Chapter 2
ICT Sector and the Importance of ICT Infrastructure Management

While it is clear in their *application* that ICTs hold the greatest potential for economic and social development, many governments are actively seeking to spur domestic economic growth by nurturing the emergence of local ICT *industries*. This is hardly surprising, as the remarkable expansion of the ICT marketplace in recent years has generated millions of new jobs and billions in additional tax revenues, growth that has benefited nearly every region of the world. Many developing countries also perceive domestic ICT industry growth as an effective means to achieve related development objectives, including to attract foreign direct investment, provide a basis for technology transfer, satisfy local market demand for ICTs, and generate further growth in upstream and downstream industries (such as marketing or financial services).

Another argument for inciting the ICT sector development comes from the relationship that exists between the need for strategy and e-readiness assessment, a component of which is also the measurements of indicators in the ICT sector, as mentioned in the second section.

2.1 ICT as an Industrial Sector

Determination of the industries is traditionally done by industry classification systems in each country. Given that ICT sector is highly developed these last decades, there is an increased demand for official statistics, in terms of harmonized international standards regarding the information society.

The main purpose for the classification of industries is to obtain accurate statistics as a measure of output, return rates, trade balances, employment rates, etc. It is exactly such statistics that show the development of the sector and its contribution in the information society in different economies.

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Many countries have based their efforts in gathering statistics of ICT in their definitions. Some of the different classifications are:

- NACE (Statistical Classification of Economic Activities in the European Community)
- CPC (Central Product Clasification) in the USA
- CSIC (Canadian Standard Industrial Classification)
- NAICS (North American Industry Classification System)
- ISIC (International Standard Industrial Classification)

In recent years has arisen a need for international definition of ICT sector, especially ICT services, which can be used as a communication bridge between the definitions of systems of different countries. An international accepted definition is also helpful in the reflection of different changes as a result of evolution and technology change. For this reason, OECD set up a working group which would have to study the different definitions and history of the industry.

In 1997, the ICT sector was defined according to the OECD (WPIIS) definition, first released in 1998 and revised slightly in 2002. It was revised again in 2007 (ISIC Rev. 4). The 1998 and 2002 OECD ICT sector definitions are expressed in terms of the characteristics of its products:

1. For manufacturing industries, the products (goods) of a candidate industry must fulfill the function of information processing and communication including transmission and display, **or** use electronic processing to detect, measure and/or record physical phenomena, or control a physical process.
2. For service industries, the products (services) of a candidate industry must be intended to enable the **function of information processing and communication** by electronic means.

The new (2007) definition differs from that of 2002 in two ways:

– Products which "use electronic processing to detect, measure and/or record physical phenomena, or control a physical process" are now excluded, thus narrowing the scope of the ICT sector
– Some categories are more ICT specific in ISIC Rev. 4 (partly due to WPIIS involvement) ≥narrower scope.

The 2007 definition of the ICT sector is "The production (goods and services) of a candidate industry must primarily be intended to fulfill or enable the function of information processing and communication by electronic means, including transmission and display."

For the services, the WPIIS 2007 proposal essentially consisted of reorganizing the outputs of the computer services and software publishing industries from this structure.

Referring to the Fig. 2.1, it is proposed that conceptually ICT sector could be seen as the group of activities that fall into the union of the Information Technology

Box 2.1: The 2007 OECD ICT Sector Definition (ISIC Rev. 4)
ICT manufacturing industries

2,610 Manufacture of electronic components and boards
2,620 Manufacture of computers and peripheral equipment
2,630 Manufacture of communication equipment
2,640 Manufacture of consumer electronics
2,680 Manufacture of magnetic and optical media

ICT service industries

4,651 Wholesale of computers, computer peripheral equipment and software
4,652 Wholesale of electronic and telecommunications equipment and parts
5,820 Software publishing
61 Telecommunications
62 Computer programming, consultancy and related activities
631 Data processing, hosting and related activities; Web portals
951 Repair of computers and communication equipment

and Telecommunications activities in the diagram below. It includes therefore the intersections between them and the Information Content activities. However, it excludes those Information Content activities which fall outside those intersections, that is, those which have no direct ICT association.

The above list of products and services is based on the harmonized system classification, proposing 4–6 figures, so that problems with the unavailability and credibility of data can be avoided. HS classification has been selected because detailed data are available for all member countries and also for its suitability with the CPC. According to the principles of this classification, the products included as ICT must:

- Fulfill the function of information processing and communication by electronic means, including transmission and presentation.
- Use electronic processing to detect measure and/or maintain physical phenomena or control physical processes.

Since the study of infrastructure and services is in focus of this study, the component of ICT services in the ICT sector should be of special importance.

As the recent downturn in corporate ICT spending has demonstrated, the scope for growth in the ICT marketplace, like every other sector of the economy, is indeed finite. Thus, it is perhaps unrealistic to think that the ICT sector will account for a substantial share of economic activity in all or even most developing nations in the foreseeable future. Nevertheless, it is clear that many developing countries are

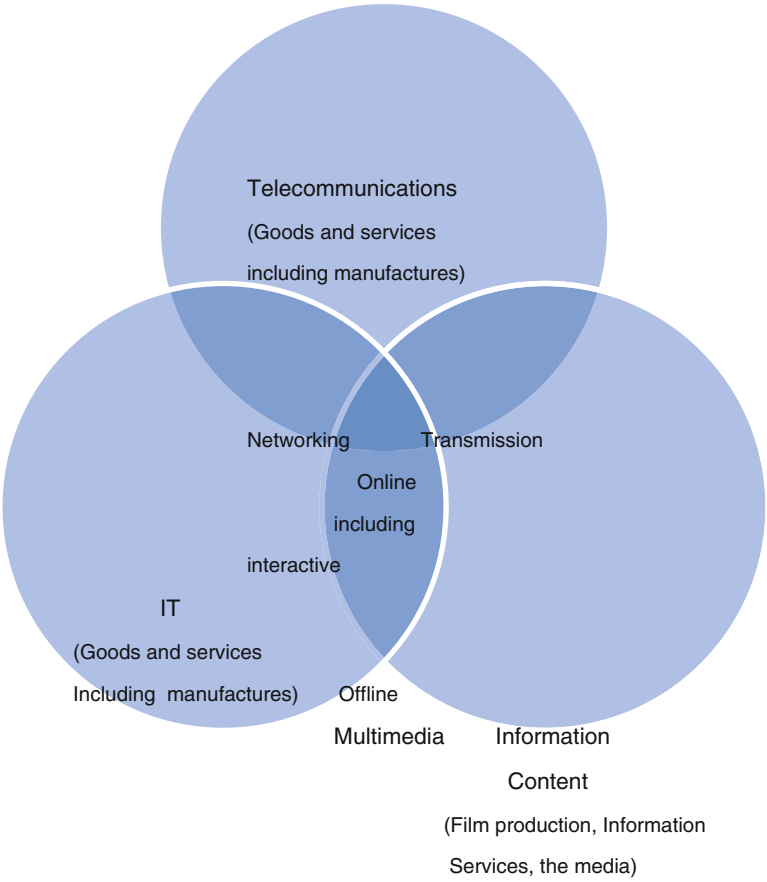

Fig. 2.1 Overlap between the information technology, telecommunications, and information content activities of firms (adapted from a Finnish model)

establishing domestic ICT firms to service domestic and even regional users. Indeed, recent data from International Data Corporation suggests that developed countries, as well as a core group of developing ones in several different regions of the world have experienced impressive ICT industry growth over the past several years. For instance:

- European ICT industry
- Combined net sales of the EU top 40 ICT sample increased by 5 % in 2010 compared to 2009, but are still 4.7 % lower than in 2007. Net sales of companies other than telecom operators increased by 9 % year-over-year, some of the growth represents a bounce back from the declines of 2009. Nevertheless, there is still a gap of 7 % compared to 2007. R&D spending of the EU top-40 companies that reported R&D spending (25 companies) 9 did not change significantly over the period. It increased by 2 % in 2010 (year-on-year), at a level very close

to 2007. The European ICT industry considered as a whole came out of the crisis and the sector analysis shows that this is true for most business segments.

- The US ICT industry, however, has achieved a lot more both in terms of net sales and R&D spending over the relevant period. The main factor explaining this is the 2007–2010 innovation waves. Total net sales of the Top-25 US ICT companies increased by 18 % between 2010 and 2009 and by 22 % compared to the 2007 pre-recession level. The combined R&D spending of the same list of US companies increased by 12 % in 2010 compared to 2009 and by 14 % compared to 2007. Smartphones and electronic tablets, together with global Internet platforms, have been the main drivers of the US ICT industry growth during the 2007–2010 period.
- Russia. The Russian IT market is experiencing a strong growth. It declined in 2009, but after that is growing in all its components. Measured in euro, for the last year, the market value still remains €1.1 billion smaller in comparison to almost €14 billion reached in 2008.
- The increase of the sales in 2010 was registered in every segment of the Russian IT market. The main reason for the market recovery in 2010 was overall improvement in Russian economy and growing confidence of the consumers in their future incomes. As a result, the retail sales of personal computers, in particular of the notebooks, were quickly growing pulling the entire market up.
- Canada. Revenues in the ICT sector increased by 6.0 % in 2010, recovering from a slight decline in 2009 (–0.7 %). The 2010 growth was driven by the wholesaling industries which grew by 14.3 % and accounted for 59 % of the sector's growth. The services industries grew by 3.3 %, led by strong growth in software and computer systems design. The services sub-sector accounted for 34 % of the sector's growth while the manufacturing industries accounted for only 7 %. The manufacturing industries grew by 3.0 % in 2010 recovering from a 8.6 % decline in 2009. The 2010 growth in value added was bolstered by a 16.0 % jump in wholesaling industries GDP. The manufacturing industries also had strong growth (8.8 %) in GDP in 2010 led by the commercial and service machinery industry. GDP in the services industries only increased by 0.9 % in 2010 due to very slow growth in the communications services industries (0.5 %). However, since 2002, the services industries have driven the ICT sector by generating 72 % of the growth.
- Central and Eastern Europe. The telecommunications market in the CEE has become more mature. Telecoms are facing problems typical of saturated markets, which are lowering ARPU and higher expectations of consumers. Convergence and growing significance of data transmission services in mobile networks will continue to shape the market. The total value of the telecommunications services market in the CEE region amounted to approx. €28.3 billion in 2010, which represented an increase of 0.9 % year on year. In 2004–2008, the telecommunications services market in the CEE witnessed a compound annual growth rate of 7.5 %. The market grew relatively quickly, fuelled chiefly by the dynamic development of the Ukrainian and Romanian market. The worldwide economic crisis, together with the regulatory policy aimed at cutting mobile termination rates, negatively influenced the market value in 2009–2010.

- India, between 1995 and 2001, experienced over 10 % annual growth in the number of IT companies and over 13 % annual growth in the number of IT industry employees. India's ICT market has grown with a compound annual growth rate (CAGR) of 20.3 % to reach $24.3 billion, or nearly 2 % of the country's gross domestic product (GDP), by 2011. There have been a large diffusion of ICT orientation in India—thanks to the efforts taken by Central Government and various State Governments. According to INDIAN DATA ICT SECTOR, SHIKO AUTORET), the sheer size of the ICT market in India has a lot of upside potential. The trend of ICT market is still growing. Till about 2008 when for the first time in Indian IT history, the domestic growth in IT overtook the IT exports. The domestic IT grew by as much as 34 % as opposed to a 27 % growth in exports. India is characterized by rapid growth also in the telecom sector with a subscriber base increasing at an average of eight million per month. India is next only to China and the USA in the telecom space with over 250 million subscribers.
- Latin America. The growth of the Brazilian ICT market has been impressive. The ICT sector was one of the most affected by the economic opening process observed in Brazil in the 1990s. The relative value of the ICT market almost doubled over the decade. The growth is expected to continue in the future according to EITO (2011). The value is now equivalent to 7 % of the Brazilian GDP. The largest subsegments are telecom services (43.14 %) and IT services (17.87 %) as illustrated in Fig. 1.1. (market shares) and Table 1.2. (value). The workforce attained 392,700 employees: 26,700 in the manufacturing industry, 138,000 in the telecom services (out of which 31,100 in the fixed provision, 30,200 in the mobile, 16,100 for cable, and 56,000 in other services such as broadcasting and the Internet services), 177,400 in call centers.
- China. The ICT sector is certainly representative of the massive changes in the Chinese industry and economy. It has developed a strongly growing manufacturing arm, with large inward and outward FDI flows and export-led activities. Since China's economic reform and opening-up in 1978, China's information and communication technology (ICT) manufacturing has been growing rapidly. The ICT sector rose as a pillar of the Chinese economy. Over the last years, the Chinese government has been paying more and more attention and investing more money in the sector. The sector has seen a very rapid growth from 2000 to 2004 with growth rate of 45 % per year, from 2005 to 2007 it became a steady 20 % growth. However since 2008, it went through a sharp slowdown with a growth rate reduced to 5 % allegedly due to the lack of R&D over the last 10 years.

Although these and other developing nations have been key beneficiaries of global ICT industry growth, the paths that these nations have followed have varied tremendously. To a large extent, this divergence mirrors the diversity of the ICT industry itself, which comprises many different sectors, each with its own unique characteristics. Briefly, the characteristics of each major segment of the "information technology" component of the ICT industry are as follows:

- ***Hardware***. Hardware comprises the tangible element of ICT systems. Despite the proliferation of ITC devices in recent years, the industry has been consolidating and further consolidation seems likely. Hardware firms typically engage in asset-intensive manufacturing and, accordingly, often require large up-front investments. As a result, start-up firms can find it difficult to compete against their larger, established rivals. Also, the current trend is towards commoditization of components, which may make it difficult for new firms to distinguish themselves in the marketplace on anything other than price. At present, much hardware manufacturing occurs in a handful of Asian nations, whose low labor costs and deep manufacturing know-how make them formidable competitors.
- ***Software***. Software helps people use ICT devices to perform specific tasks. The software industry is extremely varied and comprises literally thousands of firms offering a wide range of products. In contrast to the hardware industry, software development has become more focused and specialized, which has led to significant industry diversification. At its core, developing software is an intellectual activity and, as such, generally requires relatively few up-front resources. Successful software firms can be found in many developing countries and range in size from one-person shops to large multinational corporations. Due to the intangible nature of software, developers typically rely on intellectual property laws to protect their products against unauthorized copying.
- ***Service providers***. Service providers help organizations use their ITC systems effectively. Today's IT services industry is led by a handful of large multinational firms and thousands of smaller firms. Like the hardware industry, IT services firms often operate on small margins. As such, changes in global exchange rates and labor costs can cause rapid changes in the competitiveness of service firms that rely on export-oriented work. In addition, smaller firms may not be able to achieve the economies of scale necessary to bid competitively against large multinational firms.
- ***Software-plus-services***. Many nations have developed a mixed software-plus-services industry. To a substantial degree, this pattern results from the fact that most IT service providers also develop and license software. For instance, website designers, systems integrators, e-commerce solution providers, and IT security providers, among others, typically develop specialized products as an integral part of their business. These firms typically operate with higher margins than "pure" services firms and are less impacted by economies of scale or changing labor rates. Similarly, many software firms also provide customization and consulting services to customers, either through in-house providers or through partnerships with third parties.

Depending on their circumstances, some developing countries might be in a better position to leverage their local strengths and resources to competitive advantage in one ICT sector more than others. Indeed, it is relatively unlikely that any single developing country will excel in *every* sector of the ICT industry. Accordingly, **policymakers working to drive the growth of a domestic ICT industry should carefully evaluate their country's own resources and other sources of possible**

competitive advantage against the characteristics of each ICT sector to determine which areas, if any, are potential areas for long-term industrial growth.

As noted also at the very beginning, the initial enthusiasm for ICTs in the development community has been tempered in recent years by the realization that merely introducing ICTs into development projects—without also addressing other elements of the development equation—will often fail to provide the development panacea that many had hoped. Accordingly, several governments and organizations have turned their efforts to seeking to understand why some applications of ICT to development succeed while others fail. These efforts have helped illuminate the pitfalls that can capsize even the best-intentioned ICT development projects.

Certain of these studies have also sought to illuminate how social, economic, and legal factors can impact ICT-based development. **These issues are of particular relevance to policymakers, as a nation's regulatory environment can have a profound impact on the incentives and disincentives that motivate investors, ICT suppliers, and users and that can often spell success or failure for an ICT-based project.**

Since ICT users and suppliers have an important voice in this aspect, let us see the different kind of policies that may be taken into account for the purpose of building the proper infrastructures from ICT suppliers or government, towards ICT users. In the next section, the question about the importance of infrastructure is answered.

2.2 Infrastructure Management, Types and Policies

Most companies today rely on ICT, which means that the core business process and the mere existence of the company depend on the normal functioning of various IT services, and IT-dependent services. In other words, the focus of most business activities is on services and service management. A successfully delivered service is a result of good organizational skills and synergy of the following three elements: people, processes, and technology.

Access to advanced information and communications technology (ICT) infrastructure is increasingly vital to the socioeconomic well-being of cities, regions, and nations in the global knowledge-based economy (Bleha 2005; Castells 1989; Sassen 2002; Wilhelm 2004). Firms, investors, skilled workers, researchers, and governments rely on such infrastructure to share data and information, transact business, innovate, communicate, and work more efficiently. The availability of the so-called *smart* or *intelligent* infrastructure is used increasingly by states and communities to compete for investment and skilled workers (Blackwell et al. 1999). Citizens, meanwhile, are increasingly reliant upon advanced ICT infrastructures like the Internet to carry out their daily lives, from accessing news and information and communicating with friends and relatives to working, learning, finding employment, and accessing health and other public services (Horrigan 2006; National Broadband Task Force 2001). Indeed, the accessibility and reliability of such infrastructure is assuming an

importance to the knowledge-based economy and society analogous to that of the great public infrastructures and utilities of the twentieth century—electricity, highways, telephony, power grids, and water and sewage treatment—four leading some to suggest that broadband networks too ought to be owned and operated as public utilities (Geist 2005).

By and large, however, with the exception of modest public investments and programs devoted to public access and provisioning broadband to rural and remote areas (e.g., Industry Canada 2002; Industry Canada 2005), since the mid-1990s federal policy in Canada and the USA has been to leave the development of ICT infrastructure to market forces (Brown et al. 1995; Information Highway Advisory Council 1997). A growing body of evidence suggests that such a laissez-faire approach has failed to keep the USA and Canada among the leading nations in broadband and wireless deployment (Fransman 2006). While initially among the most "connected" nations in the world, North Americans are falling behind countries like Iceland, South Korea, Japan, the Netherlands, and Denmark in broadband uptake (OECD 2006). The US broadband consumers, in particular, pay among the highest prices in the OECD for broadband services that don't even begin to match the quality and speed of services available to Korean, Japanese, and European consumers (Bleha 2005). Lagging broadband infrastructure development in North America jeopardizes economic competitiveness, employment growth, technological innovation, and overall quality of life (Bleha 2005).

While broadband service is available to nearly all Canadians, barely 50 % choose to subscribe (CRTC 2006), and in the USA, only 42 % have residential high speed Internet access (Horrigan 2006). Persistent gaps in broadband access infrastructure development continue to exclude many from the benefits of new ICTs, including inhabitants of rural and remote communities, Aboriginals, the disabled, and low income families (CRACIN 2005; Middleton and Sorensen 2005; Servon 2002; Warschauer 2003). The consequences for individuals and communities without access, or without the desire, knowledge, or skills to take five advantages of access where it exists, can be serious (Servon 2002; Warschauer 2003). Collectively, the slow household uptake of broadband networks in serviced areas, and the lack of affordable service to many rural and remote communities signal the failure of free market forces alone to equip North Americans with the broadband and wireless infrastructures they need to compete and thrive in the global economy. The lack of government leadership on the broadband file has led to calls for governments to reassert themselves in this policy field through such means as regulatory reform and renewed public investment (Bleha 2005; Wilhelm 2004). A recent review of telecommunications policy in Canada (Telecommunications Policy Review Panel 2006) recommends the development of "affordable and reliable" broadband connectivity to all citizens by 2010, acknowledging that the 2004 target date for universal broadband (National Broadband Task Force 2001) was not met. Impatient with waiting for the private sector or federal government agencies to roll out adequate and affordable broadband infrastructure, municipalities and communities across North America are planning and deploying their own networks, using a range of technologies including fiber, broadband-over-power-lines, and wireless to provide citizens

with Internet connectivity (American Public Power Association 2005; Feld et al. 2005; Powell and Shade forthcoming; Sandvig 2004; Schuler and Day 2004; Strover 2003). These municipal and community-based models of broadband and wireless infrastructure provision take a variety of forms, ranging from regional fiber backbones owned and/or managed by major institutional bandwidth users (utilities, hospitals, universities, and local governments, for example, the City of Fredericton's e-NovationsCom Net Inc., e-Novations 2005), public/private municipal Wi-Fi ventures such as San Francisco's (in which Google provides an advertising-supported free service), local hydroelectric utilities (e.g., Toronto Hydro Telecom) offering both wired and wireless broadband service and, lastly, all-volunteer community wireless networks (CWNs) that six install and operate free Wi-Fi "hotspots" or mesh networks in public places (Bar and Park 2006), for example, Ile sans Fil in Montreal, NYC Wireless in New York, and Champaign-Urbana Community Wireless Network (CUWiN), among many others. Wireless networking is a particularly interesting development because it provides community groups, municipalities, and individuals with a relatively simple and affordable mechanism for Internet service delivery. Using 802.11x wireless ethernet standards, commonly known as Wi-Fi (for wireless fidelity), wireless local area networks (WLANs) can be established using unlicensed spectrum to share Internet connectivity (Galperin 2005; Lehr and McKnight 2003; Mackenzie 2005; Sawhney 2003) 1 WiMax (802.16) networks use licensed spectrum to provide fixed or mobile wireless coverage over larger distances (International Telecommunication Union 2004).

Research relating to wireless networks can be divided into two basic categories: a systemic perspective and a player perspective. From a systemic perspective, research has raised questions about how future wireless networks may be structured. This debate has focused around centralization/decentralization and what possibilities may exist for network structures as wireless technology and systems become more established (Bautista and Inagaki 2005; Tapia et al. 2005). An important factor influencing these potential structures is **spectrum policy** (Buck 2002). In addition, researchers have investigated or theorized how various community, **public**, **and private players in a wireless system might work together** (Bautista and Inagaki 2005; Tapia et al. 2005). Work based on case studies has also defined various infrastructure models for wireless networks. For instance, Powell and Shade (forthcoming) name and briefly describe three models for wireless provision: hot spots, hub and spoke, and 1 Wi-Fi network also support peer-to-peer connectivity, allowing direct wireless information transfer without using the Internet. Most wireless networks are connected to the Internet, and this chapter focuses on the use of Wi-Fi for Internet access. Seven dynamic mesh. Shamp (2004) focuses on two types: Wi-Fi zones and Wi-Fi clouds. Bar and Galperin (2005) distinguish between "hot zones" and "city-wide wireless broadband," and Vos (2005) categorizes wireless projects as "regional wireless broadband networks," "citywide networks," "city hot zones," and "countrywide networks."

From a player perspective, work has concentrated on the roles that various groups may play in wireless networks. Some research has considered the community, municipal, and private sectors (Bar and Galperin 2005), but most focuses on either

municipal or community players, likely because of the **potential these two groups have to significantly alter how citizens access telecommunications services**. Key issues in municipal wireless debates center around policy issues and the legal and regulatory aspects of deploying networks (e.g., can and should municipalities compete with the private telecommunications industry?) (Gillett 2006; New Millennium Research Council 2005). There has been some discussion of the purpose of such networks (Bar and Park 2006) and the role of municipalities as service providers (Gillett et al. 2004, 2006a).

In the community wireless arena, networks have emerged from two sources. Some community wireless networks developed as extensions of existing community networks or community technology centers, using wireless technologies to expand access and coverage (Strover, Chapman, and Waters 2003). Others were established by grassroots users with the express purposes of providing community-operated, inexpensive alternatives to commercial Internet service provider offerings (Sandvig 2004), using the technology to foster a sense of community (Powell and Shade forthcoming), and/or challenging regulatory policies and practices that favor private sector interests in the provision of Internet access (Meinrath 2005). The nature of community-based wireless networks has been influenced strongly by the local context, with a variety of models serving the needs of different communities. Eight while there has been little work that relates specifically to the relationship between community and municipal wireless networks, the Austin, TX experience of converging networks offering overlapping services is becoming more common (Bautista and Inagaki 2005). In Toronto, for instance, citizens will soon have a choice between Toronto Hydro Telecom's pay-for-use municipal service, Wireless Nomad's subscription cooperative or Wireless Toronto's free community network, in addition to commercial hotspots. Following Bautista and Inagaki, we use the term "public wireless networks" to encompass both community and municipal wireless, with the assumption that these public wireless networks offer broadband Internet access. Regardless of the ownership structures of such networks, we consider wireless networks to be forms of public infrastructure that provide public benefits (Infrastructure Canada 2004).

The section below outlines the anticipated benefits of public wireless networking. Community and municipal wireless networks have been established in a climate of technological enthusiasm (Sawhney 2003), with little attention paid to date to the benefits they offer or assessing how they are being used (Strover 2003) or whether they are living up to their potential. Most press coverage of public wireless networks paints a positive picture of their deployment, but there are some examples of failed or underused networks (e.g., Belson 2006a; Ewalt 2005). As public wireless networks move into the mainstream and attract increasing numbers of users, it is important to be able to assess their performance as public infrastructure, moving beyond discussions of how the networks are built to understand how public Internet infrastructures provide value to their stakeholders.

During the past year, information and communications technologies (ICTs) continued to spread throughout the world, and more and more people have access to the Internet and its wealth of information and applications. Access to the Internet via

mobile cellular networks has grown rapidly with the increasing availability of IMT-2000/3G networks and enabled devices, including mobile handsets and data cards that allow users to access the Internet over the mobile cellular network using their computers. Internet access speeds are also increasing, with fixed broadband replacing dial-up in most developed countries, accompanied by a decline in tariffs.

2.3 The Importance of Speed and Quality

Reliable, convenient, and affordable access to voice and data services continues to underpin a digital economy. In addition, as in most years previously, our research shows continued, steady improvement in broadband, mobile, and Internet connectivity levels across most countries in the world. Of the top 20 countries in the overall rankings, all but three—Taiwan, Austria (15th), and Ireland (17th)—had broadband penetration of more than 25 % at the end of 2009; and only three—South Korea, the USA (3rd), and Canada (11th)—registered mobile penetration levels of less than 100 %. More devices mean more access to the Internet, and all its productivity-enhancing benefits. Broadband is increasingly the default mode of access to the Internet: Pyramid Research, a telecoms research firm, estimates that there were over 450 m broadband subscribers in the world in 2009. There are more than 40 m smartphones in service in the USA, according to media research firm Nielsen, and more than 30 m BlackBerry devices and iPhones each globally. Even in emerging markets, broadband reaches deep—of the 390 m people online in China (56th), over 100 m have fixed broadband connections.

Technology availability by itself is not enough to ensure it can be used. For one thing, it must be affordable, and fortunately this is increasingly becoming the case. In 49 of the 70 countries in the rankings, the monthly fee charged by the main broadband provider amounted to less than 2 % of median monthly household income in 2009, according to Economist Intelligence Unit research. (This was the case in 42 of the 70 countries in our 2009 study, and only 33 countries in 2008.) Moreover, in countries with some of the world's steepest fees for broadband access, including Nigeria (61st), Vietnam (62nd), and Indonesia (65th), prices continue to decline.

The quality of access is also important. Accordingly, in 2010 we have added a new indicator to the connectivity category of our model—broadband quality. The proxy we use to assess this is the share of high-capacity fiber-optic access lines in a country's total broadband connections. Fiber networks while still more expensive than the copper networks that carry DSL traffic are becoming more cost-effective and have a much higher carrying capacity than current generations of either wireless or enhanced copper access. This speeds up transmission and provides a higher quality experience for Internet users (see Box 2.1 below). Operators are realizing the benefits of fiber as networks strain to deliver sufficient bandwidth to meet subscriber demand for video and file-sharing. Current fiber access adoption levels are still relatively low—less than 9 % of total broadband connections globally, according to

Pyramid Research—and nonexistent in many countries. But fiber is already a key part of the broadband landscape in a few countries, particularly in Asia: more than 70 % of the world's fiber-based broadband subscribers at end-2009 were in Asia, according to the same source.

Rich and densely urban Asian countries with strong ICT support from the state fare particularly well in this indicator—and partly as a result have risen significantly in the overall rankings. The fiber density of Japan, South Korea, and Taiwan is both testament to these countries' ability to execute on their digital agendas and an accurate measure of their achievements relative to their global peers. Fixed broadband networks are only one means of accessing the Internet. Mobile data is becoming an increasingly important mode of broadband access. To reflect this, we have introduced a second new indicator to our connectivity category: mobile quality, represented by the share of 3G and 4G subscriptions among a country's total mobile subscriptions. The CDMA Development Group, an industry body, estimates that 3G mobile networks worldwide serve nearly 1.2 billion users—one-quarter of the world's mobile subscriptions. Only eight of the countries in the digital economy rankings did not have operating 3G networks in 2009.

Internet users in emerging markets increasingly use smartphones as their primary form of access. Opera, a Norwegian mobile software firm, estimates that page-views in Africa's top ten mobile Internet markets (led by South Africa [40th] and Nigeria) grew almost fourfold in 2009, and that unique users and the data they consumed nearly doubled. By some measures, mobile data consumed in African markets rivals the amounts in most developed markets 2, and like their rich-nation peers, consumers are using the Internet in similar ways.

Whether used for entertainment or essential connectivity, the need for greater wireless speed is pressing, and the world's largest providers of converged services are raising the bar for the next generation of wireless data networks. Verizon, a US operator, which invested around US$17 billion in its fixed and mobile network infrastructure last year, is planning to launch 4G services in as many as 30 American cities this year. Advocates of the world's various flavors of ultra-broadband wireless technology are looking to increase penetration through co-operation efforts and standards adoption:

The WiMAX Forum, an industry body promoting the use of this fixed-wireless broadband technology, recently announced a simpler device certification process that it hopes will double WiMAX chipsets consumed globally.

2.4 Using the Available Technology Better

For policymakers, adoption of digital channels by constituents remains an elusive goal. As illustrated by the long-established leaders in our rankings, connecting the dots between the supply of services and the demand for them can be difficult. South Korea is well known for both the density of its broadband penetration and the strength of its digital vision. The country leads the world in e-government, according to the United Nations survey of member states. Yet even this country's wired

citizens do not take full advantage of more than 150 service portals offered by the government. A survey conducted by the government's Board of Audit and Inspection found that although awareness of e-government portals was high, less than one-half of the citizens surveyed actually used them. Utility is the main issue: South Korean e-government channels that were popular either offered an easy solution to a requirement—such as tax filing—or provided additional benefits, such as the anti-corruption and complaint channel, which offers speed of response and anonymity. Governments should take heed: not everything needs to be digitized simply because it can.

People, whether acting as consumers or constituents, use the Internet when it is useful and provides clear benefits (see Box 2.1). Business and government alike are learning how to respond.

Google's recent entanglement in China shows clearly that this stage of the digital economy journey is different from the previous one. When the primary mission of countries was to become "e-ready," the interests of various stakeholders were aligned around a shared vision to increase digital access. But as the imperative turns from availability to greater usage, those interests can start to diverge.

For reasons of safety and security, for example, governments take an interest in how constituents use the Internet. China's interest is particularly keen, but the vigor with which it seeks to "protect" its people from dangerous online content is having a clear impact on the digital economy. One consequence has been Google's retreat from the China market. Social media and user-generated content is also being curtailed there by the government's recent move to effectively restrict Internet domain names to approved groups. But China is far from alone in trying to control its digitally enabled citizens: the Committee to Protect Journalists names China, Vietnam, Syria, Iran, and Egypt among the toughest countries to be a blogger and has recently criticized. Vietnam for shutting down political blogs.

Governments wield the greater power, but digital companies often themselves impose controls on the use of online content. For example, companies and governments generally agree on efforts to limit access to pornography (although many such initiatives are not without controversy), but some online firms also restrict access to political cartoonists and certain news outlets. The net effect on individuals' use of digital content and services is usually restrictive.

Such constraints may be one reason why usage of online services is more robust in some places than others. Only 27 of the 70 countries in our rankings boast a score for "use of Internet by consumers" (which considers online purchasing activity and the range of Internet features that individuals use) of seven or higher on a 1–10 scale. Even fewer (23 countries) score at this level when it comes to citizens' use of online public services. Clearly, there remains much work to do by companies and governments, beyond increasing physical access to ICT, to make it attractive for people to use the plethora of digital services available to them.

The next section will try to have a look at ICT sector in Albania for the purpose of exploring in greater detail how governments can promote policies to encourage private-sector development and utilization of ICTs and lay the regulatory groundwork for the successful application of ICTs to social and economic development.