeds of up to 120 Mbps, and telephone companies are increasing the availability of faster DSL connections (with download speeds in the range of 20–50 Mbps).[13]

Mobile broadband services are also becoming more common, providing users with coverage anywhere served by mobile broadband networks. Although speeds vary enormously, and connectivity is not always reliable, mobile broadband is used by many as a substitute for fixed line service.

Examples could be provided from many other countries, but the data above are sufficient to demonstrate that there are many definitions of broadband, and that there are vast differences in the speeds of broadband
p. 12 connections ↳ used by citizens around the world. Variations in connection speeds result in differing experiences of the Internet. Additionally, actual connection speeds often do not match the advertised speeds, with connections frequently slower than advertised. The discrepancies are noted in reports by the Federal Communications Commission in the United States,[14] Epitiro in Australia,[15] and Ofcom in the United Kingdom,[16] and indicate that the problem is not confined to a specific country.

There are three other pertinent issues regarding the speed of Internet connections that impact the way that citizens experience broadband networks. The first is that in a few countries, Internet service providers (ISPs) impose strict limits on the volume of data that can be downloaded in a fixed period (often a month).[17] These download caps counteract the value of having a high-speed connection, because once the monthly cap has been reached, financial or technical penalties (e.g., reduced download speeds) are imposed on the subscriber. As such, it is important to understand the conditions of access that govern a broadband connection, as speed is not the only factor that can constrain usage.

The second concern is that in some countries, independent of download caps, ISPs are known to "throttle" or "shape" (i.e., degrade) certain types of Internet traffic. This is typically done in the guise of network management, but it is argued these practices violate the principles of network neutrality and detract from a citizen's ability to freely access online content.[18] Given the differential traffic shaping practices among ISPs, it is useful to understand how these practices can impinge upon citizens' Internet activities, as they may impact their ability to fully engage in the information society.

Third, the interactive nature of the Internet means that not only do people want to *download* content and services, they also want to *upload* their own content and create their own services.[19] Residential Internet connections have traditionally been asymmetrical and it is a technical challenge to increase upload speeds on copper and cable networks.[20] But as citizens become more engaged with the information society they want fast download speeds to be matched with fast upload speeds. Some providers do offer symmetrical or near symmetrical speeds, but faster upload speeds are usually considered a premium service and cost more.

Without knowing the connection speed, whether there is a download cap, whether the connection is subject to traffic management practices, and whether the connection supports symmetrical or near-symmetrical uploads it is difficult to make assumptions as to the capacity of an individual's broadband network.

Why do speed and network quality matter? Most people would instinctively choose a faster speed connection over a slower one, but it is useful to consider the specific benefits that can arise with the adoption and use of
p. 13 faster, ↳ higher quality, unrestricted networks. There are numerous reports that describe the applications that are enabled by higher speed connections,[21] as well as documents that explore the added functionality offered by faster broadband networks and consider demand for such networks.[22] But simply building a higher speed network and making it available to users without imposing download caps or traffic shaping does not ensure that they will be able to benefit from access to it. Thus, the observations made here about the potential uses of higher speed networks are premised on the assumption that the users will have the necessary skills and interest to take up these applications in meaningful ways.

One of the most frequently cited benefits of higher capacity networks is the ability to support video applications. These networks will support multiple high-definition television (HDTV) streams into homes, but with more symmetrical network architecture, networks can also be used to support interactive high-

resolution video conferencing. Advanced video services can support healthcare, entertainment (e.g., interactive gaming) and educational applications, as well as enabling energy management functionality, and remote monitoring of any location.

Speed and quality matter because they have a large influence over what can be done on a particular broadband network. If broadband networks are to deliver benefits to users by enabling certain functionality, then it is essential to understand whether the user's broadband network can actually deliver such functionality. By assessing users' needs and recognizing the limitations of lower speed, restricted, asymmetrical broadband networks, it is possible to create an upgrade path to provide improved connectivity and enhanced access to the information society.

Assessing broadband connectivity. This section has outlined some of the problems in assuming that the simple availability of a broadband network will enable all of a citizen's desired online activities. Given the many variations in broadband speeds, access restrictions and network quality, there is a strong case to be made for ensuring that the attributes of broadband networks are well understood by those planning to deploy services over them, and by those responsible for providing broadband connectivity as a means of enabling the information society.

Table 1-1 highlights network characteristics that should be considered in order to assess the extent to which a broadband network can meet its users' needs.[23] Ideally, this information could be used to develop a household broadband profile.[24] This profile would allow for immediate determination of whether a household has the capacity to engage in specific activities, and identification of gaps to be remedied. The answers to some questions are clear cut (e.g., advertised speed), others are more subjective (e.g., definitions
p. 14 of affordability, which is relevant in understanding whether a citizen can ↳ maintain this connection over time) or subject to variation over time (e.g., actual speeds, whether a connection can support particular applications).

Table 1-1 Sample Components of a Household Broadband Profile

Issue: Broadband Network Characteristics	Information Required
Speed	What are the advertised upload and download speeds?
	What are the actual upload and download speeds?
	Do these speeds support all the applications citizens want to use?
Type of connection	What is the access technology (or technologies) in use?
	Are there technical limitations imposed by the type(s) of connection in use (e.g., will a wireless connection support all necessary applications)?
	Is the connection upgradable to meet demands for increased bandwidth?
Quality of service	Does the network provider allow for prioritization of specific types of traffic? Does such prioritization meet user and application provider needs?
Service provider	Do service providers' policies (e.g., with respect to traffic shaping or download caps) negatively impact the user's experience?
	Is the connection affordable?

Developing household broadband profiles is only a first step in the exploration of how citizens can benefit from broadband infrastructure. The profile provides information on the current and future capacity of a household's broadband connectivity, but capacity is a measure of potential benefit, not of realized benefit. As Gillett et al. observed, in order to benefit from broadband infrastructure, "broadband ha[s] to be used, not just available."[25]

The issue of use is central to the "broadband enables the information society" logic. Although it seems obvious that broadband networks must be used to create value, this point is not always explicitly considered. Indeed, many international measures of broadband "use" are actually access measures, and simply

measuring use does not address the question of "use for what purpose." The next two sections address these concerns.

Using Broadband to Participate in the Information Society

It is beyond the scope of this chapter to review the discourses of the information society and the related
p. 15 dialogues that consider the role of information and ↳ communication technologies in enabling a knowledge-based society or digital economy.[26] There are, for instance, streams of research focusing on conceptualizing the information society,[27] technologies and environments that foster ICT to support the information society,[28] measuring the information society and its enabling technologies,[29] and policy making.[30] Additionally, extensive work has been done by governments and NGOs to discuss, define, and measure the information society.[31]

Despite enormous diversity in research and policy making regarding the information society, there is some common ground in the basic definitions of the concept. In 1994 a commission on Europe and the Global Information Society noted that "Technological progress now enables us to process, store, retrieve and communicate information in whatever form it may take, whether oral, written or visual, unconstrained by distance, time and volume."[32] In the 2006 *World Information Society Report*, Yoshio Utsumi, the secretary general of the World Summit on the Information Society (WSIS) described "a future Information Society [as one] in which Information and Communication Technologies (ICTs) are available anywhere, anytime and to anyone."[33] The European Commission's Knowledge Society Web Portal (now defunct, but accessible through archive.org) defined the information society as "a society in which low-cost information and ICT are in general use" and then applied the term *knowledge-based society* "to stress the fact that the most valuable asset is investment in intangible, human and social capital and that the key factors are knowledge and creativity."[34] In brief, the information society is built on information and communication technologies, and broadband can provide access to them.

Many studies offer evidence that broadband connectivity provides economic benefits. The World Bank recently reported that "for every 10-percentage-point increase in the penetration of broadband services, there is an increase in economic growth of 1.3 percentage points." Van Gaasbeck found that increased broadband use in California is associated with employment growth,[35] Fornefeld et al. discuss the ways that broadband spurs growth and innovation in European industries,[36] and Greenstein and McDevitt note broadband adoption has a positive impact on US gross domestic product.[37]

But for the purposes of understanding how broadband facilitates individual engagement in the information society, economic impact studies offer little specific insight. Assertions that broadband enables employment, education, and healthcare are plentiful, but specific studies that consider how individual usage of broadband[38] actually results in increased engagement with the information society are less common,[39] even when the possibilities for such engagement are clearly articulated.[40] Recent work by Kolko
p. 16 suggests that benefits to households as a result of increased broadband ↳ expansion are "ambiguous," and concludes that "the local economic development benefits of broadband are mixed."[41]

One of the reasons for the somewhat uncertain relationship between broadband adoption and improved information society outcomes is that these improved outcomes are not always easily recognized. In other words, it is difficult to know exactly when an individual is actually improving his or her information society "involvement" when using a broadband network. Kolko calls for more research that specifically considers the relationship between investments in broadband infrastructure and tangible benefits for citizens, and assesses how (or whether) broadband uptake can lead to better social outcomes.[42]

Because there are many disparate broadband applications that can provide different sorts of information society benefits, it will be necessary to develop a range of assessment tools. There are two key requirements for these tools. The first is that they enable recognition of broadband-enabled information society benefits; that is, they make it possible for researchers to identify the precise ways that broadband network use contributes to an individual's engagement with the information society. The second is that the tools allow for a measure of the extent or size of the benefit.

There is some work being done that offers more detailed articulation of the ways in which Internet usage can help people participate in the information society. For instance, the World Bank notes that "in developed countries and urban areas in developing countries, an increasing number of individuals build up

social networks through broadband-enabled, peer-to-peer Web-based groups that facilitate economic integration and drive development. Blogs (Web logs, or online diaries), wikis (Web sites where users can contribute and edit content), video sharing sites, and the like allow new, decentralized, and dynamic approaches to capturing and disseminating information that allows individuals to become better prepared for the knowledge economy."[43] This kind of description starts to explain how the Internet fosters information society engagement, but does not consider the extent to which it actually works for various individuals.

To consider another example, it is agreed that broadband connections support e-learning. But how is that support actually provided, and how can it be measured? E-learning activities might consist of corresponding with an instructor by email, downloading reading materials and contributing to a chat forum, none of which are sophisticated or bandwidth-intensive activities. It might also consist of high-definition video conferencing between students, interactive simulations conducted by video or in virtual worlds, creating video content to share with other students and streaming video live from field trips. These two descriptions of e-learning demonstrate the complexity inherent in trying to understand how broadband
p. 17 enables e-learning, ↳ and, perhaps more importantly, highlight the fact that information society engagement can take place on many levels.

Data collected from surveys that pose simple questions like "have you used the Internet at home for ..." and then provide a list of possible activities like email, banking, searching for work, education, watching TV, and searching for information[44] cannot be used to assess the extent of information society benefits gained by these types of Internet usage. Such data do allow for a very basic description of the nature of individuals' online activities, but can really only be used to understand the relative popularity of applications, not to understand how or whether people benefit from using them. As the e-learning example suggests, developing a detailed questionnaire about the benefits of e-learning requires a sophisticated understanding of its potential and possibilities.

A more informative approach would be to gather extensive observational data, with researchers actually observing how people use their broadband connections over time, and allowing them to articulate the benefits in their own ways, rather than by selecting from a stated list of anticipated benefits.[45] As such an approach may not be very feasible on a wide scale, use of diaries and personal video recordings (e.g., to describe uses, benefits, and challenges faced in engaging with the information society) could offer a less resource-intensive means of gathering richer data, while still allowing individuals to share their experiences in ways that are meaningful to them. Table 1-2 summarizes the objectives for data collection regarding use of, and benefits from broadband (not just Internet) connectivity.

Table 1-2 Linking Broadband use to Information Society Benefits

Issue: Mechanism for Benefiting from Broadband	Information Required
Network use	Do citizens access services that enable them to participate in the information society?
	Do citizens accrue benefits from the use of such services? How? What skills are needed to ensure maximum benefit?

If the overall objective of encouraging the development of broadband capacity is to allow it to be used to foster engagement or participation in the information society, then it is important for policy makers to be able to determine whether, and how this interaction is actually happening. Researchers can help to reveal the ways in which broadband connections are being used by individuals to participate in the information
p. 18 society, and ↳ can then identify actions to be taken to encourage greater engagement as appropriate.

In addition to understanding what sorts of information society activities are undertaken, it is also important to know more about the extent to which specific activities are undertaken (this helps to articulate the extent of benefits realized from a given activity). A problem with much of the current information on broadband usage is that it measures the type of use (what people are doing) without considering frequency or intensity of use (e.g., data record that individuals use e-learning applications, but don't indicate whether the use is frequent or infrequent, and whether it is extensive or superficial). An additional problem, especially within various international ICT indexes that purport to assess use, is that many measures of use are actually measures of adoption. The reason this is problematic is considered below, followed by a discussion of what can be derived about usage and information society engagement from other data sources.

In order to use a technology or service, the first decision is an adoption decision. If a household adopts a broadband connection, this means that the connection is available for use. The fact that the connection has been established means that the household is now considered to be a "broadband household," and the household's connection would be recorded by the OECD, the ITU or statistical agencies that track broadband subscriptions. But adoption does not mean that the technology or service is actually being used or will be used in the future, nor does the act of adoption imbue potential users with the skill or capacity to use whatever it is they have adopted.

Adoption allows for the possibility of use. While people generally adopt technologies with the intention to use them, there is potential for much variety in actual technology use. Acquiring access to a broadband network is a first step toward participation in the information society, but it may not produce immediate benefits. As such, efforts to understand how having access to a broadband connection can enable the benefits of the information society must be informed by usage data, not adoption data. But to date, a variety of widely used ICT indexes are based on adoption data, limiting their usefulness in informing governments and policy makers about citizens' readiness to engage with the information society.

Information society indicators. An enormous amount of effort has been expended to develop indexes that provide internationally comparative data on various ICT and information society indicators. Measuring the
p. 19 information society is a complicated task, and much progress has been made by the ↳ international working parties (comprised of a mixture of representatives of statistical agencies, the United Nations, the OECD, the International Telecommunication Union [ITU], telecommunications policy makers and academics, among others) that do this work. Two high-profile indexes are the ITU ICT Development Index,[46] and the World Economic Forum/INSEAD Networked Readiness Index.[47] Both indexes offer data that can be used by policy makers for international comparisons, and for assessing progress within countries over time. But they offer minimal value in assessing the extent to which individuals in particular countries are using their broadband connections to engage in the information society and to achieve personal benefits. Despite assertions that their indexes assess the state of usage of broadband technologies, the data really report on technology adoption (i.e., penetration rates).

Waverman and Dasgupta observe that "the literature on mobile communications and telecommunications generally has not, to date, looked in sufficient detail at factors beyond penetration."[48] They, as well as Pepper et al., propose stage models of adoption that do take into account real measures of usage.[49] These models demonstrate increasing levels of sophistication of (aggregate) use of communication technologies among populations and offer some commentary on how to encourage greater societal and economic benefits through increased usage of ICTs. Furthering this approach, Waverman and Dasgupta's Connectivity Scorecard recognizes the importance of what is termed "useful connectivity," attempting to develop an index that takes into account not just the development of infrastructure, but also the uses of this infrastructure, and investment in developing skills among users, in order to assess the contributions of connectivity to economic growth.[50]

Pepper et al. identify the "intensive" stage of broadband adoption, at which "e-commerce, e-government services, business collaboration, and social networking, among others, are pervasive and have become an integral part of the social fabric and economy."[51] At this stage, reached when approximately 50 percent of households have broadband access and two-thirds of the population are using the Internet, broadband networks are being used to enable services that foster engagement in the information society. Only 23 countries, with a total population of about 850 million, had reached this intensive use stage by 2009. These countries are at the leading edge of the information society, but if the information society is to be integrated

into the lives of everyone in the world, universal access is needed. While reaching 50 percent household broadband penetration, with two-thirds of the population online is an accomplishment, it also highlights the broadband digital divide—any society with 50 percent of its citizens not having broadband access cannot be considered a broadband-enabled information society.

p. 20 Information society indicators, as currently formulated, do not provide good information on the nature of use of information technologies in the information society. The basic adoption/penetration information provided in these indexes offers value to policy makers and researchers, as does the opportunity for cross-national comparisons, but to really understand the extent to which the goals of an information society, with information access for all, can be achieved by the deployment of broadband and Internet technologies, further information is needed. Additionally, the evidence provided by these indexes and other investigative models suggests that there is much work to be done to reach universal or even near-universal access and use of information society enabling technologies. These two points are explored further in a discussion of other sources of Internet use data.

Internet use data. As noted in the previous section, it is challenging to assess the relationship between broadband usage and specific information society benefits. However, there are two ways that the relationship can be explored. The first is by considering basic usage data, on the assumption that if citizens are not using broadband connections, they will not be engaging in the information society. The second is to consider the scope and intensity of users' activities, as this can identify usage patterns that encourage positive information society outcomes.

As discussed above, international ICT indicators (generally based on source data from the OECD and the ITU) are not very helpful in assessing Internet and broadband use. They do show that broadband adoption continues to grow steadily around the globe, meaning that the number of users is increasing, and the potential for more citizens to engage with the information society through broadband connections is growing. Outside the indexes, OECD broadband adoption statistics are widely used, and widely criticized.[52] There are other sources of information on national ICT indicators, including national or pan-national statistical agencies (e.g., Australian Bureau of Statistics, Eurostat, Singapore's Infocomm, Statistics Canada), and nonprofit research consortia (e.g., Pew Internet Project, World Internet Project). Additional data and commentary are available from various consulting firms and other private sector companies like Nielsen.[53]

Much of the available Internet use data comes from user surveys. Survey responses provide static measures of use, enabling cross-sectional data analysis. These data are helpful in understanding the types of activities favored by Internet users, and activities can be assessed in terms of how they help individuals participate in an information society (e.g., by accessing educational content, government services, healthcare and so on). Although longitudinal tracking of changes in specific individuals' habits over time is not possible with most surveys, data that is collected on a regular basis can be used to identify trends within a population. For
p. 21 instance, the Canadian Internet Use ↳ Survey data shows how use has changed from 2005 to 2007 to 2009, illustrating a decreasing digital divide, and increasing uptake of a wider variety of online activities.[54]

Kolko does use longitudinal data to consider the impact of broadband adoption, concluding that not all "socially desirable" activities increase when individuals switch from dial-up to broadband services. His findings offer a tangible example of how broadband usage data can be linked to achievement of information society benefits by individuals, and reinforce the observation that broadband connectivity alone does not ensure beneficial outcomes. He also makes the point that assessing the benefits of broadband use is very complicated, and argues that much more research is needed to "help assess how socially or economically desirable various online behaviors are."[55]

In addition to assessing the types of activities people conduct online, it is important to understand users' capacity to fully engage with the applications and services that they are using. Gurstein argues that in order to enable "effective use" of information and communication technologies, individuals must have knowledge, skills, and a supportive environment.[56] Hargittai's work demonstrates that many users are not highly skilled, which could indicate that their ability to benefit from the use of various Internet and broadband applications is decreased.[57] Similarly, Middleton et al. suggest that even when broadband adoption rates are high, many Internet users engage in relatively few activities and do not use the Internet particularly intensely.[58]

To enable better understanding of the extent of benefits that individuals can realize by adopting and using broadband networks, the following information is required: international comparative indicators that measure use, not just adoption of information and communication technologies; detailed data on broadband usage, revealing how often and for what purposes broadband connectivity is used; assessment of users' skills and capacity to use their broadband connectivity, to allow for full benefits of connectivity to be realized. The key points here are that adoption alone does not guarantee that an individual will engage in the information society, and that variations in extent of use of broadband applications and services will result in variations in benefits accrued to individual users.

Conclusion

This chapter explores three challenges that arise when trying to understand the ways in which broadband network connectivity, as used by individuals, enables the information society. It identifies research questions and data required to assess the direct impact of broadband development and use. Any research that considers the benefits of investing in broadband connectivity must begin with a description of
p. 22 broadband services actually available to users. ↳ Applications and services that can offer benefits must be identified, and user uptake of such services should be tracked. When examining broadband usage, it is essential to go beyond yes/no measures of adoption, developing models of use and engagement that reflect what citizens do with their broadband connections, how frequently they use the network, and their overall capacity to use broadband networks to achieve positive social and economic outcomes.

It is a relatively straightforward exercise to identify general ways in which data collection and measures of broadband impact could be improved. It is more complex to put these ideas into action in a way that will allow for meaningful international comparisons of data, and that will result in tangible conclusions regarding the impact of broadband connectivity in enabling and sustaining an information society. As governments invest in broadband infrastructure, it is very important that they also provide support for assessment of the impact of this investment, explicitly funding research, and collaborating in data analysis. As discussed, such research should build on existing baseline data around user characteristics and adoption patterns, to offer detailed quantitative and qualitative insight on what citizens do with broadband connections, and how this connectivity provides benefits to individuals and to society as a whole.

As broadband networks are considered an essential infrastructure in the twenty-first century, improved understanding of how they support individuals in their everyday activities will allow for more effective use of this infrastructure. Research on the specific ways that broadband can and does enable the information society will reveal shortcomings in current approaches. Such research can inform development of improved applications and services, identify appropriate technical characteristics of faster networks, and provide guidance on skills development and digital literacy standards that will ensure individuals have the capacity to engage with applications and services available to them. Billions of dollars will be invested in broadband infrastructure development. This chapter offers some specific suggestions as to how to ensure that a return on this investment is realized. The outcome of the research approach outlined here can inform the development of good public policy regarding broadband deployment and use.

Notes

1. European Commission, "EU Guidelines on Public Funding of Broadband Networks in Member States—FAQs," http://www.egovmonitor.com/node/28328.
2. Organisation for Economic Co-operation and Development, *Broadband Growth and Policies in OECD Countries* (Paris: OECD, 2008); OECD Directorate for Science Technology and Industry, *OECD Policy Guidance on Convergence and Next Generation Networks* (Seoul: OECD Ministerial Meeting on the Future of the Internet Economy, 2008).
3. It is acknowledged that there are broader goals for broadband investment, goals that involve engagement with government and industry as well as individuals. The overall impact of broadband investment on an economy is not measured just by considering individual uptake and use. While the focus of this chapter is on the relationship between individual broadband adoption and societal benefits, this is just one piece of a much larger puzzle about how benefits are realized from investment in broadband technologies.
4. Paschal Preston and Anthony Cawley, "Broadband Development in the European Union to 2012—A Virtuous Circle Scenario," *Futures* 40 (2008): 813.
5. Statistics Canada, "Canadian Internet Use Survey, 2009," http://www.statcan.gc.ca/daily-quotidien/100510/dq100510a-eng.htm.

6. Canadian Radio-television and Telecommunications Commission, *Communications Monitoring Report* (Ottawa: Canadian Radio-television and Telecommunications Commission, 2009).
7. Australian Bureau of Statistics, "Internet Activity, Australia, December 2009—Internet Subscribers by Access Connection, for ISPs with More Than 1,000 Active Subscribers," http://tinyurl.com/abs-internet-activity.
8. Government of Australia, "21st Century Broadband," http://www.dbcde.gov.au/__data/assets/word_doc/0017/112454/National_Broadband_Network_policy_brochure.doc.
9. These data are available online at http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/data/main_tables. Numbers reported here are for the EU15 countries. These countries report higher broadband penetration and higher usage rates than the EU25 or EU27 countries.
10. Council of the European Union, *Council Resolution on the Implementation of the eEurope 2005 Action Plan* (Brussels: European Union, 2005), 16.
11. Organisation for Economic Co-operation and Development, "Broadband Penetration, Historical Broadband Penetration Rates (December 2009)," http://www.oecd.org/dataoecd/22/12/39574779.xls.
12. Organisation for Economic Co-operation and Development, "Percentage of Fibre Connections in Total Broadband among Countries Reporting Fibre Subscribers, December 2009," http://www.oecd.org/dataoecd/21/58/39574845.xls.
13. OECD Directorate for Science Technology and Industry, *Developments in Fibre Technologies and Investment* (Paris: OECD Working Party on Communication Infrastructures and Services Policy, 2008).
14. Federal Communications Commission, *Broadband Performance—OBI Technical Paper No. 4* (Washington, DC: Federal Communications Commission, 2010).
15. Epitiro, *Australia Internet Performance Index—Summary Findings 2008 (Q4)* (Sydney: Epitiro, 2009).
16. Ofcom, *UK Fixed Broadband Speeds, November/December 2010—The Performance of Fixed-Line Broadband Delivered to UK Residential Consumers* (London: Ofcom, 2011).
17. Caps are very common in Australia, Belgium, Canada, Iceland, and New Zealand. For data on monthly download caps and pricing for additional usage, see OECD, "Average Monthly Bit/Data Cap Size and Price Per Additional Mb, by Country, October 2009," http://www.oecd.org/dataoecd/22/46/39575020.xls.
18. A discussion of network neutrality is beyond the scope of this chapter. See the collection by Thomas M. Lenard and Randolph J. May, *Net Neutrality or Net Neutering: Should Broadband Internet Services Be Regulated* (New York: Springer, 2006) and the *International Journal of Communication*'s Net Neutrality issue (2007) for discussion of the key issues.
19. For a discussion of "user-generated content," see OECD Directorate for Science Technology and Industry, *Participative Web: User-Created Content* (Paris: OECD, 2007).
20. ADSL refers to asymmetrical DSL (digital subscriber line) service, for instance.
21. Broadband Stakeholder Group, *Predicting UK Future Residential Bandwidth Requirements* (Cambridge: Broadband Stakeholder Group, 2006); California Broadband Task Force, *The State of Connectivity—Building Innovation through Broadband* (State of California, 2008); Communications Workers of America, *Speed Matters: Affordable High-Speed Internet for All* (Washington, DC: Communications Workers of America, 2007); Deloitte, *National Broadband Network—A User's Perspective* (Sydney: Deloitte, 2009); Stephen Ezell et al., *The Need for Speed: The Importance of Next-Generation Broadband Networks* (Washington, DC: The Information Technology and Innovation Foundation, 2009).
22. Broadband Stakeholder Group, "Pipe Dreams?: Prospects for Next Generation Broadband Deployment in the UK," http://www.broadbanduk.org/content/view/236/7/ ; OECD Directorate for Science Technology and Industry, *Developments in Fibre Technologies and Investment* (Paris: OECD Working Party on Communication Infrastructures and Services Policy, 2008).
23. For a broader discussion of the characteristics required for broadband networks to meet the needs of the public, see Amelia Bryne Potter and Andrew Clement, "A Desiderata for Broadband Networks in the Public Interest," (paper presented at the 35th Research Conference on Communication, Information and Internet Policy, Arlington, VA, 2007).
24. Over time, it may make more sense to develop individual broadband profiles, reflecting the increased uptake of mobile broadband, and the proliferation of access devices, both of which allow for more personalized individual broadband services. But in the short term, it is suggested that an individual's primary broadband access point is the home, and as such the household likely provides the appropriate location for assessing broadband capacity. This assumption should be revisited periodically.
25. Sharon E. Gillett et al., *Measuring Broadband's Economic Impact: Final Report* (Washington, DC: US Department of Commerce, Economic Development Administration, 2006), 3.
26. Brief reviews that cover this territory are provided by Middleton and colleagues to frame analysis of Canadian Internet usage data: Catherine A. Middleton and Jordan Leith, "Intensity of Internet Use in Canada: Exploring Canadians' Engagement with the Internet" (paper presented at the Statistics Canada Socio-economic Conference, Ottawa, 2007); Catherine A. Middleton and Jonathan Ellison, *Understanding Internet Usage among Broadband Households: A Study of Household Internet Use Survey Data* (Ottawa: Statistics Canada—Science, Innovation and Electronic Information Division Working Papers, 2008); Catherine A. Middleton and Jordan Leith, "An Analysis of Canadians' Scope of Internet Usage" (paper presented at the Statistics Canada Socio-economic Conference, Ottawa, 2008); Catherine A. Middleton, Ben Veenhof, and Jordan Leith, *Intensity of Internet Use in Canada: Understanding Different Types of Users* (Ottawa: Statistics Canada—Business Special Surveys and Technology Statistics Division Working Papers, 2010).
27. See for example Darin D Barney, *The Network Society* (Cambridge: Polity Press, 2004); Daniel Bell, *The Coming of Post-Industrial Society: A Venture in Social Forecasting* (New York: Basic Books, 1973); Manuel Castells, *The Rise of the Network Society* (Oxford; Malden, Mass.: Blackwell Publishers, 2000); Alistair S. Duff, David Craig, and David A. McNeill, "A Note on the Origins of the 'Information Society,' " *Journal of Information Science* 22 (1996); Yoneji Masuda, *The Information Society*

(Washington, DC: World Future Society, 1981); and Frank Webster, "Making Sense of the Information Age," *Information, Communication & Society* 8 (2005). This is by no means an exhaustive list of research regarding the information society. The articles noted here are examples of this work, but there are many other important works beyond the ones noted here.

28. Manuel Castells, *The Informational City: Information Technology, Economic Restructuring, and the Urban-Regional Process* (Oxford and Cambridge, MA: B. Blackwell, 1989); William H. Dutton, Jay G. Blumler, and Kenneth L. Kraemer, eds., *Wired Cities: Shaping the Future of Communications,* (*Communications Library*) (Boston: G. K. Hall, 1987); Harold Sackman and Barry W Boehm, eds., *Planning Community Information Utilities* (Montvale, NJ: AFIPS Press,1972); Harold Sackman and Norman H. Nie, eds., *The Information Utility and Social Choice* (Montvale, NJ: AFIPS Press, 1970).
29. T. Randolph Beard, George S. Ford, and Lawrence J. Spiwak, "The Broadband Adoption Index: Improving Measurements and Comparisons of Broadband Deployment and Adoption," (Phoenix Center Policy Paper Number 36), (Washington, DC: 2009); Kenneth Flamm et al., "Measuring Broadband: Improving Communications Policymaking through Better Data Collection," Pew Internet Project, http://www.pewinternet.org/Reports/2007/Measuring-Broadband/01-Executive-Summary.aspx. Payam Hanafizadeh, Mohammad Reza Hanafizadeh, and Mohsen Khodabakhshi, "Extracting Core ICT Indicators Using Entropy Method," *The Information Society* 25 (2009); Philip N. Howard et al., "Sizing up Information Societies: Toward a Better Metric for the Cultures of ICT Adoption," *The Information Society* 25 (2009); Michel J. Menou and Richard D. Taylor, "A 'Grand Challenge': Measuring Information Societies," *The Information Society* 22 (2006).
30. William H. Dutton et al., "The Politics of Information and Communication Policy: The Information Superhighway," in *Information and Communication Technologies: Visions and Realities*, ed. William H. Dutton and Malcolm Peltu (Oxford: Oxford University Press, 1996); Milton Mueller and Becky Lentz, "Revitalizing Communication and Information Policy Research," *The Information Society* 20 (2004); Audrey N. Selian, "The World Summit on the Information Society and Civil Society Participation," *The Information Society* 20 (2004).
31. Examples include the European Commission, the Information Highway Advisory Council, the Information Society Technologies Advisory Group, the National Information Infrastructure Advisory Council, the World Bank, the World Summit on the Information Society, and UNCTAD.; UNCTAD Secretariat, *Information Economy Report 2006—The Development Perspective* (New York and Geneva: United Nations Conference on Trade and Development, 2006); UNCTAD Secretariat, *Information Economy Report 2007–2008—Science and Technology for Development: The New Paradigm of ICT*; Commission of the European Communities, *Digital Divide Forum Report: Broadband Access and Public Support in Under-Served Areas* (Brussels: 2005); Commission of the European Communities, *Europe's Digital Competitiveness Report — Volume 1: i2010—Annual Information Society Report 2009. Benchmarking i2010: Trends and Main Achievements* (Brussels: 2009), Information Society Technologies Advisory Group, "Shaping Europe's Future through ICTs," ftp://ftp.cordis.europa.eu/pub/ist/docs/istag-shaping-europe-future-ict-march-2006-en.pdf; National Information Infrastructure Advisory Council, *Common Ground: Fundamental Principles for the National Information Infrastructure: First Report of the National Information Infrastructure Advisory Council* (Washington, DC: National Information Infrastructure Advisory Council, 1995); World Bank, *Information and Communications for Development 2009: Extending Reach and Increasing Impact* (Washington, DC: World Bank, 2009); International Telecommunication Union, *World Information Society Report* (Geneva: International Telecommunication Union, 2006); International Telecommunication Union, *World Information Society Report 2007—Beyond WSIS* (Geneva: International Telecommunication Union, 2007).
32. European Commission, *Europe and the Global Information Society: Recommendations of the High-Level Group on the Information Society to the Corfu European Council (Bangemann Group)* (Brussels: European Commission, 1994), 10.
33. International Telecommunication Union, *World Information Society Report*.
34. European Commission, "Knowledge Society," http://tinyurl.com/ec-knowledge.
35. Kristin A. Van Gaasbeck, "A Rising Tide: Measuring the Economic Effects of Broadband Use across California," *Social Science Journal* 45 (2008).
36. Martin Fornefeld, Gilles Delaunay, and Dieter Elixmann, *The Impact of Broadband on Growth and Productivity* (Düsseldorf: MICUS Management Consulting GmbH, 2008).
37. Shane Greenstein and Ryan C. McDevitt, *The Broadband Bonus: Accounting for Broadband Internet's Impact on U.S. GDP* (Chicago: Kellogg School of Management and Department of Economics, Northwestern University, 2009). They also note that their estimates are much more conservative than those produced earlier in the decade by Crandall and colleagues, for example, Robert Crandall, William Lehr, and Robert Litan, *The Effects of Broadband Deployment on Output and Employment: A Cross-Sectional Analysis of U.S. Data* (Washington, DC: Brookings Institution, 2007); Robert W Crandall and Charles L Jackson, *The $500 Billion Opportunity: The Potential Economic Benefit of Widespread Diffusion of Broadband Internet Access* (Washington, DC: Brookings Institution, 2001). Crandall later described the figures in the 2007 report as "grossly overestimated" and not relevant for predicting the impacts of proposed stimulus investment "Broadband Job Creation Figures Overestimated," http://www.redorbit.com/news/technology/1631755/broadband_job_creation_figures_overestimated/.
38. To be precise, it is actually the Internet connectivity that broadband enables that provides information (society) access, rather than broadband per se. Today, there are few information society type services available without Internet access, but as governments (for example) become more involved in developing next generation networks and services, it may be possible to engage in the information society without using the Internet. This may be an arcane observation, but it becomes relevant as governments try to increase the reach of the information society to people who are not interested in what the Internet offers.
39. An example that does explore the benefits of broadband at the community level is a recent report on rural broadband produced by the US Department of Agriculture's Economic Research Service. Peter Stenberg et al., *Broadband Internet's Value for Rural America: Economic Research Report Number 78* (Washington, DC: United States Department of Agriculture, 2009).

40. For instance, Deloitte offers an extensive overview of applications and services that will be available to individuals using Australia's National Broadband Network. Deloitte, *National Broadband Network—A User's Perspective*. Ezell et al. also offer detailed descriptions of applications that will be possible with higher capacity broadband access. Ezell et al., *The Need for Speed: The Importance of Next-Generation Broadband Networks*.
41. Jed Kolko, *Does Broadband Boost Local Economic Development?* (San Francisco: Public Policy Institute of California, 2010), 2.
42. Ibid.
43. World Bank, *Information and Communications for Development 2009: Extending Reach and Increasing Impact*, 5.
44. These are questions used by the Canadian Internet Use Survey. Statistics Canada, "Canadian Internet Use Survey, 2009."
45. Allen's study of the experience of connectivity for Australian Internet users is consistent with this objective. Matthew Allen, "The Experience of Connectivity—Results from a Survey of Australian Internet Users," *Information, Communication & Society* 13 (2010).
46. International Telecommunication Union, *Measuring the Information Society—The ICT Development Index* (Geneva: International Telecommunication Union, 2009).
47. Soumitra Dutta and Irene Mia, *Global Information Technology Report 2009–2010: ICT for Sustainability* (Geneva: World Economic Forum and INSEAD, 2010).
48. Leonard Waverman and Kalyan Dasgupta, "How to Maximize the Economic Impact of Mobile Communications: The Four Waves," in *Global Information Technology Report 2008–2009*, ed. Soumitra Dutta and Irene Mia (Geneva: World Economic Forum and INSEAD, 2009), 56.
49. Pepper et al., "From Mobility to Ubiquity: Ensuring the Power and Promise of Internet Connectivity … for Anyone, Anywhere, Anytime."
50. Leonard Waverman, Kalyan Dasgupta, and Nicholas Brooks, *Connectivity Scorecard 2009* (2009); Leonard Waverman and Kalyan Dasgupta, *Connectivity Scorecard 2010* (2010).
51. Pepper et al., "From Mobility to Ubiquity: Ensuring the Power and Promise of Internet Connectivity … for Anyone, Anywhere, Anytime," 39.
52. For examples of various critiques regarding these data, see George S. Ford, Thomas M. Koutsky, and Lawrence J. Spiwak, *The Broadband Performance Index: A Policy-Relevant Method of Comparing Broadband Adoption among Countries (Phoenix Center Policy Paper Number 29)* (Washington, DC: 2007); Market Clarity, *Broadband Wars: The OECD's International Broadband Arms Race* (Sydney: 2007); and Suzanne Blackwell, "Canada's Broadband Price Per Mbps—GIGO," http://www.giganomics.ca/observations-old/2009/8/20/canadas-broadband-price-per-mbps-gigo.html.
53. Nielsen, *The Global Online Media Landscape—Identifying Opportunities in a Challenging Market* (New York: 2009).
54. Statistics Canada, "Canadian Internet Use Survey, 2009."
55. Jed Kolko, "How Broadband Changes Online and Offline Behaviors," *Information Economics and Policy* 22 (2010), 152.
56. Michael Gurstein, "Effective Use: A Community Informatics Strategy Beyond the Digital Divide," *First Monday* 8 (2003); Michael Gurstein, "Effective Use and the Community Informatics Sector: Some Thoughts on Canada's Approach to Community Technology/Community Access," in *Seeking Convergence in Policy and Practice*, ed. Marita Moll and Leslie Regan Shade (Ottawa: Canadian Centre for Policy Alternatives, 2004).
57. See for example Eszter Hargittai and Steven Shafer, "Differences in Actual and Perceived Online Skills: The Role of Gender," *Social Science Quarterly* 87 (2006); Eszter Hargittai and Amanda Hinnant, "Digital Inequality: Differences in Young Adults' Use of the Internet," *Communication Research* 35 (2008); Eszter Hargittai and Gina Walejko, "The Participation Divide: Content Creation and Sharing in the Digital Age," *Information, Communication & Society* 11 (2008).
58. Middleton and Leith, "Intensity of Internet Use in Canada: Exploring Canadians' Engagement with the Internet"; Middleton and Ellison, "Understanding Internet Usage among Broadband Households: A Study of Household Internet Use Survey Data"; Middleton and Leith, "An Analysis of Canadians' Scope of Internet Usage"; Middleton, Veenhof, and Leith, *Intensity of Internet Use in Canada: Understanding Different Types of Users*.